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Unit 1

Algebra and Functions



Introduction to Algebra and Functions

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Prerequisite Skills

- Get Ready for Chapter 1 23
- Get Ready for the Next Lesson 29, 33, 37, 41, 47, 52, 56, 61

Reading and Writing Mathematics

- Reading in the Content Area 38
- Reading Math 30, 35, 69
- Reading Word Problems 24
- Vocabulary Link 31, 53
- Writing in Math 29, 33, 37, 41, 42, 47, 52, 56, 61, 67

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- Multiple Choice 29, 33, 37, 41, 47, 51, 52, 56, 61, 67
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- Challenge 29, 33, 37, 41, 47, 52, 56, 61, 67
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- Get Ready for the Next Lesson 83, 87, 92, 99, 106, 113

Reading and Writing Mathematics

- Reading in the Content Area 84
- Reading Math 80, 89, 93, 102, 114
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- Get Ready for Chapter 3 127
- Get Ready for the Next Lesson 133, 141, 146, 155, 161

Reading and Writing Mathematics

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- Reading Word Problems 150
- Writing in Math 132, 141, 146, 148, 155, 161, 167

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- Multiple Choice 126, 131, 133, 141, 147, 155, 161, 167
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- Challenge 132, 141, 146, 155, 161, 167
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Prerequisite Skills

- Get Ready for Chapter 4 179
- Get Ready for the Next Lesson 184, 189, 195, 200, 205, 210, 214, 220

Reading and Writing Mathematics

- Reading Word Problems 185
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Reading and Writing Mathematics

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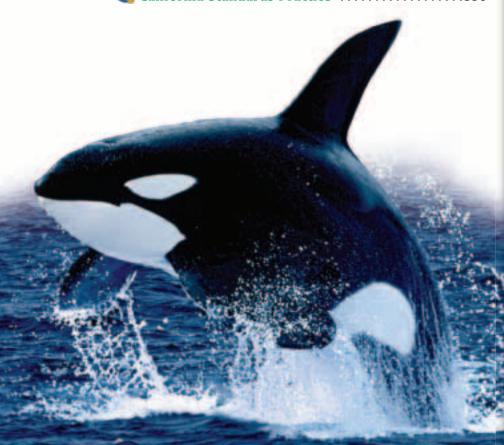
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- Get Ready for the Next Lesson 401, 408, 414, 421, 431, 435, 443, 449

Reading and Writing Mathematics

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- Reading Math 428
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- Get Ready for Chapter 10 459
- Get Ready for the Next Lesson 464, 470, 474, 478, 483, 490

Reading and Writing Mathematics

- Reading in the Content Area 471
- Reading Math 460, 462, 492
- Vocabulary Link 480
- Writing in Math 464, 469, 474, 478, 483, 484, 490, 497

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Reading and Writing Mathematics

- Reading in the Content Area 510
- Reading Math 510, 511, 515, 524, 541, 546, 547, 553
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- Multiple Choice 513, 517, 523, 529, 537, 545, 551, 557, 562
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- Get Ready for Chapter 11 571
- Get Ready for the Next Lesson 576, 582, 588, 593, 599, 606, 612, 618

Reading and Writing Mathematics

- Reading in the Content Area 614
- Reading Math 579
- Vocabulary Link 596, 613
- Writing in Math 576, 582, 588, 592, 594, 599, 606, 611, 612, 618, 622

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- Multiple Choice 576, 582, 588, 593, 599, 606, 612, 618, 623
- Worked Out Example 590

- Challenge 576, 582, 588, 592, 599, 606, 611, 618, 622
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- Get Ready for Chapter 12 635
- Get Ready for the Next Lesson 639, 645, 653

Reading and Writing Mathematics

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- Reading Math 640
- Vocabulary Link 637
- Writing in Math 639, 645, 646, 652

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- Worked Out Example 651

- Challenge 639, 645, 658
- Find the Error 645
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California Grizzly Bear

California Content Standards, Grade 6, Correlated to *California Mathematics,* Grade 6 ©2008

Key Standard defined by Mathematics Framework for California Public Schools
 * = Standard assessed on the California High School Exit Exam (CAHSEE)

Primary Supporting Standard **Text of Standard** Citations Citations **Number Sense** Students compare and order positive and negative fractions, 192-210, 215-220, 80-87, 323, 329-332, 1.0 decimals, and mixed numbers. Students solve problems 230-246, 250-270, 366-367, 460-497, involving fractions, ratios, proportions, and percentages. 282-312, 316-322, 518-523, 670 342-365, 369-383, 540-545, CA4-CA6 Compare and order positive and negative fractions, decimals, and 84-87, 215-220, 80-83, 196-210, 230-235, 🗭 1.1 mixed numbers and place them on a number line. CA4, CA6 282-286, 294-305, 670 Interpret and use ratios in different contexts (e.g., batting averages, 282-293, CA4, 206-210, 215-220, 294-311, 1.2 miles per hour) to show the relative sizes of two quantities, using CA6 316-322, 369-374, 460-497 appropriate notations (a/b, a to b, a:b). Use proportions to solve problems (e.g., determine the value of N 306-311, 316-322, 312, 323 - 1.3 if $\frac{4}{7} = \frac{N}{2!}$, find the length of a side of a polygon similar to a known 350-354, 540-545, CA4, CA5, CA6 polygon). Use cross-multiplication as a method for solving such problems, understanding it as the multiplication of both sides of an equation by a multiplicative inverse. Calculate given percentages of quantities and solve problems 342-365, 375-383, 202-205, 349, 366-367, - 1.4 involving discounts at sales, interest earned, and tips. CA5, CA6 518-523 Students calculate and solve problems involving addition, 24-69, 80-118, 128-168, 396-449, 2.0 460-497, 510-562, subtraction, multiplication, and division. 180-220, 230-270, 282-332, 342-383, 572-625, 636-659 CA7-CA9 Solve problems involving addition, subtraction, multiplication, and 236-246, 252-257, 2.1 230-235, 248-251, 314-322, division of positive fractions and explain why a particular operation 265-270, CA7, 584-588, 646-647 was used for a given situation. CA8 Explain the meaning of multiplication and division of positive 2.2 252-257, 264-270, 250-251 fractions and perform the calculations $\left(e.g., \frac{5}{8} \div \frac{15}{16} = \frac{5}{8} \times \frac{16}{15} = \frac{2}{3}\right)$ CA9 Solve addition, subtraction, multiplication, and division problems, 93-99, 101-111, 24-29, 38-41, 44-47, 53-56, - 2.3 including those arising in concrete situations, that use positive and 114-118, CA7, 112-113, 314-315 negative integers and combinations of these operations. CA8, CA9 Determine the least common multiple and the greatest common 186-189, 192-195, 180-185, 192-195, 202-205, 2.4 divisor of whole numbers; use them to solve problems with fractions 211-214, CA7, CA9 215-220, 236-241, 242-246, (e.g., to find a common denominator to add two fractions or to find 252-257, 282-286 the reduced form for a fraction).

Standard	Text of Standard	Primary Citations	Supporting Citations
1.2	Write and evaluate an algebraic expression for a given situation, using up to three variables.	44-47, 128-133	57-61, 62, 69, 103-106, 112-113, 114-118, 156-161, 163-167, 252-257, 379-382, 572-576, 578-582, 613-618, 636-639, 649-653
1.3	Apply algebraic order of operations and the commutative, associative, and distributive properties to evaluate expressions; and justify each step in the process.	38-41, 53-56	44-47, 80-82, 578-582
1.4	Solve problems manually by using the correct order of operations or by using a scientific calculator.	38-41	44-47, 69, 80-82, 151-155, 168, 196-200, 344-348, 409, 619-624, 636-639
2.0	Students analyze and use tables, graphs, and rules to solve proble	ms involving rates	and proportions.
2.1	Convert one unit of measurement to another (e.g., from feet to miles, from centimeters to inches).	294-305	156-161, 168
— 2.2	Demonstrate an understanding that <i>rate</i> is a measure of one quantity per unit value of another quantity.	287-292	293
2.3	Solve problems involving rates, average speed, distance, and time.	142-146, 287-292	63-67, 163-167, 282-286
3.0	Students investigate geometric patterns and describe them algebra	aically.	
3.1	Use variables in expressions describing geometric quantities (e.g., $P = 2w + 2\ell$, $A = \frac{1}{2}bh$, $C = \pi d$ – the formulas for the perimeter of a rectangle, the area of a triangle, and the circumference of a circle, respectively).	156-161, 577-588, 596-599	162, 572-576, 589-593, 640-645, 649-653, 656-659
3.2	Express in symbolic form simple relationships arising from geometry.	156-161, 546-551, 572-593, 596-599	47, 128-133, 162, 600-601, 613-618, 640-645, 649-653, 656-659
Measurement a	nd Geometry		
1.0	Students deepen their understanding of the measurement of plane understanding to solve problems.	e and solid shapes	and use this
— 1.1	Understand the concept of a constant such as π ; know the formulas for the circumference and area of a circle.	583-593	656-659
1.2	Know common estimates of π (3.14; $\frac{22}{7}$) and use these values to estimate and calculate the circumference and the area of circles; compare with actual measurements.	584-593	619-623, 656-659
1.3	Know and use the formulas for the volume of triangular prisms and cylinders (area of base x height); compare these formulas and explain the similarity between them and the formula for the volume of a rectangular solid.	613-623	639, 645
2.0	Students identify and describe the properties of two-dimensional	figures.	
2.1	Identify angles as vertical, adjacent, complementary, or supplementary and provide descriptions of these terms.	510-517	529, 568
2.2	Use the properties of complementary and supplementary angles and the sum of the angles of a triangle to solve problems involving an unknown angle.	514-517, 524-529	569

Standard	Text of Standard	Primary Citations	Supporting Citations
2.3	Draw quadrilaterals and triangles from given information about them (e.g., a quadrilateral having equal sides but no right angles, a right isosceles triangle).	524-529, 533-538	156-161, 530-531
Statistics, Data	Analysis, and Probability		
1.0	Students compute and analyze statistical measurements for data s	ets.	
1.1*	Compute the range, mean, median, and mode of data sets.	396-408	402-414
1.2	Understand how additional data added to data sets may affect these computations.	396-408	410-414
1.3	Understand how the inclusion or exclusion of outliers affects these computations.	410-414	396-408
1.4	Know why a specific measure of central tendency (mean, median, mode) provides the most useful information in a given context.	402-408	409-414
2.0	Students use data samples of a population and describe the chara	cteristics and limita	tions of the samples.
2.1	Compare different samples of a population with the data from the entire population and identify a situation in which it makes sense to use a sample.	438-443	312
 2.2	Identify different ways of selecting a sample (e.g., convenience sampling, responses to a survey, random sampling) and which method makes a sample more representative for a population.	438-443	434-437
- 2.3	Analyze data displays and explain why the way in which the question was asked might have influenced the results obtained and why the way in which the results were displayed might have influenced the conclusions reached.	415-422, 424-425, 432-433, 438-449	438-443
**** 2.4	Identify data that represent sampling errors and explain why the sample (and the display) might be biased.	444-449	438-443
2.5 *	Identify claims based on statistical data and, in simple cases, evaluate the validity of the claims.	409, 426-431, 434-443	438-443
3.0	Students determine theoretical and experimental probabilities and	d use these to make	e predictions about events.
\$ 3.1*	Represent all possible outcomes for compound events in an organized way (e.g., tables, grids, tree diagrams) and express the theoretical probability of each outcome.	465-478	128-133, 190-191
3.2	Use data to estimate the probability of future events (e.g., batting averages or number of accidents per mile driven).	486-491	484-485
 3.3*	Represent probabilities as ratios, proportions, decimals between 0 and 1, and percentages between 0 and 100 and verify that the probabilities computed are reasonable; know that if P is the probability of an event, $1-P$ is the probability of an event not occurring.	460-464	465-478, 484-497
3.4	Understand that the probability of either of two disjoint events occurring is the sum of the two individual probabilities and that the probability of one event following another, in independent trials, is the product of the two probabilities.	492-497	523, 623, 665
\$ 3.5*	Understand the difference between independent and dependent events.	492-497	523, 623, 665

Standard	Text of Standard	Primary Citations	Supporting Citations
Mathematical R	easoning		
1.0	Students make decisions about how to approach problems.		
1.1	Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns.	25-29, 42-43, 107-111, 148-149, 180, 190-191, 248-249, 532	57-67, 84-87
1.2	Formulate and justify mathematical conjectures based on a general description of the mathematical question or problem posed.	93-94, 101-102, 530-531	69, 134-135, 168, 409, 415-422, 426-431, 434-437, 491, 552, 577, 624, 654-655
1.3	Determine when and how to break a problem into simpler parts.	594-595	25-29, 53-56, 95-99, 150, 607, 649-653, 656-659
2.0	Students use strategies, skills, and concepts in finding solutions.		
2.1	Use estimation to verify the reasonableness of calculated results.	148-149, 355-360	25-29, 236-246, 312
2.2	Apply strategies and results from simpler problems to more complex problems.	546-551, 594-595	62, 180
2.3	Estimate unknown quantities graphically and solve for them by using logical reasoning and arithmetic and algebraic techniques.	424-431	49-52, 136-146, 151-155, 230-235, 350-354, 426-431, 434-437
2.4	Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.	62-67, 69, 134- 135, 162-168, 314-315, 424-425, 484-485, 518-523, 607-612, 624, 646-647	30-41, 44-47, 49-52, 80-82, 88-94, 95-106, 114-118, 128-146, 151-155, 163-167, 180, 185, 196-200, 202-205, 230-241, 252-263, 265-270, 282-286, 293, 316-322, 324-332, 342-349, 369-374, 355-360, 396-409, 415-422, 426-437, 532, 553-562, 600-601, 607, 624, 636-645, 654-655, 649-653, 656-659
2.5	Express the solution clearly and logically by using the appropriate mathematical notation and terms and clear language; support solutions with evidence in both verbal and symbolic work.	38-41, 128-133	53-56, 136-146, 151-161, 258-263, 350-354, 383, 409, 510-513, 540-545
2.6	Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.	584-588	300-305, 344-348, 350-354, 361-365, 369-378, 546-551, 572-576, 578-582, 589-593, 636-639, 656-659
2.7	Make precise calculations and check the validity of the results from the context of the problem.	148-149	24-29, 42-43, 136-146, 151-155, 265-270
3.0	Students move beyond a particular problem by generalizing to ot	her situations.	
3.1	Evaluate the reasonableness of the solution in the context of the original situation.	366-367	24-29, 42-43, 236-241, 265-270, 324-328, 355-365, 518-531, 553-557, 572-576, 619-623, 640-645

Standard	Text of Standard	Primary Citations	Supporting Citations
3.2	Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.	24-29	42-43, 62, 93-94, 101-102, 112-113, 134-135, 148-149, 190-191, 248-249, 314-315, 342-343, 366-367, 424-425, 484-485, 530-531, 594-595, 646-647
3.3	Develop generalizations of the results obtained and the strategies used and apply them in new problem situations.	93-94, 101-102, 250-251, 577, 583, 600-601	62, 162, 168, 323

Hearst Castle, San Simeon



Start Smart!

Be a Better Problem Solver

As you gear up to study mathematics, you are probably wondering, "What will I learn this year?" You will focus on these three areas:

- Calculate and solve problems involving addition, subtraction, multiplication, and division.
- Analyze and use tables, graphs, and rules to solve problems involving rates and proportions.
- Use data samples of a population and describe the characteristics and limitations of the samples.

Along the way, you'll learn more about problem solving, how to use the tools and language of mathematics, and how to THINK mathematically.



Reinforcement of Standard 5MR1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns.

Reinforcement of Standard 5NS2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.

Real-World Problem Solving In 2001, Eric Weihenmayer made history as one of a few adventurous people who have made it to the summit of Mt. Everest, the highest peak in the world. What makes Eric's feat so incredible is that he is blind. He and his team had to plan the journey carefully and come up with unique solutions along the way when things didn't go just as they planned. Eric, who was a former mathematics teacher, and his team are expert problem solvers.

You may not face a challenge as big as Mt. Everest this year. But, when you do encounter a new problem situation, there is a series of steps that will help you to attack the problem efficiently. It's called the *four-step plan*.

Real-World EXAMPLE

MOUNTAIN CLIMBING The Seven Summits are the highest mountains on each continent. The ages of two of the youngest climbers of the Seven Summits are 23 years 9 days and 22 years 175 days. What is the age difference between the two climbers?

EXPLORE

What are you trying to find? Restate the problem in your own words. Use as few words as possible. You need to find the age difference between the climbers.

Do you think you'll need any additional information such as a formula or measurement conversion? You may need to know the number of days in one year. 1 year = 365 days

🕨 PLAN

Are there any key words in the problem?

The problem asks you to find the difference between the ages. To find the difference, subtract.

Estimate the answer.

Think 23 years 9 days – 22 years 175 days \approx 23 years – 22.5 years \approx 0.5 year

SOLVE	Before you can subtract, convert 1 year to days.
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
	The age difference between the climbers is 199 days.
СНЕСК	<i>Is the answer reasonable?</i> Compare your answer to the estimate. Since 199 days is a little more than one half year, the answer is reasonable.

Practice

Use the four-step plan to solve each problem.

1. As the length of a gift box increases by $2\frac{1}{4}$ inches, the price of the gift box increases by \$1.50. There are five different sizes of gift boxes. The box shown at the right is the middle-sized gift box. It costs \$4.65. What are



the lengths of the remaining gift boxes? What do they cost?

2. The counselors at Hembrick Middle School are assigning students to math classes for the coming year. There can be no more than 28 students in any class. The counselors decided to add or remove the same number of students from each class. How many students should be moved? What are the new class sizes?

Mr. Leonard	Ms. Jackowski	Coach Broussard	Mrs. Almedia	Mr. Chan	Miss Banks
31	24	26	30	23	25

- 3. The Academic Boosters expect 500 people at the annual awards banquet. If each table seats 8 people, how many tables are needed?
- 4. Samantha was making treat bags for her classmates. She has already made 2 dozen bags. If she wants to have a treat bag for each of the 33 students in her class, how many more should she make?
- 5. Mrs. Bentley spent \$125 to rent a popcorn machine for the school carnival and \$80 to buy popcorn, oil, and other supplies. If she sold 256 bags of popcorn for \$2 each, how much money did she make after paying for the machine and the supplies?

Is your answer reasonable? Check to be sure it is.

18

Problem-Solving Strategies

Reinforcement of Standard 5MR1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns. Reinforcement of Standard 5NS2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.

Real-World Problem Solving The artistry of stained glass windows has been around since about 313 A.D. Sometimes the designer uses repeated patterns, like tessellations, to create the window.

There are many different types of problems that you encounter in your life. In mathematics, one of the most common problem-solving strategies is the *look for a pattern* strategy. You can use problem-solving strategies to solve a variety of problems.

Real-World EXAMPLE

SCHOOL Steven is trying to determine the maximum number of students that can sit in the small auditorium at his school. The first row has 28 seats. He notices that the second row has two more seats than the first row, and the third row has two more seats than the second row. If there are 8 rows of seats in the auditorium, how many students can be seated at one time?

EXPLORE What are you trying to find? Restate the problem in your own words. Use as few words as possible. You need to find the total number of students that can be seated in the auditorium.

What information do you need to solve the problem? You need the number of seats in each row.

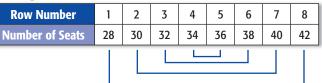
Make a table showing the number of seats in each row. Then find the total number of seats in the auditorium.

PROBLEM-SOLVING STRATEGIES

- Draw a diagram.
- Look for a pattern.
- Guess and check.
- Act it out.
- Work a simpler problem.
- Work backward.

SOLVE

You could add to find the total. But, if you look closely, you'll notice another pattern in the table—pairs of numbers add up to 70.



There are 4 groups of 70. So, there are 4(70) or 280 seats in the auditorium.

🐌 СНЕСК

Is the answer reasonable?

Four of the numbers round to 30, and four round to 40. $4 \times 30 = 120$ and $4 \times 40 = 160$. 120 + 160 = 280 \checkmark

Practice

Use the *look for a pattern* strategy to solve each problem.

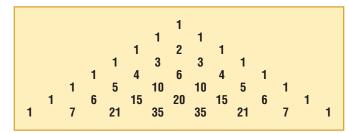
 Caton and Jordan are playing a game called Mancala. They have been keeping score by placing a ✓ beside the winner's name. If the pattern continues, how many wins will Caton have after 20 games?

Game	1	2	3	4	5	6	7	8
Caton	~	~		~		~	~	
Jordan			~		~			~

2. The table shows the amount of money in Jennifer's savings and checking accounts for the last several months. If the trend continues, in which month will Jennifer's savings account be greater than her checking account? How much money will she have in each account?

Month	Savings (dollars)	Checking (dollars)
1	346.25	735.75
2	388.75	693.25
3	431.25	650.75
4	473.75	608.25

3. Blaise Pascal was a famous mathematician who lived in the 1600s. Pascal is well known for a pattern known as Pascal's Triangle. What patterns do you see in Pascal's Triangle?



an Problems

Reinforcement of Standard 5MR2.6 Make precise calculations and check the validity of the results from the context of the problem. Reinforcement of - Standard 5NS2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.

The Rose Bowl Stadium, in Pasadena, California, was built to look like a horseshoe, with the south end open. This end was later closed, giving the stadium its famous elliptical shape. Imagine the problem-solving situations the engineers, architects, and contractors encountered when designing and building this stadium! How do you suppose they solved them?



You encounter mathematics everyday. But usually it's not written as a problem like 10×25 . Often the mathematics you encounter takes more than one step to solve. We call these problems *multi-step* problems. How do you solve a multi-step problem?—one step at a time.

Real-World EXAMPLE

FOOD The Fort Couch Middle School Cafeteria has a special lunch every Thursday. How much will you save by buying the special on Thursday instead of each item separately on any other day?

Entreé		Sides	
Chili	\$1.49	Salad	\$1.19
Chicken Fingers	\$1.39	Fruit	\$0.99
Hamburger	\$1.99	Tortilla Chips	\$1.29
All Drinks	\$0.99	Thursday Special	
		Chili, Salad, and Drink	\$3.49

EXPLORE What are you trying to find?

You need to find how much you'll save by buying the special instead of buying the items separately. So, you need to find the difference between the two costs.

What information do you need to find the difference? You need the cost of the special and the total cost of the items.

2 PLAN	What s Step 1 Step 2	Find t Find t	<i>you need to s</i> he total cost o he difference l he total of the i	f the item petween t	s by addi	0
3 SOLVE	Step 1	\$1.49 1.19 + 0.99 \$3.67	cost of chili cost of salad cost of drink total cost	Step 2	\$3.67 <u>- 3.49</u> \$0.18	total cost cost of special difference
	5		ve \$0.18 by bu 1 item separate		-	•
СНЕСК	\$1.50 +	- \$1.20 -	to check. The ⊦ \$1.00 or abo ifference is abo	ut \$3.70. 🕻	The specia	

Practice

 CIRCUS The table displays the ticket prices for the circus. For one show, 180 adult tickets, 360 child tickets, 70 student tickets, and 50 senior tickets were sold. Find the total income from tickets for the one show.

Ticket P	rices
Adult	\$5
Student	\$4
Child	\$2
Senior	\$3

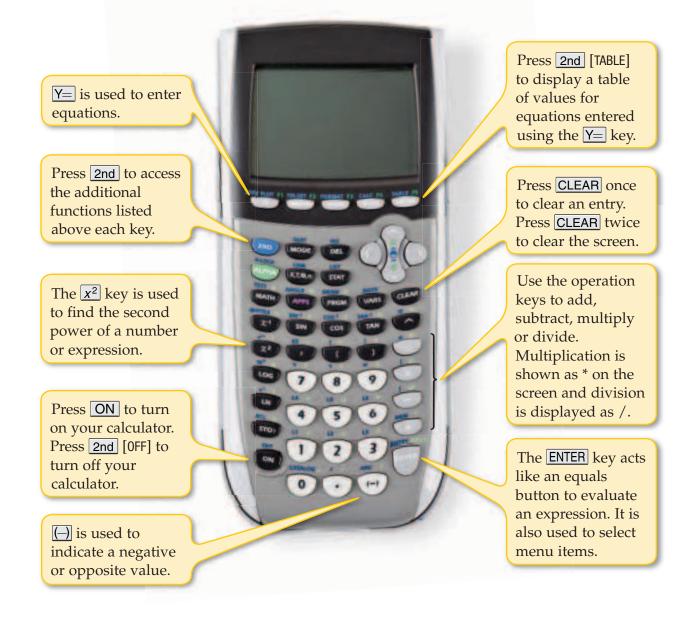
- 2. EARNINGS Dolores earns \$9 an hour and worked a total of 75 hours this month. Dexter earns \$7 an hour and worked a total of 94 hours this month. How much more did Dolores earn this month than Dexter?
- **3. GEOMETRY** The courtyard at Eastmoor Middle School is shaped like a rectangle that is 18.8 feet long. If the width of the courtyard is 4.8 feet less than the length, what is the total distance around the courtyard?
- 4. **TIME** Nathan has 3 hours before he has to be at field hockey practice. He spends 45 minutes working on homework, 25 minutes eating dinner, and 35 minutes watching television. How much time does he have left before he has to be at hockey practice?
- **5. MOVIES** The table shows the concession stand prices including tax at Movie Central. Paula ordered 2 medium drinks and a large popcorn. If she gave the cashier \$10, how much change should she receive?

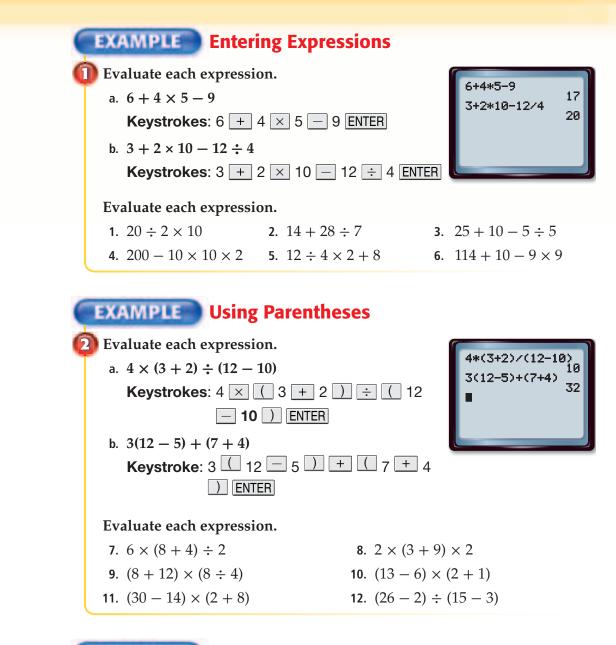
M	ovie Cer	itral Menu	I (
Drin	ks	Ρορςα	rn	
Small	\$1.99	Small	\$2.49	
Medium	\$2.75	Medium	\$3.50	
Large	\$3.50	Large	\$3.95	

Tools for Problem Solving

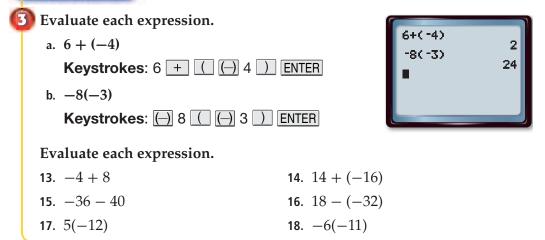
Reinforcement of Standard 5NS2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.

This year, you may use an exciting tool to help you visualize and strengthen concepts—a graphing utility or graphing calculator. Graphing Calculator Labs have been included in your textbook so you can use technology to extend concepts. These labs use the TI-83 Plus or TI-84 Plus calculator. A graphing calculator does more than just graph. You can also use it to calculate.





EXAMPLE Evaluating with Integers





Reinforcement of Standard 5MR2.1 Use estimation to verify the reasonableness of calculated results. **Reinforcement of — Standard 5NS2.1** Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.

Solving problems is more than using paper and pencil. Follow the path to choose the best method of computation.



10 Start Smart

(tl)CORBIS/PictureQuest, (tr)Comstock/PictureQuest, (bl)Brand X Pictures/PunchStock, (br)Barbara Penoyar/Getty Images

Practice

Choose the best method of computation to solve each problem. Then solve.

- 1. A restaurant prepared 1,987 lunches last week. *About* how many lunches were prepared each day?
- **2**. Eduardo purchased a bag of pretzels, a mechanical pencil, and a package of baseball cards. The total bill is \$9.12. He gives the cashier a \$20 bill. How much change should he receive?

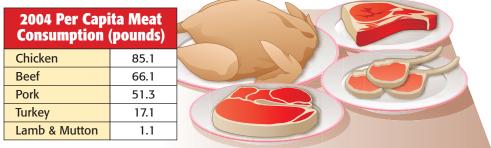
For Exercises 3–5, use the information in the table.

- **3.** On average, how many times does an elephant's heart beat in 1 hour?
- 4. On average, how many times does a horse's heart beat in 1 hour?
- 5. On average, how many more times does a mouse's heart beat in 1 hour than a rabbit's heart?

Animal	Heart Rates (beats per minute)	
Cat	120	
Elephant	30	
Horse	44	
Mouse	700	
Rabbit	205	

6. The number of students at Blendon Middle School is half the number it was twenty years ago. If there were 826 students twenty years ago, how many students are there now?

- **Source:** Merck Veterinary Manual
- **7**. Enrique has two samples of the same chemical. He wants to store both samples in a 0.5-liter container. One sample is 0.38 liter. The other sample is 0.21 liter. Can he store both samples in the container?
- **8.** The table below shows the average number of pounds of various meat consumed per person in the United States.



Source: National Turkey federation

About how many more pounds of beef than turkey is consumed on average by each person per year?

- **9**. Pluto, normally the farthest planet from the Sun, is also the slowest. Its average speed around the Sun is 10,604 miles per hour. Earth, by contrast, travels 6.28 times as fast. What is the average speed of Earth?
- **10**. Emilio is taking karate lessons. The instructor charges \$25 for each lesson. If Emilio has 8 lessons in one month, how much does he owe the instructor?

How to Use Your Math Book

Why do I need my math book? Have you ever been in class and not understood all of what was presented? Or, you understood everything in class, but at home, got stuck on how to solve a couple of problems? Maybe you just wondered when you were ever going to use this stuff?

These next few pages are designed to help you understand everything your math book can be used for ... besides homework problems!

Before you read, have a goal.

- What information are you trying to find?
- Why is this information important to you?
- How will you use the information?

Have a plan when you read.

- Read the Main IDEA at the beginning of the lesson.
- Look over photos, tables, graphs, and opening activities.
- Locate words highlighted in yellow and read their definitions.
- Find Key Concept and Concept Summary boxes for a preview of what's important.
- Skim the example problems.

Keep a positive attitude.

- Expect mathematics reading to take time.
- It is normal to *not* understand some concepts the first time.

Make a

goal!

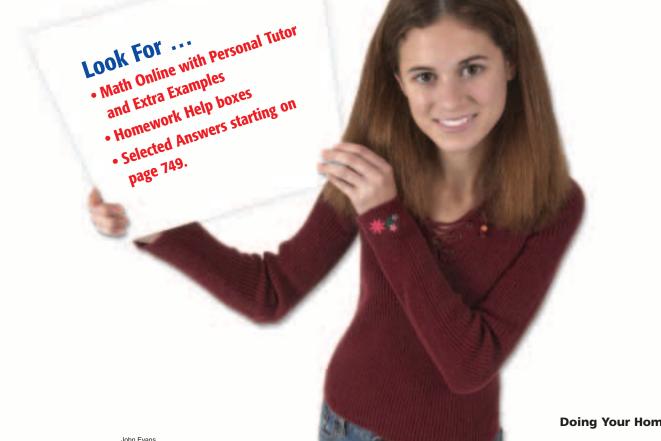
• If you don't understand something you read, it is likely that others don't understand it either.

12 Start Smart

Doing Your Homework

Regardless of how well you paid attention in class, by the time you arrive at home, your notes may no longer make any sense and your homework seems impossible. It's during these times that your book can be most useful.

- Each lesson has example problems, solved step-by-step, so you can review the day's lesson material.
- Math math has extra examples at <u>ca.gr6math.com</u> to coach you through solving those difficult problems.
- Each exercise set has **HOMEWORK** HELP boxes that show you which examples may help with your homework problems.
- Answers to the odd-numbered problems are in the back of the book. Use them to see if you are solving the problems correctly. If you have difficulty on an even problem, do the odd problem next to it. That should give you a hint about how to proceed with the even problem.



Studying for a Test

You may think there is no way to study for a math test. However, there *are* ways to review before a test. Your book can help!

- Review all of the new vocabulary words and be sure you understand their definitions. These can be found on the first page of each lesson or highlighted in yellow in the text.
- Review the notes you've taken on your and write down any questions that you still need answered.
- Practice all of the concepts presented in the chapter by using the chapter Study Guide and Review. It has additional problems for you to try as well as more examples to help you understand. You can also take the Chapter Practice Test.
- Take the Self-Check Quizzes at <u>ca.gr6math.com</u>.

Look For ...

- Self-check Quizzes at <u>ca.gr6math.com</u>
- Study Guide and Review at the end of each chapter

Scavenger Hunt

Let's Get Started

Use the Scavenger Hunt below to learn where things are located in each chapter.

- 1. What is the title of Chapter 1?
- 2. How can you tell what you'll learn in Lesson 1-1?
- **3**. Sometimes you may ask "When am I ever going to use this". Name a situation that uses the concepts from Lesson 1-2.
- 4. In the margin of Lesson 1-2, there is a Vocabulary Link. What can you learn from that feature?
- 5. What is the key concept presented in Lesson 1-3?
- 6. How many examples are presented in Lesson 1-3?
- **7.** What is the title of the feature in Lesson 1-3 that tells you how to read square roots?
- 8. What is the web address where you could find extra examples?
- **9**. Suppose you're doing your homework on page 40 and you get stuck on Exercise 18. Where could you find help?
- **10**. What problem-solving strategy is presented in the Problem-Solving Investigation in Lesson 1-5?
- 11. List the new vocabulary words that are presented in Lesson 1-7.
- **12**. What is the web address that would allow you to take a self-check quiz to be sure you understand the lesson?
- 13. There is a Real-World Career mentioned in Lesson 1-10. What is it?
- 14. On what pages will you find the Study Guide and Review for Chapter 1?
- **15.** Suppose you can't figure out how to do Exercise 25 in the Study Guide and Review on page 72. Where could you find help?



CALIFORNIA Data File

The following pages contain data about California that you'll use throughout the book.

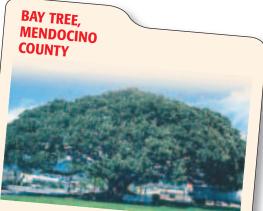


Colossus

- The Colossus is the tallest and fastest roller coaster • Its tallest drop height is 115 feet, and its top speed
- is 62 miles per hour. Colossus has double tracks with a total length of
- 8,650 feet and 24 passenger trains sitting 2 per seat.

Source: sixflags.com





The Bay Tree, found in Mendocino County, reaches a height of 108 feet. The circumference of the trunk is 536 inches and the tree's crown spread is 119 feet. Source: ufei.org

CALIFORNIA MUSEUM FOR HISTORY, WOMEN, AND THE ARTS

Admission Fees per Person			
Adults	\$5.00		
Seniors	\$4.00		
Youth (6–13)	\$3.50		
5 and under	Free		
Groups of 10 or more	\$4.00		

Source: californiamuseum.org

BASEBALL

Team	ason Standi		
	Wins	Losses	
Oakland	93	69	
San Diego	88		
San Francisco		74	
	76	85	
Los Angeles	88	74	
ource: mlb.com			

COBBIS

CALIFORNIA VALLEY QUAIL

Adult Male

Length to end of tail: $9\frac{1}{2}$ in.

Length of wing from flexure: $4\frac{7}{12}$ in.

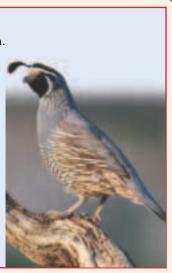
Length of tail: $3\frac{1}{2}$ in.

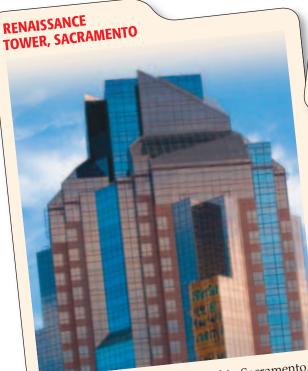
Adult Female Length to end of tail: 9 in.

Length of wing from flexure: $4\frac{7}{12}$ in.

Length of tail: $3\frac{3}{4}$ in.

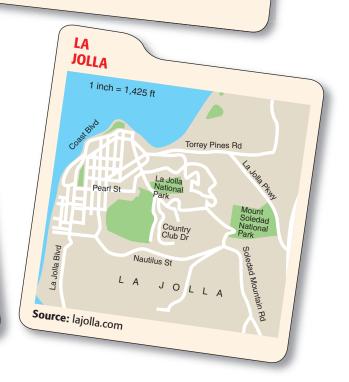
Source: 50states.com

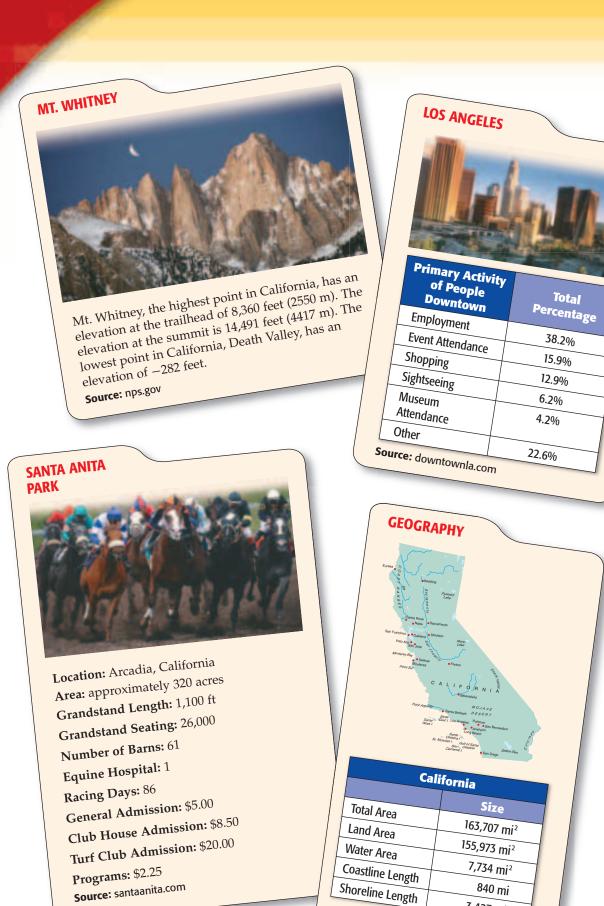




The Renaissance Tower, located in Sacramento, is 113 meters tall and has 28 floors. The height of the tower is about 87.6% of the height of the Wells Fargo Tower, which has 30 floors. **Source:** emporis.com **MOJAVE DESERT**

The Mojave Desert is a region of low barren mountains and flat valleys in Southern California near the Nevada border. The mountains range from 2,000 feet to 5,000 feet in height (610–1,524 meters). The desert has an area of 15,000 square miles (38,850 square kilometers) and receives an average yearly rainfall of 5 inches (12.7 centimeters). Source: infoplease.com





3,427 mi

Source: 50states.com

California's 10	Largest Cities
City	2005 Estimated Population
Los Angeles	3,819,951
San Diego	1,266,753
San Jose	898,349
San Francisco	751,682
Long Beach	475,460
Fresno	451,455
Sacramento	445,335
Oakland	398,844
	342,510
Santa Ana Anaheim	332,361



YOSEMITE NATIONAL PARK

Acreage: 750,000 acres

Area: 1,200 mi²

Streams: 1,600 mi

Hiking Trails: 800 mi

Roads: 350 mi

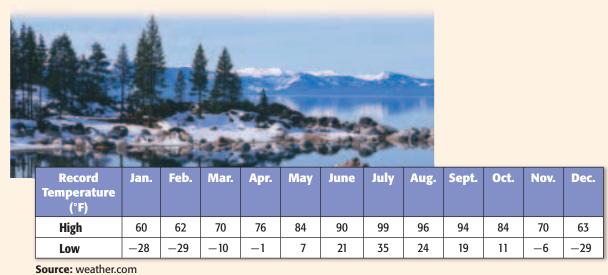
Federally designated wild and scenic rivers: 2

Annual park visitation: over 3.5 million

Source: nps.gov



LAKE TAHOE



Unit 1 Algebra and Functions

Focus

Apply the four operations to accurately compute and solve problems and equations involving whole numbers, integers, and decimals.

CHAPTER 1 Introduction to Algebra and Functions

BIG Idea) Write verbal expressions and sentences as algebraic expressions and equations; evaluate algebraic expressions, solve simple linear equations, and graph and interpret their results.

CHAPTER 2 Integers

BIG Idea) Calculate and solve problems involving addition, subtraction, multiplication, and division.

CHAPTER 3 Algebra: Linear Equations and Functions

BIG Idea) Write verbal expressions and sentences as algebraic expressions and equations; evaluate algebraic expressions, solve simple linear equations, and graph and interpret their results.

Cross-Curricular Project

Math and Geography

The Wide World of Soccer Soccer fans, get up on your feet! You've been selected to join us on a world-wide soccer adventure. Along the way, you'll gather data about the geography of countries where soccer is the favorite sport. You'll also make some predictions about the future of soccer in the United States. We will be leaving on our adventure shortly, so pack your math tools and your thinking cap. This is one adventure you don't want to miss!

Math Log on to ca.gr6math.com to begin.





 Standard 6AF1.0 Write verbal expressions and sentences as algebraic expressions and equations; evaluate algebraic expressions, solve simple linear equations, and graph and interpret their results.

Key Vocabulary

algebra (p. 44) defining the variable (p. 50) evaluate (p. 31) numerical expression (p. 38)

Introduction to Algebra and Functions

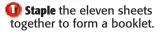


Real-World Link

TIME The day tour of the White House costs \$60 for each adult and \$40 for each child. The night tour costs \$25 for each adult and \$15 for each child. You can use the four-step problem-solving plan to determine the cost of each tour for a family of 2 adults and 3 children.



Introduction to Algebra and Functions Make this Foldable to help you organize your notes. Begin with eleven sheets of notebook paper.





2 Cut tabs. Make each one 2 lines longer than the one before it.



Write the chapter title on the cover and label each tab with the lesson number.



GET READY for Chapter 1

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 2

Math Take the Online Readiness Quiz at <u>ca.gr6math.com</u>.

Take the Quick Check below. Refer to the Quick Review for help.

Option 1

QUICKCheck	QUICKReview
 Add. (Prior Grade) 1. 89.3 + 16.5 2. 7.9 + 32.45 3. 54.25 + 6.39 4. 10.8 + 2.6 5. TECHNOLOGY Patrick bought a personal electronic organizer for \$59.99 and a carrying case for \$12.95. What was his total cost, not including tax? (Prior Grade) 	Example 1 Find 17.89 + 43.2. 17.89 Line up the decimal points. + 43.20 Annex a zero. 61.09
Subtract. (Prior Grade) 6. 24.6 - 13.3 7. 9.1 - 6.6 8. 30.55 - 2.86 9. 17.4 - 11.2	Example 2 Find 37.45 – 8.52. 37.45 Line up the decimal points. - 8.52 28.93 28.93
Multiply. (Prior Grade)10. 4×7.7 11. 9.8×3 12. 2.7×6.3 13. 8.5×1.2	Example 3 Find 1.7 \times 3.5. 1.7 \leftarrow 1 decimal place $\times 3.5 \leftarrow + 1$ decimal place 5.95 $\leftarrow 2$ decimal places
 Divide. (Prior Grade) 14. 37.49 ÷ 4.6 15. 14.31 ÷ 2.7 16. 5.94 ÷ 6.16 17. 11.15 ÷ 2.5 18. PIZZA Four friends decided to split the cost of a pizza evenly. The total cost was \$25.48. How much does each friend need to pay? (Prior Grade) 	Example 4 Find 24.6 ÷ 2.5. $2.5)\overline{24.6} \rightarrow 25.\overline{)246}$. Multiply both numbers by the same power of 10. 9.84 $25)\overline{246.00}$ Annex zeros. -225 210 Divide as with -200 whole numbers. 100 -100 0

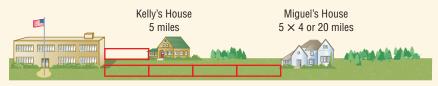
READING Word Problems

Making Sense

When you solve a word problem, the first thing to do is to read the problem carefully. The last thing to do is to see whether your answer makes sense. Sometimes a picture or diagram can help.

Kelly lives 5 miles from school. This is 4 times as far as Miguel lives from school. How far does Miguel live from school?

If you look just at the key words in the problem, it might seem that 4 *times* 5 would give the solution.



But the important question is, "Does this solution make sense?" In this case, the solution does *not* make sense because Kelly lives farther away. This problem is solved by dividing.



So, Miguel lives 1.25 miles away from school.

PRACTICE

For Exercises 1 and 2, choose the model that illustrates each problem. Explain your reasoning. Then solve.

1. Jennifer has saved \$210 to purchase an MP3 player. She needs \$299 to buy it. How much more money does she need?



2. The school cafeteria sold 465 lunches on Thursday. They expect to sell 75 more lunches on Friday because they serve pizza that day. How many lunches do they expect to sell on Friday?



Evaluate the reasonableness of the solution in the context of the original situation. Standard 6NS2.3 Solve addition, subtraction, multiplication, and division problems, including those arising in concrete situations, that use positive and negative integers and combinations of these operations.

Standard 6MR3.1



A Plan for Problem Solving

Main IDEA

Solve problems using the four-step plan.



Standard 6MR1.1 Analyze problems by identifying

relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns.

Reinforcement of Standard 5NS2.1 Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.

GET READY for the Lesson

ANALYZE GRAPHS The bar graph shows the countries with the most world championship motocross wins. What is the total number of wins for these five countries?

- Do you have all of the information necessary to solve this problem?
- **2**. Explain how you would solve this problem. Then solve it.



Source: Motocross.com

- **3**. Does your answer make sense? Explain.
- **4**. What can you do if your first attempt at solving the problem does not work?

In mathematics, there is a *four-step plan* you can use to help you solve any problem.

- **1. Explore** Read the problem carefully.
 - What information is given?
 - What do you need to find out?
 - Is enough information given?
 - Is there any extra information?
- **2. Plan** How do the facts relate to each other?
 - Select a strategy for solving the problem. There may be several that you can use.
 - Estimate the answer.
- 3. Solve
- Use your plan to solve the problem.
 - If your plan does not work, revise it or make a new plan.
 - What is the solution?

4. Check

- Does your answer fit the facts given in the problem?
- Is your answer reasonable compared to your estimate?
- If not, make a new plan and start again.



Four-Step Plan No matter what strategy you use, you can always use the four-step plan to solve a problem.



In a recent year, worldwide consumers purchased 8.8 million LCD (Liquid Crystal Display) TVs. Source: Display Search

EXAMPLE Use the Four-Step Plan

TELEVISION There were about 260 million TVs in the U.S. in 2005. This amount increases by 4 million each year after 2005. In what year will there be at least 300 million TVs?

Explore What are you trying to find? In what year will there be at least 300 million TVs in the U.S.?

> *What information do you need to solve the problem?* You know how many TVs there were in 2005. Also, the number increases by 4 million each year.

PlanFind the number of TVs needed to reach 300 million.Then divide this number by 4 to find the number of years
that will pass before the total reaches 300 million TVs.

The change in the number of TVs from 260 million to 300 million is 300 - 260 or 40 million TVs. Dividing the difference by 4, you get $40 \div 4$ or 10.

You can also use the *make a table* strategy.

Year	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15
Number (millions)	260	264	268	272	276	280	284	288	292	296	300
+4 +4 +4 +4 +4 +4 +4 +4											

So, there will be at least 300 million TVs in the U.S. in the year 2015.

Check10 years \times 4 million = 40 million260 million + 40 million = 300 million

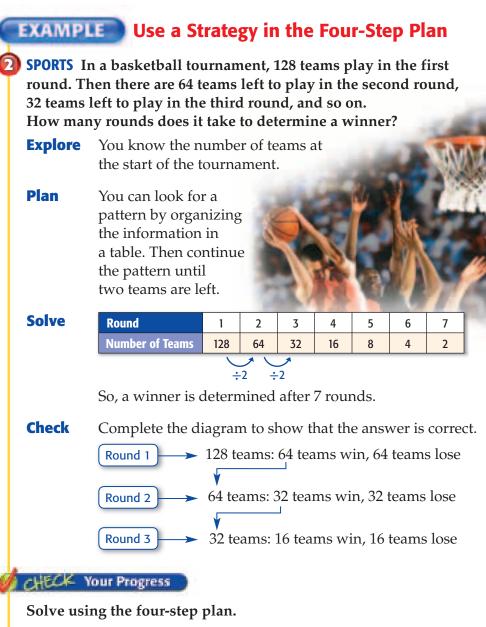
CHECK Your Progress

Solve

a. **WHALES** A baby blue whale gains about 200 pounds each day. About how many pounds does a baby blue whale gain per hour?

Problems can be solved using different operations or strategies.

KEY CONCEPT	Problem-Solving Strategies
guess and check	use a graph
look for a pattern	work backward
make an organized list	eliminate possibilities
draw a diagram	estimate reasonable answers
act it out	use logical reasoning
solve a simpler problem	make a model



b. SPORTS How many rounds would it take to determine a winner if 512 teams participated in the tournament?

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CHECK Your Understanding

Use the four-step plan to solve each problem.

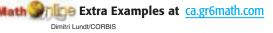
Example 1 (p. 26)

1. **ANALYZE TABLES** The table lists the sizes of six of the larger lakes in North Carolina. About

- how many times larger is High Rock Lake than Hyco Lake?2. E-MAIL If Isaac receives an e-mail every
- Example 2 (p. 27)
 2. E-MAIL If Isaac receives an e-mail every 20 minutes during the workday, how many e-mails would he expect to receive between 8:00 A.M. and noon?

Lake	Size (acres)
Lake Mattamuskeet	40,000
Falls Lake	12,000
Hyco Lake	3,750
Lake Gaston	20,000
Lake James	6,500
High Rock Lake	15,000
Source: visitne com	





Exercises

HOMEWORK HELP		
For Exercises	See Examples	
3–6	1	
7–10	2	

Use the four-step plan to solve each problem.

- **3. BIRDS** Most hummingbirds flap their wings about 50 times a second. How many times can a hummingbird flap its wings in one minute?
- **4. PLANETS** Jupiter is about 3 times the size of Neptune. If the diameter of Jupiter is 88,736 miles, estimate the diameter of Neptune.
- **5. MONEY** To attend the class picnic, each student will have to pay \$5.25 for transportation and \$5.75 for food. If there are 379 students in the class, how much money will be collected for the picnic?
- 6. **DVD RENTALS** A video store took in \$5,400 in DVD rentals during July. January sales are expected to be double that amount. If DVDs rent for \$4, how many DVD rentals are expected in January?
- 7. **GEOMETRY** What are the next two figures in the pattern?



8. ALGEBRA What are the next two numbers in the pattern?

9, 27, 81, 243, 729,

ANALYZE TABLES For Exercises 9 and 10, use the commuter train schedule shown.

A commuter train departs from a train station and travels to the city each day. The schedule shows the first five departure and arrival times.

- **9**. How often does the commuter train arrive in the city?
- **10**. What is the latest time that passengers can depart from the train station if they need to arrive in the city no later than noon?

Commuter Train Schedule		
Departure	Arrival	
6:30 а.м.	6:50 A.M.	
7:15 a.m.	7:35 a.m.	
8:00 A.M.	8:20 A.M.	
8:45 A.M.	9:05 a.m.	
9:30 а.м.	9:50 А.М.	

- **11. COOKING** Mr. Sanders is serving fried turkey at 3:00 P.M. The 15-pound turkey has to cook 3 minutes for every pound and then cool for at least 45 minutes. What is the latest time he can start frying?
- **12. ESTIMATION** Terry opened a savings account in December with \$132 and saved \$27 each month beginning in January. Estimate the value of Terry's account in July. Then calculate the amount and evaluate the reasonableness of your estimate.
- **13**. **FIND THE DATA** Refer to the California Data File on pages 16–19 of your book. Choose some data and write a real-world problem in which you would use the four-step plan to solve the problem.

- 14. **ANALYZE TABLES** The sizes of Earth's oceans in millions of square kilometers are shown in the table. If the combined size of Earth's oceans is 367 million square kilometers, what is the size of the Pacific Ocean?
- **15. MONEY** Kishi wants to buy a DVD player that costs \$261.25 with tax. So far, she has saved \$145.75. If she saves \$5.50 every week, in how many weeks will she be able to purchase the DVD player?

Earth's Oceans		
Ocean	Size (million km²)	
Arctic	45	
Atlantic	77	
Indian	69	
Pacific		
Southern	20	

Source: The World Factbook

- **H.O.T.** Problems 16. CHALLENGE Use the digits 1, 2, 3, 4, and 5 to form a two-digit number and a three-digit number so that their product is as small as possible. Use each digit only once.
 - **17. OPEN ENDED** Create a real-world problem that can be solved by adding 79 and 42 and then multiplying the result by 3.
 - **18. WRITING IN MATH** Explain why it is important to plan before solving a problem.

STANDARDS PRACTICE

EXTRAPRACTICE

See pages 679, 715.

Math 💯 🗇 🔟 🕑 🖉

Self-Check Quiz at

ca.gr6math.com

19. Jeannie has \$72 to spend on birthday gifts for her mother. Which three items from the table could Jeannie purchase, not including tax?

Item	Cost
sweater	\$29.50
gloves	\$22.75
purse	\$32.00
chocolates	\$15.00
movie passes	\$27.75

- A gloves, movie passes, sweater
- **B** movie passes, sweater, purse
- **C** sweater, gloves, chocolates
- D sweater, gloves, purse

- 20. Mr. Brooks went on a business trip. The trip was 380 miles, and the average price of gasoline was \$3.15 per gallon. What information is needed to find the amount Mr. Brooks spent on gasoline for the trip?
 - **F** Number of times Mr. Brooks stopped to fill his tank with gasoline
 - **G** Number of miles the car can travel using one gallon of gasoline
 - H Number of hours the trip took
 - J Average number of miles Mr. Brooks drove per day

GET READY for the Next Lesson

PREREQUISITE SKILL Multiply.

21. 10×10 **22.** $3 \times 3 \times 3$ **23.** $5 \times 5 \times 5 \times 5$ **24.** $2 \times 2 \times 2 \times 2 \times 2$



Powers and Exponents

Main IDEA

Use powers and exponents.

Reinforcement of Standard 5NS1.3 Understand and compute positive integer powers of nonnegative integers; compute examples as repeated multiplication.

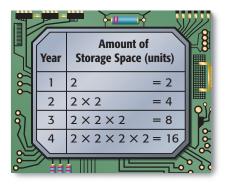
NEW Vocabulary

factors exponent base powers squared cubed evaluate standard form exponential form

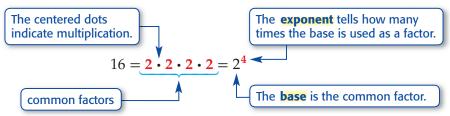
GET READY for the Lesson

TECHNOLOGY The amount of available storage space on a computer chip doubles every year.

- **1**. How is doubling shown in the table?
- **2**. If the pattern continues, how much space will be available by year 6?
- **3**. What is the relationship between the number of 2s and the year?



Two or more numbers that are multiplied together to form a product are called **factors**. When the same factor is used, you may use an exponent to simplify the notation.

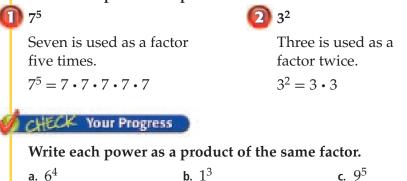


Numbers expressed using exponents are called **powers**.

Powers	Words
5 ²	five to the second power or five squared
4 ³	four to the third power or four cubed
2 ⁴	two to the fourth power

EXAMPLES Write Powers as Products

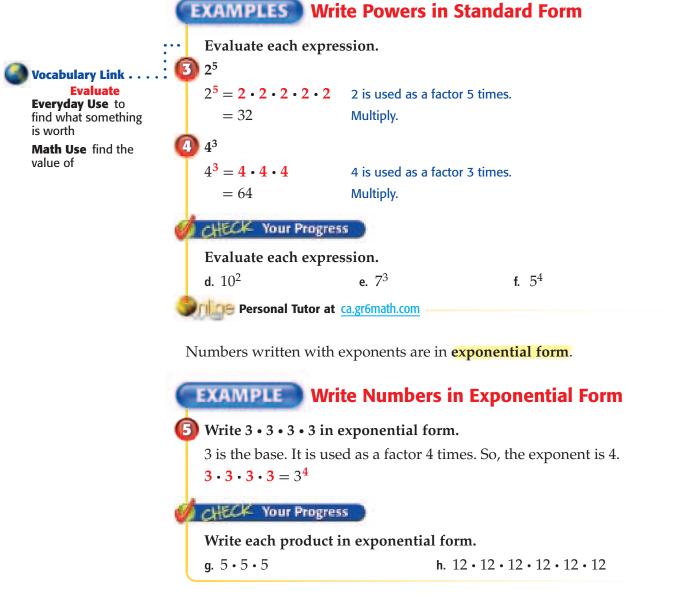
Write each power as a product of the same factor.



READING Math

First Power When a number does not have an exponent, the exponent is understood to be 1. For example, $8 = 8^{1}$.

You can **evaluate**, or find the value of, powers by multiplying the factors. Numbers written without exponents are in **standard form**.



Your Understanding Examples 1, 2 Write each power as a product of the same factor. (p. 30) 1. 9³ **2**. 3⁴ **3**. 8⁵ **Evaluate each expression.** Examples 3, 4 (p. 31) **4**. 2⁴ **5**. 7² **6**. 10³ 7. **POPULATION** There are approximately 7^{10} people living in the United States. About how many people is this? Write each product in exponential form. Example 5 (p. 31) **8**. 5 • 5 • 5 • 5 • 5 • 5 9. 1 • 1 • 1 • 1 10. 4 • 4 • 4 • 4 • 4

Exercises

HOMEWORK HELP		
For Exercises	See Examples	
11-16	1, 2	
17–24	3, 4	
25–28	5	

Write each p	power as a product of the same factor.
11 1 ⁵	12 4^2

11. 1	12. 4	13. 5
14. 8 ⁶	15 . 9 ³	16. 10^4
Evaluate each exp	ression.	
17. 2 ⁶	18. 4 ³	19. 7^4
20. 4 ⁶	21. 1 ¹⁰	22. 10 ¹

23. BIKING In a recent year, the number of 12- to 17-year-olds that went off-road biking was 10⁶. Write this number in standard form.

12 28

24. **TRAINS** The Maglev train in China is the fastest passenger train in the world. Its average speed is 3⁵ miles per hour. Write this speed in standard form.

Write each product in exponential form.

25. 3 • 3	26 . $7 \cdot 7 \cdot 7 \cdot 7$
27 . 1 • 1 • 1 • 1 • 1 • 1 • 1 • 1	28 . 6 • 6 • 6 • 6 • 6

Write each power as a product of the same factor.

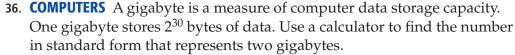
Evaluate each expression.

31 . <i>six to the fourth power</i>	32 . 6 cubed
--	---------------------

GEOMETRY For Exercises 33 and 34, use the figures below.



- **33**. Find the number of unit cubes that make up each cube. Write your answers using exponents.
- **34**. Why do you think the expression 2^3 is sometimes read as 2 *cubed*?
- **35. NUMBERS** Write $5 \cdot 5 \cdot 5 \cdot 5 \cdot 4 \cdot 4 \cdot 4$ in exponential form.



Order the following powers from least to greatest.

37. 6 ⁵ , 1 ¹⁴ , 4 ¹⁰ , 17 ³	38 . 2^8 , 15^2 , 6^3 , 3^5	39. 5^3 , 4^6 , 2^{11} , 7^2
37 . 0, 1, 1, 1, 17	JU. Z , IU , U , U	

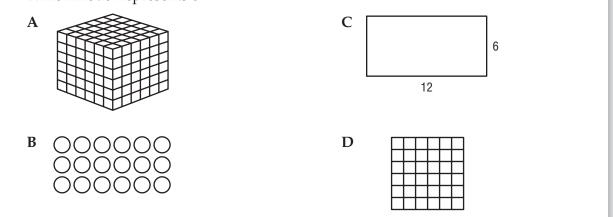
- H.O.T. Problems **40. CHALLENGE** Write two different powers that have the same value.
 - **41.** Which One Doesn't Belong? Identify the number that does not belong with the other three. Explain your reasoning.



- 42. **OPEN ENDED** Select a number between 1,000 and 2,000 that can be expressed as a power.
- **43. WRITING IN MATH** Analyze the number pattern $2^4 = 16$ shown at the right. Then write a convincing $2^3 = 8$ argument as to the value of 2⁰. Based on your $2^2 = 4$ argument, what do you think will be the $2^1 = 2$ value of 2^{-1} ? $2^0 = ?$

STANDARDS PRACTICE

44. Which model represents 6^{3} ?





- **45. RACING** The graph shows which numbered cars have the most wins at the Indianapolis 500. How many times more did the number 3 car win than the number 14 car? (Lesson 1-1)
- **46. PRODUCTION** A machine on a production line fills 8 soft drink cans per minute. How many cans does it fill in 8 hours? (Lesson 1-1)

GET READY I	or the Next Lesson			
PREREQUISITE SKILL Multiply.				
47. 2 • 2	48. 3 • 3			



Source: indy500.com

49. 5 • 5

50. 7 • 7



Squares and Square Roots

Main IDEA

Find squares of numbers and square roots of perfect squares.



Preparation for

Standard 7NS2.4 Use the inverse relationship between raising to a power and extracting the root of a perfect square; for an integer that is not square, determine without a calculator the two integers between which its square root lies and explain why.

NEW Vocabulary

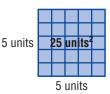
square perfect squares square root radical sign

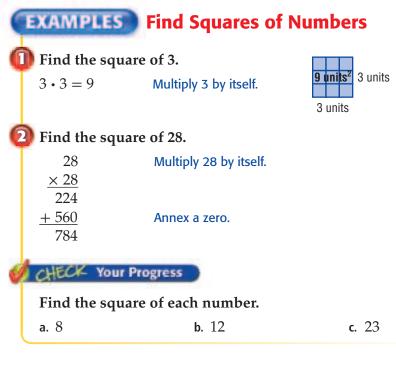
MINI Lab

A square with an area of 36 square units is shown.

- 1. Using tiles, try to construct squares with areas of 4, 9, and 16 square units.
- 2. Try to construct squares with areas 12, 18, and 20 square units.
- **3**. Which of the areas form squares?
- 4. What is the relationship between the lengths of the sides and the areas of these squares?
- 5. Using your square tiles, create a square that has an area of 49 square units. What are the lengths of the sides of the square?

The area of the square at the right is $5 \cdot 5$ or 25 square units. The product of a number and itself is the **square** of the number. So, the square of 5 is 25.





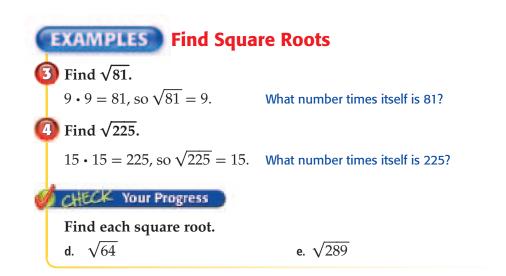
Numbers like 9, 16, and 225 are called square numbers or **perfect squares** because they are squares of whole numbers.

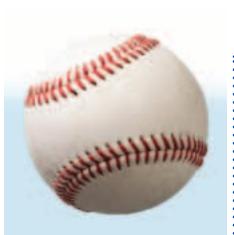
The factors multiplied to form perfect squares are called **square roots**. A **radical sign**, $\sqrt{-}$, is the symbol used to indicate the square root of a number.

READING Math

Square Roots Read $\sqrt{16} = 4$ as the square root of 16 is 4.

KEY CONCEPTSquare RootWordsA square root of a number is one of its two equal factors.ExamplesNumbers $4 \cdot 4 = 16$, so $\sqrt{16} = 4$.If $x \cdot x$ or $x^2 = y$, then $\sqrt{y} = x$.





Real-World Link The average lifespan of a major league baseball is 7 pitches. Source: superkids.com

Real-World EXAMPLE 2nd base **SPORTS** The infield of a baseball \bigcirc field is a square with an area of 8,100 square feet. What are the Pitcher's dimensions of the infield? 3rd base 1st base The infield is a square. By finding the square root of the area, 8,100, you find the length of one side of the infield. $90 \cdot 90 = 8,100$, so $\sqrt{8,100} = 90$. Home plate The length of one side of the infield is 90 feet. So, the dimensions of the infield are 90 feet by 90 feet.

CHECK Your Progress

f. **SPORTS** The largest ring in amateur boxing is a square with an area of 400 square feet. What are the dimensions of the ring?

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CHECK Your Understanding

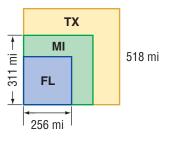
	Find the square of each number.			
(p. 34)	1. 6	2. 10	3. 17	4. 30
Examples 3, 4	Find each squar	e root.		
(p. 35)	5 . $\sqrt{9}$	6 . $\sqrt{36}$	7 . √121	8 . $\sqrt{169}$
Example 5 (p. 35)	Los Angeles If the area of	is known as the M a Route 66 sign r ne sign is a square	6 from Chicago to Main Street of America neasures 576 square e, what are the	a.

Exercises

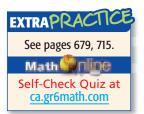
HOMEWO	RKHELP	Find the square o	f each number.		
For	See	10. 4	11. 1	12. 7	13. 11
Exercises	Examples	14 . 16	15. 20	16. 18	17 . 34
10-17	1, 2				
18–25	3, 4	Find each square	root.		
26–27	5	18. $\sqrt{4}$	19 . $\sqrt{16}$	20 . $\sqrt{49}$	21 . $\sqrt{100}$
		22. $\sqrt{144}$	23 . $\sqrt{256}$	24 . $\sqrt{529}$	25 . $\sqrt{625}$

- **26. MEASUREMENT** Emma's bedroom is shaped like a square. What are the dimensions of the room if the area of the floor is 196 square feet?
- **27. SPORTS** For the floor exercise, gymnasts perform their tumbling skills on a mat that has an area of 1,600 square feet. How much room does a gymnast have to run along one side of the mat?
- **28**. What is the square of 12? **29**. Find the square of 19.
- **30. GARDENING** A square garden has an area of 225 square feet. How much fencing will a gardener need to buy in order to place fencing around the garden?

GEOGRAPHY For Exercises 31–33, refer to the squares in the diagram. They represent the approximate areas of Texas, Michigan, and Florida.



- **31**. What is the area of Michigan in square miles?
- 32. How much larger is Texas than Florida?
- **33**. The water areas of Texas, Michigan, and Florida are about 6,724 square miles, 40,000 square miles, and 11,664 square miles, respectively. Make a similar diagram comparing the water areas of these states. Label the squares.



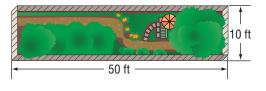
34. MEASUREMENT A chessboard has an area of 324 square inches. There is a 1-inch border around the 64 squares on the board. What is the length of one side of the region containing the small squares?



- H.O.T. Problems 35. CHALLENGE The area of a square that is 8 meters by 8 meters is how much greater than the area of a square containing 9 square meters? Explain.
 - **36. OPEN ENDED** Write a number whose square is between 200 and 300.

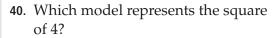
CHALLENGE For Exercises 37 and 38, use the diagram shown.

37. Could the garden area be made larger using the same amount of fencing? Explain.



- **38**. Describe the largest garden area possible using the same amount of fencing. How do the perimeter and area compare to the original garden?
- **39. WRITING IN MATH** Explain why raising a number to the second power is called *squaring* the number.

STANDARDS PRACTICE



A	C
B	D

- **41**. Which measure can be the area of a square if the measure of the side length is a whole number?
 - **F** 836 sq ft
 - **G** 949 sq ft
 - **H** 1,100 sq ft
 - J 1,225 sq ft

	05			
2 . 3 ⁴	43 . 8 ⁵	44. 7 ²	45. 2 ⁶	
equal in siz	ze and weight, how mu	uch did it cost to ship ea	ach package? (Lesson 1-1)	

47. 13 + 8	48. 10 - 6	49 . 5 × 6	50 . 36 ÷ 4
- 14. m			

Order of Operations

Main IDEA

Evaluate expressions using the order of operations.

Standard 6AF1.3 Apply algebraic order of operations and the commutative, associative, and distributive properties to evaluate expressions; and justify each step in the process. Standard 6AF1.4 Solve problems manually by using the correct order of operations or by using a scientific calculator.

NEW Vocabulary

numerical expression order of operations

GET READY for the Lesson

SPORTS The Kent City football team made one 6-point touchdown and four 3-point field goals in its last game. Kaitlyn and Percy each use an expression to find the total number of points the team scored.

Kaitlyn $6 + 4 \cdot 3 = 6 + 12$ = 18The team scored 18 points.

Percy $(6 + 4) \cdot 3 = 10 \cdot 3$ = 30The team scored 30 points.

- 1. List the differences between their calculations.
- 2. Whose calculations are correct?
- Make a conjecture about what should be the first step in simplifying 6 + 4 • 3.

The expression $6 + 4 \cdot 3$ is a **numerical expression**. To evaluate expressions, use the **order of operations**. These rules ensure that numerical expressions have only one value.

KEY CONCEPT

Order of Operations

- 1. Evaluate the expressions inside grouping symbols.
- 2. Evaluate all powers.
- 3. Multiply and divide in order from left to right.
- 4. Add and subtract in order from left to right.

EXAMPLES Use Order of Operations

Add 5 and 9.

Evaluate 5 + (12 – 3). Justify each step.

5 + (12 - 3) = 5 + 9

= 14

= 14

Evaluate 8 – 3 • 2 + 7. Justify each step.

 $8 - 3 \cdot 2 + 7 = 8 - 6 + 7$ Multiply 3 and 2. = 2 + 7 Subtract 6 from 8. = 9 Add 2 and 7.

CHECK Your Progress

Evaluate each expression. Justify each step.

a. $39 \div (9 + 4)$

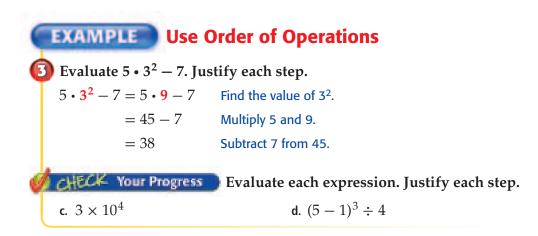
b. $10 + 8 \div 2 - 6$

Subtract first, since 12 - 3 is in parentheses.

READING in the Content Area

For strategies in reading this lesson, visit ca.gr6math.com.

Math The Extra Examples at ca.gr6math.com



In addition to using the symbols \times and \cdot , multiplication can be indicated by using parentheses. For example, 2(3 + 5) means $2 \times (3 + 5)$.

EXAMPLE Use Order of Operations 4 Evaluate 14 + 3(7 – 2). Justify each step. 14 + 3(7 - 2) = 14 + 3(5)Subtract 2 from 7. = 14 + 15Multiply 3 and 5. = 29Add 14 and 15.

e. $20 - 2(4 - 1) \cdot 3$

CHECK Your Progress Evaluate each expression. Justify each step.

f. $6 + 8 \div 2 + 2(3 - 1)$

Real-World EXAMPLE

5 VIDEO GAMES Evita is buying a video game station, three extra controllers, and four new video games. What is the total cost?

ltem	Quantity	Unit Cost
game station	1	\$180
controller	3	\$24
game	4	\$35

Words	cost of 1 game station	+	cost of 3 controllers	+	cost of 4 games
Expression	\$180	+	3 × 24	+	4 × 35

 $180 + 3 \times 24 + 4 \times 35 = 180 + 72 + 140$ Multiply from left to right. = 392Add.

The total cost is \$392.

CHECK Your Progress

g. What is the total cost of a video game station, four extra controllers, and three new video games?

Dersonal Tutor at ca.gr6math.com



Real-World Link.

A team of 500 engineers and technicians built the first video game console in 1966. Source: gamersmark.com

Chuck Savage/CORBIS

HECK Your Understanding

Evaluate each expression. Justify each step.

- Examples 1, 2 1 (p. 38) 3 Examples 3, 4 5 (p. 39) _
- 1. 8 + (5 2)2. $25 \div (9 4)$ 3. $14 2 \cdot 6 + 9$ 4. $8 \cdot 5 4 \cdot 3$ 5. 4×10^2 6. $45 \div (4 1)^2$ 7. $17 + 2(6 3) 3 \times 4$ 8. $22 3(8 2) + 12 \div 4$
 - Example 5 (p. 39)
- **9. COINS** Isabelle has 3 nickels, 2 quarters, 2 dimes, and 7 pennies. Write an expression that can be used to find how much money Isabelle has altogether. How much money does Isabelle have?

Exercises

HOMEWORKHELP				
For Exercises	See Examples			
10–17	1, 2			
18–23	3			
24–27	4			
28, 29	5			

Evaluate each expression. Justify each step.

10. $(1+8) \times 3$	11. $10 - (3 + 4)$	12 . $(25 \div 5) + 8$
13 . (11 − 2) ÷ 9	14. $3 \cdot 2 + 14 \div 7$	15 . $4 \div 2 - 1 + 7$
16. $12 + 6 \div 3 - 4$	17. $18 - 3 \cdot 6 + 5$	18. 6×10^2
19. 3×10^4	20. $5 \times 4^3 + 2$	21 . $8 \times 7^2 - 6$
22. $8 \div 2 \times 6 + 6^2$	23. $9^2 - 14$	$\div 7 \cdot 3$
24. $(17+3) \div (4+1)$	25 . (6 + 5)	• (8 – 6)
26. $6 + 2(4 - 1) + 4 \times 9$	27. 3(4 + 7)	$)-5\cdot4\div2$

For Exercises 28 and 29, write an expression for each situation. Then evaluate to find the solution.

28. MONEY Julian orders nine rolls of crepe paper, four boxes of balloons, and two boxes of favors for the school dance. What is the total cost?

ltem	Cost
box of favors	\$7
box of balloons	\$5
roll of crepe paper	\$2

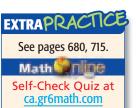
29. TRAINING On Mondays, Wednesdays, and Fridays, Jacob trains for a marathon for 2 hours a day. On Tuesdays and Thursdays, he trains for 3 hours a day, and on Saturdays, he trains for 4 hours. On Sundays, he does not train. How many hours does Jacob train per week?

Evaluate each expression. Justify each step.

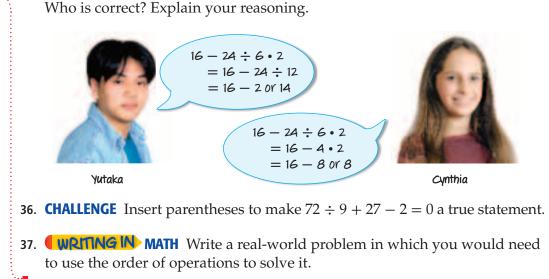
30. $(2+10)^2 \div 4$	31. $(3^3 + 8) - (10 - 6)^2$
32. $3 \cdot 4(5.2 + 3.8) + 2.7$	33. $7 \times 9 - (4 - 3.2) + 1.8$

34. MONEY Suppose that your family orders 2 pizzas, 2 orders of garlic bread, and 1 order of BBQ wings from Mario's Pizza Shop. Write an expression to find the amount of change you would receive from \$30. Then evaluate the expression.

Mario's Pizza Shop				
Item	Cost			
14" pizza	\$8			
garlic bread	\$2			
BBQ wings	\$4			



H.O.T. Problems 35. FIND THE ERROR Yutaka and Cynthia are evaluating $16 - 24 \div 6 \cdot 2$.



STANDARDS PRACTICE

38. Simplify $3^2 + 9 \div 3 + 3$.

A 3	C 15
B 9	D 18

39. Grace has 2 boxes that contain 24 straws each and 3 boxes that contain 15 cups each. Which expression *cannot* be used to find the total number of items she has?

F
$$2(24) + 3(15)$$

- $\mathbf{G} \ 3 \times 15 + 2 \times 24$
- H $5 \times (24 + 15)$
- $J \quad 15 + 15 + 15 + 24 + 24$

- **40**. The steps Alana took to evaluate the expression $4y + 4 \div 4$ when y = 7 are shown below.
 - $4y + 4 \div 4 \text{ when } y = 7$ $4 \times 7 = 28$ 28 + 4 = 32 $32 \div 4 = 8$

What should Alana have done differently in order to evaluate the expression correctly?

A divided (28 + 4) by (28×4)

- **B** divided (28 + 4) by (28 + 4)
- **C** added (4 ÷ 4) to 28
- **D** added 4 to $(28 \div 4)$



Find each square root. (Lesson 1-3)

41. √64

42. $\sqrt{2,025}$



44. INTERNET Each day, Internet users perform 2⁵ million searches using a popular search engine. How many searches is this? (Lesson 1-2)

GET READY for the Next Lesson

45. PREREQUISITE SKILL A Chinese checkerboard has 121 holes. How many holes can be found on eight Chinese checkerboards? (Lesson 1-1)

Problem-Solving Investigation

MAIN IDEA: Solve problems using the guess and check strategy.

Standard 6MR1.1 Analyze problems by identifying relationships, ..., and observing patterns. **Reinforcement of Standard 5NS2.1** Add, subtract, multiply, and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results.

P.S.I. TERM +

e-Mail: GUESS AND CHECK

Your MISSION: Use guess and check to solve the problem.

THE PROBLEM: How many adult and student tickets were sold?

Justin: The total ticket sales for the school play were \$255. Adult tickets cost \$7 and student tickets cost \$4. Also, twice as many students bought tickets as adults.

EXPLORE	You know adult tickets are \$7, student tickets are \$4, and twice as many students bought tickets than did adults.		
PLAN	Make a guess and check it. Adjust the guess until you get the correct answer.		
SOLVE	Make a guess.		
	10 adults, 20 students Adjust the guess upward.	7(10) + 4(20) = \$150 >>>>>	too low
	20 adults, 40 students Adjust the guess downward slightly.	7 (20) + 4 (40) = \$300 >>>>>>	too high
	18 adults, 36 students Adjust the guess downward again.	7 (18) + 4 (36) = \$270 >>>>>>	too high
	17 adults, 34 students So, there were 17 adult and 34 studen	7(17) + 4(34) = \$255 >>>>>> ti tickets sold.	correct
CHECK	Seventeen adult tickets cost \$119, and 34 student tickets cost \$136. Since \$119 + \$136 = \$255 and 34 tickets are twice as many as 17 tickets, the guess is correct.		

Analyze The Strategy

- 1. Explain why you must keep a cafeful record of each of your guesses and their results in the *solve* step of the problem-solving plan.
- 2. **WRITING IN MATH** Write a problem that could be solved by guess and check. Then write the steps you would take to find the solution to your problem.

Mixed Problem Soluing

Use the *guess and check* strategy to solve Exercises 3–6.

- 3. **MONEY** A band sponsored a car wash to help pay for their uniforms. They charged \$4 for a car and \$6 for an SUV. During the first hour, they washed 16 vehicles and earned \$78. How many of each type of vehicle did they wash?
- 4. **NUMBERS** A number is multiplied by 6. Then 4 is added to the product. The result is 82. What is the number?
- 5. **ANALYZE TABLES** Flor is burning a CD. Suppose the CD holds 30 minutes of music. Which songs should she select from the list below to record the maximum time on the CD without going over?



6. **MONEY** Kelly has \$2.80 in change in her purse. If she has an equal number of nickels, dimes, and quarters, how many of each does she have?

Use any strategy to solve Exercises 7–10. Some strategies are shown below.



7. **BRIDGES** The total length of wire used in the cables supporting the Golden Gate Bridge in San Francisco is about 80,000 miles. This is 5,300 miles longer than three times the distance around Earth at the Equator. What is the distance around Earth at the Equator?

8. **GEOMETRY** What are the next two figures in the pattern?



9. ALGEBRA What are the next two numbers in the pattern?

16, 32, 64, 128, 256, ,

10. SOUVENIRS A souvenir shop sells standardsized postcards in packages of 5 and largesized postcards in packages of 3. If Juan bought 16 postcards, how many packages of each did he buy?

Select the Operation

For Exercises 11 and 12, select the appropriate operation(s) to solve the problem. Justify your selection(s) and solve the problem.

11. ANALYZE TABLES The table gives the average snowfall, in inches, for Valdez, Alaska, for the months October through April.

11.6 40.3 73.0
73.0
65.8
59.4
52.0
22.7

Source: ncdc.noaa.gov

How many inches total of snowfall could a resident of Valdez expect to receive from October to April?

12. ROLLER COASTERS The Wicked Twister roller coaster can accommodate 1,056 passengers per hour. The coaster has 8 vehicles. If each vehicle carries 4 passengers, how many runs are made in one hour?

Algebra: Variables and Expressions

MINI Lab

Evaluate simple algebraic expressions.

Main IDEA

Standard 6AF1.2 Write and evaluate an algebraic expression for a given situation, using up to

three variables. Standard 6AF1.4 Solve problems manually by

using the correct order of operations or by using a scientific calculator.

NEW Vocabulary

variable algebra algebraic expression coefficient The pattern is made up of triangles, each with side lengths of 1.



- 1. Draw the next three figures in the pattern.
- 2. Find the perimeter of each figure and record your data in a table like the one shown below. The first three are completed for you.

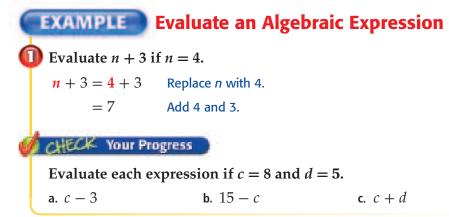
Number of Triangles	1	2	3	4	5	6
Perimeter	3	4	5			

- **3**. Without drawing the figure, determine the perimeter of a figure made up of 10 triangles. Check by making a drawing.
- 4. Find a relationship between the number of triangles and the perimeter at each stage of the pattern.

In the Mini Lab, you found that the perimeter of the figure is two more than the number of triangles. You can use a placeholder, or variable, to represent the number of triangles. A **variable** is a symbol that represents an unknown quantity.

> number of triangles $\rightarrow n + 2$ perimeter of figure

The branch of mathematics that involves expressions with variables is called **algebra**. The expression n + 2 is called an **algebraic expression** because it contains variables, numbers, and at least one operation.



REVIEW Vocabulary

evaluate find the value (Lesson 1-2)

In algebra, the multiplication sign is often omitted.





The numerical factor of a multiplication expression that contains a variable is called a **coefficient**. So, 6 is the coefficient of 6*d*.

(EXAMPLES Evalua	nte Expressions	
C	Evaluate $8w - 2v$ if $w =$	= 5 and v = 3.	
	8w - 2v = 8(5) - 2(3)	Replace <i>w</i> with 5 and <i>v</i> w	with 3.
	= 40 - 6	Do all multiplications firs	st.
	= 34	Subtract 6 from 40.	
E	Evaluate $4y^2 + 2$ if $y = 3$	3.	
	$4y^2 + 2 = 4(3)^2 + 2$	Replace y with 3.	
	=4(9)+2	Evaluate the power.	
	= 38	Multiply, then add.	
é	CHECK Your Progress		
	Evaluate each expressio	on if $a = 4$ and $b = 3$.	
	d. $9a - 6b$ e	$\frac{ab}{2}$	f. $2a^2$



Real-World Link . . Athletic trainers use the formula $\frac{3(220-a)}{5}$ where *a* is a person's age, to find their minimum training heart rate. Source: CMPMedica Ltd.

The fraction bar is a grouping symbol. Evaluate the expressions in the numerator and denominator separately before dividing.

eal-World EXAMPLE

HEALTH Use the formula at the left to find Kaylee's minimum training heart rate if she is 15 years old.

$\frac{3(220-a)}{2}$ _ 3(220 - 15)	Replace <i>a</i> with 15.
5 - 5	
$=\frac{3(205)}{5}$	Subtract 15 from 220.
$=\frac{615}{5}$	Multiply 3 and 205.
= 123	Divide 615 by 5.

Kaylee's minimum training heart rate is 123 beats per minute.

CHECK Your Progress

g. MEASUREMENT To find the area of a triangle, you can use the formula $\frac{bh}{2}$, where *h* is the height and *b* is the base. What is the area in square inches of a triangle with a height of 6 inches and base of 8 inches?

f. $2a^2 + 5$

Your Understanding Evaluate each expression if a = 3 and b = 5. Example 1 (p. 44) **2**. 8 − *b* **1**. *a* + 7 **3**. *b* − *a* 4. **HEALTH** The standard formula for finding your maximum heart rate is 220 - a, where a represents a person's age in years. What is your maximum heart rate? Examples 2–4 Evaluate each expression if m = 2, n = 6, and p = 4. (p. 45) **6.** 7m - 2n**5**. 6*n* − *p* **7.** 3m + 4p

9. $15 - m^3$

HOMEWO	RKHELP	
For Exercises	See Examples	
14–29	1–3	
30–31	4	

Exercises

8. $n^2 + 5$

11. $\frac{mn}{4}$

Evaluate eacl	n ovnrossion	if $d =$	8 0 -	3 f - 4	and $a - 1$	

	1 ,	· · · · · · · · · · · · · · · · · · ·	
14. <i>d</i> + 9	15 . 10 − <i>e</i>	16 . 4 <i>f</i> + 1	17 . 8 <i>g</i> - 3
18. <i>f</i> − <i>e</i>	19 . <i>d</i> + <i>f</i>	20 . 10 <i>g</i> - 6	21 . 8 + 5 <i>d</i>
22. $\frac{d}{5}$	23. $\frac{16}{f}$	24. $\frac{5d-25}{5}$	25. $\frac{(5+g)^2}{2}$
26 . 6 <i>f</i> ²	27. $4e^2$	28. $d^2 + 7$	29. $e^2 - 4$

30. BOWLING The expression 5n + 2 can be used to find the total cost in dollars of bowling where *n* is the number of games bowled. How much will it cost Vincent to bowl 3 games?

10. $3p^2 - n$

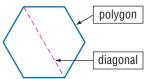
12. $\frac{3n}{9}$ **13.** $\frac{5n+m}{8}$

31. HEALTH A nurse can use the expression $110 + \frac{A}{2}$, where *A* is a person's age, to estimate a person's normal systolic blood pressure. Estimate the normal systolic blood pressure for a 16-year old.

Evaluate each expression if x = 3.2, y = 6.1, and z = 0.2. 32. x + y - z 33. 14.6 - (x + y + z) 34. $xz + y^2$

- **35. CAR RENTAL** A car rental company charges \$19.99 per day and \$0.17 per mile to rent a car. Write an expression that gives the total cost in dollars to rent a car for *d* days and *m* miles.
- **36**. **MUSIC** A Web site charges \$0.99 to download a song onto an MP3 player and \$12.49 to download an entire album. Write an expression that gives the total cost in dollars to download *a* albums and *s* songs.

- **37. SCIENCE** The expression $\frac{32t^2}{2}$ gives the falling distance of an object in feet after *t* seconds. How far would a bungee jumper fall 2 seconds after jumping?
- **EXTRAPRACICE** See pages 680, 715. **See pages 680, 715. See pages 680, 715. See pages 680, 715. Self-Check Quiz at ca.gr6math.com GEOMETRY** To find the total number of diagonals for any given polygon, you can use the expression $\frac{n(n-3)}{2}$, where *n* is the number of sides of the polygon. What is the total number of diagonals for a 10-sided polygon?



- **39**. **OPEN ENDED** Write an algebraic expression with the variable *x* that has a value of 3 when evaluated.
- **40. CHALLENGE** Name values of *x* and *y* so that the value of 7x + 2 is greater than the value of 3y + 23.
- 41. **WRITING IN MATH** Tell whether the statement below is *sometimes, always,* or *never* true. Justify your reasoning.

The expressions x - 3 *and* y - 3 *represent the same value.*

STANDARDS PRACTICE

H.O.T. Problems

- **42**. Which expression could be used to find the cost of buying *b* baseball bats at \$74.99 each and *g* baseball gloves at \$98.50 each?
 - A 74.99b + 98.50g
 - **B** 74.99*b* 98.50*g*
 - **C** 173.49(b + g)
 - **D** 173.49(*bg*)

- **43**. Tonya has *x* quarters, *y* dimes, and *z* nickels in her pocket. Which of the following expressions gives the total amount of change she has in her pocket?
 - **F** \$0.25x + \$0.05y + \$0.10z
 - **G** \$0.25x + \$0.10y + \$0.05z
 - **H** 0.05x + 0.25y + 0.10z
 - **J** \$0.10x + \$0.05y + \$0.25z

Ý

Spiral Review

44. SHOPPING A grocery store sells hot dog buns in packages of 8 and 12. How many 8-packs and 12-packs could you buy if you needed 44 hot dog buns? Use the *guess and check* strategy. (Lesson 1-5)

Evaluate each expression. (Lesson 1-4)

45. 6(5) - 2 **46.** $9 + 9 \div 3$ **47.** $4 \cdot 2(8 - 1)$ **48.** $(17 + 3) \div 5$

49. Find $\sqrt{361}$. (Lesson 1-3)

GET READY for the Next Lesson

 PREREQUISITE SKILL Determine whether each sentence is *true* or *false*. (Lesson 1-4)

 50. 15 - 2(3) = 9 51. $20 \div 5 \times 4 = 1$ 52. $4^2 + 6 \cdot 7 = 154$

Mid-Chapter Quiz

Lessons 1-1 through 1-6

- 1. **STANDARDS PRACTICE** A cycling club is planning a 1,800-mile trip. The cyclers average 15 miles per hour. What additional information is needed to determine the number of days it will take them to complete the trip? (Lesson 1-1)
 - A The number of cyclists in the club
 - **B** The number of miles of rough terrain
 - **C** The number of hours they plan to cycle each day

3. 9⁶

D Their average speed per minute

Write each power as a product of the same factor. (Lesson 1-2)

2. 4⁵

CHAPTER

- 4. **OCEANS** The world's largest ocean, the Pacific Ocean, covers approximately 4³ million square miles. Write this area in standard form. (Lesson 1-2)
- **ZOOS** The Lincoln Park Zoo in Illinois is 2 • 2 • 2 • 2 • 2 • 2 • 2 years old. Write this age in exponential form. (Lesson 1-2)
- 6. **STANDARDS PRACTICE** The model below represents $\sqrt{49} = 7$.

Which arrangement of small squares can be used to model a large square that represents $\sqrt{324}$? (Lesson 1-3)

- F 9 rows of 36 squares
- G 18 rows of 18 squares
- H 12 rows of 27 squares
- J 6 rows of 54 squares

Find the square of each number. (Lesson 1-3)

7.4

8. 12

Find each square root. (Lesson 1-3)

9. $\sqrt{64}$ **10.** $\sqrt{289}$

 LANDSCAPING A bag of lawn fertilizer covers 2,500 square feet. Describe the largest square that one bag of fertilizer could cover. (Lesson 1-3)

Evaluate each expression. (Lesson 1-4)

12.
$$25 - (3^2 + 2 \times 5)$$
 13. $\frac{2(7-3)}{2^2}$

- 14. **MEASUREMENT** The perimeter of a rectangle is 42 inches and its area is 104 square inches. Find the dimensions of the rectangle. Use the *guess and check* strategy. (Lesson 1-5)
- 15. STANDARDS PRACTICE Ana buys some baseball bats at \$35 each and some baseball gloves at \$48 each. Which expression could be used to find the total cost of the sports items? (Lesson 1-6)
 - **A** 35*b* 48*g*
 - **B** $\frac{35b}{48g}$
 - **C** 35b + 48g
 - **D** 48g 35b

Evaluate each expression if x = 12, y = 4, and z = 8. (Lesson 1-6)

 16. x - 5 17. 3y + 10z

 18. $\frac{yz}{2}$ 19. $\frac{(y+8)^2}{x}$

20. HEALTH The expression $\frac{w}{30}$, where *w* is a person's weight in pounds, is used to find the approximate number of quarts of blood in the person's body. How many quarts of blood does a 120-pound person have? (Lesson 1-6)



Algebra: Equations

Main IDEA

Write and solve equations using mental math.

Contemporation Contemporation Standard GAF1.1 Write and solve one-step linear equations in one variable.

NEW Vocabulary

equation solution solving an equation defining the variable

GET READY for the Lesson

BASKETBALL The table shows the number of wins for six WNBA teams after playing 34 games each.

- 1. How many losses did each team have?
- 2. Write a rule to describe how you found the number of losses.
- Let *w* represent the number of wins and *ℓ* represent the number of losses. Rewrite your rule using numbers, variables, and an equals sign.

Women's National Basketball Association, 2005

	Team	Wins	Losses
	Sacramento	25	?
	Los Angeles	17	?
	Houston	19	?
5	Seattle	20	?
	Minnesota	14	?
	Phoenix	16	?

Source: wnba.com

An **equation** is a sentence that contains an equals sign, =. The equals sign tells you that the expression on the left is equivalent to the expression on the right.

7 = 8 - 1 3(4) = 12 17 = 13 + 2 + 2

An equation that contains a variable is neither true nor false until the variable is replaced with a number. A **solution** of an equation is a numerical value for the variable that makes the sentence true.

The process of finding a solution is called **solving an equation**. Some equations can be solved using mental math.

EXAMPLE Solve an Equation Mentally

- **D** Solve 18 = 14 + t mentally.
 - 18 = 14 + t Write the equation.

 18 = 14 + 4 You know that 14 + 4 is 18.

 18 = 18 Simplify.

So, t = 4. The solution is 4.

CHECK Your Progress

Solve each equation mentally.

a. p - 5 = 20 **b.** $8 = y \div 3$ **c**

c. 7h = 56

STANDARDS EXAMPLE

2 Each day, Sierra cycles 3 miles on a bicycle trail. The equation 3d = 36 represents how many days it will take her to cycle 36 miles. How many days *d* will it take her to cycle 36 miles?

10 B 12	C 15	D 20
----------------	-------------	-------------

Read the Item

Α

Solve 3d = 36 to find how many days it will take to cycle 36 miles.

Solve the Item

3d = 36 Write the equation.

 $3 \cdot 12 = 36$ You know that $3 \cdot 12$ is 36.

Therefore, d = 12. The answer is B.

CHECK Your Progress

d. Jordan has 16 video games. This is 3 less than the number Casey has. To find how many video games Casey has, the equation v - 3 = 16 can be used. How many video games v does Casey have?

F 13	G 15	H 18	J 19

Personal Tutor at ca.gr6math.com

Choosing a variable to represent an unknown quantity is called **defining the variable**.

Real-World EXAMPLE

3 FOOD The total cost of a hamburger, and a soft drink is \$5.50. If the drink costs \$2.50, what is the cost of the hamburger?

Words	cost of a hamburger	plus	cost of a soft drink	is	\$5.50.
Variable	Let <i>h</i> represe	nt the co	ost in dollars of	the h	amburger.
Equation		<u>h</u> +	2.50 = <mark>5.50</mark>		

h + 2.50 = 5.50 Write the equation.

3 + 2.50 = 5.50 Replace *h* with 3 to make the equation true.

So, h = 3. The cost of the hamburger is \$3.00.

CHECK Your Progress

e. Aaron buys a movie rental, popcorn, and a soft drink for a total cost of \$6.25. What is the cost of the popcorn if the movie rental and soft drink cost \$4.70 together?



Defining the Variable Although any symbol can be used, it is a good idea to use the first letter of the word you are defining as a variable. For example: *h* stands for the cost of a hamburger.

Test-Taking Tip

Backsolving To find which answer choice is the solution, you can also substitute each value for *x* to see which answer choice makes the left side of the equation equal to the right side.

Example 1 (p. 49)Solve each equation mentally. 1. $75 = w + 72$ 2. $y - 18 = 20$ 3. $\frac{r}{9} = 6$ Example 2 (p. 50)4. STANDARDS PRACTICE David scored 7 points in a football game. Together, he and Jason scored 28 points. Solve the equation $7 + p =$ to find how many points p Jason scored. A 14B 21C 23D 35	CHEC	Your Unde	rstanding	đ		
(p. 50) Together, he and Jason scored 28 points. Solve the equation $7 + p =$ to find how many points <i>p</i> Jason scored.		-	2	= 20	3. $\frac{r}{9} = 6$	
A 14 B 21 C 23 D 35		🔊 Together, h	e and Jason score	ed 28 points. Sc	s in a football game. Note the equation $7 + p$	v = 28
		A 14	B 21	C 23	D 35	

Example 3 (p. 50)
 5. MONEY Jessica buys a notebook and a pack of pencils for a total of \$3.50. What is the cost of the notebook if the pack of pencils costs \$1.25?

Exercises

HOMEWORKHELP			
For Exercises	See Examples		
6–17	1		
18–19 33–34	2		
20–21	3		

Solve each equation mentally.

6. $b + 7 = 13$	7. $8 + x = 15$	8. $y - 14 = 20$
9. $a - 18 = 10$	10. $25 - n = 19$	11. $x + 17 = 63$
12. $77 = 7t$	13. $3d = 99$	14. $n = \frac{30}{6}$
15. $16 = \frac{u}{4}$	16. $20 = y \div 5$	17. $84 \div z = 12$

- **18. MONEY** Maria charges \$9 per hour of baby-sitting. Solve the equation 9h = 63 to find how many hours *h* Maria needs to baby-sit to earn \$63.
- **19. SNACKS** A box initially contained 25 snack bars. There are 14 snack bars remaining. Solve the equation 25 x = 14 to find how many snack bars *x* were eaten.

For Exercises 20 and 21, define a variable. Then write and solve an equation.

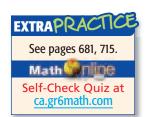
- **20. BASKETBALL** During one game of his rookie year, LeBron James scored 41 of the Cleveland Cavaliers' 107 points. How many points did the rest of the team score?
- **21. EXERCISE** On Monday and Tuesday, Derrick walked a total of 6.3 miles. If he walked 2.5 miles on Tuesday, how many miles did he walk on Monday?

Solve each equation mentally.

22. 1.5 + j = 10.0**23.** 1.2 = m - 4.2**25.** 13.4 - h = 9.0**26.** 9.9 + r = 24.2

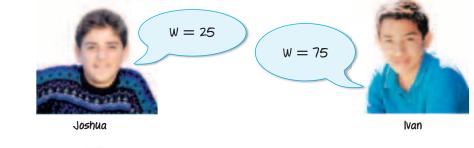
24. n - 1.4 = 3.5
27. w + 15.8 = 17.0

Type of Penguin	Height (in.)
Emperor	51
Adelie	18



28. **PENGUINS** The table shows the average height of Emperor and Adelie penguins. Write and solve an addition equation to find how much taller Emperor penguins are than Adelie penguins.

- **29. WHALES** Each winter, Humpback whales migrate 1,500 miles to the Indian Ocean. However, scientists tracked one whale that migrated 5,000 miles in one season. Write and solve an equation that can be used to find how many miles farther than normal the whale traveled.
- **H.O.T.** Problems ..., 30. CHALLENGE Find the values of *a* and *b* if $0 \cdot a = b$. Explain your reasoning.
 - **31. FIND THE ERROR** Joshua and Ivan each solved w 25 = 50. Whose solution is correct? Explain your reasoning.

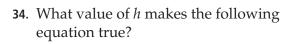


32. WRITING IN MATH Explain what it means to solve an equation.

STANDARDS PRACTICE

Lawrence

33. The diagram shows the distance from Madison to Hudson and from Lawrence to Hudson. Which equation can be used to find how many more miles *x* Lawrence is from Hudson than Madison?



$$h \div 4 = 32$$

- F 8 G 28
- H 36
- J 128

A 58 = x + 36 C $36 \cdot 58 = x$ B $58 = \frac{x}{36}$ D x - 36 = 58

Madison

Spiral Review

35. ALGEBRA Evaluate $3a + b^2$ if a = 2 and b = 3. (Lesson 1-6)

Evaluate each expression. (Lesson 1-4)

36. $11 \cdot 6 \div 3 + 9$ **37.** $5 \cdot 13 - 6^2$ **38.** $1 + 2(8 - 5)^2$

39. DINING Four hundred sixty people are scheduled to attend a banquet. If each table seats 8 people, how many tables are needed? (Lesson 1-1)

Hudson

GET READY for the Next Lesson **PREREQUISITE SKILL** Multiply. (Lesson 1-4)

40. $2 \cdot (4 + 10)$ **41.** $(9 \cdot 1) \cdot 8$ **42.** $(5 \cdot 3)(5 \cdot 2)$ **43.** $(6 + 8) \cdot 12$



Algebra: Properties

Main IDEA

Use Commutative, Associative, Identity, and Distributive properties to solve problems.

Standard 6AF1.3 Apply algebraic order of operations and the commutative, associative, and distributive properties to evaluate expressions; and justify each step in the process.

NEW Vocabulary

equivalent expressions

Vocabulary Link . . .

divide among several,

as in distribute a deck

Distributive

Math Use property

that allows you to

multiply a sum by

of cards

a number

Distribute Everyday Use to

properties

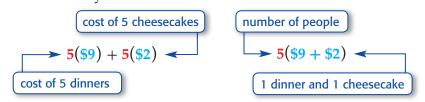
GET READY for the Lesson

- **RESTAURANTS** Land-Ho! Fish Market is having a special.
- **1**. Find the total cost for a 5-member family, without tax and tip, if each one orders a fish-bake dinner and cheesecake.



2. Describe the method you used to find the total cost.

Here are two ways to find the total cost of the dinner:



The expressions 5(\$9) + 5(\$2) and 5(\$9 + \$2) are **equivalent**

expressions because they have the same value, \$55. This shows how

the **Distributive Property** combines addition and multiplication.

KEY CONCEPT

Distributive Property

Words To multiply a sum by a number, multiply each addend of the sum by the number outside the parentheses.

Examples

Algebra

3(4+6) = 3(4) + 3(6)a(b + c) = a(b) + a(c)5(7) + 5(3) = 5(7 + 3)

a(b) + a(c) = a(b + c)

EXAMPLES Write Sentences as Equations

Numbers

Use the Distributive Property to rewrite each expression. Then evaluate it.

You can use the Distributive Property to solve problems mentally.

Real-World EXAMPLE

3 HISTORY The Pony Express riders carried mail from Missouri to California in eight days. On average, the riders covered 250 miles each day. About how far did the riders travel?

Use the Distributive Property to multiply 8(250) mentally.

8(250) = 8(200 + 50)Rewrite 250 as 200 + 50. = 8(200) + 8(50)Distributive Property = 1,600 + 400Multiply. = 2,000Add.

The riders traveled about 2,000 miles.

CHECK Your Progress

c. Jennifer saved \$120 each month for five months. How much did she save in all? Explain your reasoning.

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Properties are statements that are true for all numbers.

CONCEP	T Summary	Real Number Properties
Commutative Properties	The order in which two n does not change their sur	umbers are added or multiplied n or product.
Associative Properties		umbers are grouped when ied does not change their
Identity Properties	The sum of an addend an of a factor and 1 is the factor and 1 is t	d 0 is the addend. The product ctor.

EXAMPLE Use Properties to Evaluate Expressions

4 Find 4 • 12 • 25 mentally. Justify each step.

 $4 \cdot 12 \cdot 25 = 4 \cdot 25 \cdot 12$ = $(4 \cdot 25) \cdot 12$

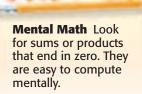
- $= 100 \cdot 12 \text{ or } 1,200$
- Commutative Property of Multiplication Associative Property of Multiplication Multiply 100 and 12 mentally.

CHECK Your Progress

Find each of the following. Justify each step.

d. 40 • (7 • 5)

e. (89 + 15) + 1



CHECK Your Understanding

7. 44 + (23 + 16)

Examples 1, 2		ative Property to rev	write each expression	1. Then evaluate it.
(p. 53)	1 . 7(4 + 3)	2. $5(6+2)$	3. 3(9) + 3(6)	4. $6(17) + 6(3)$
Example 3 (p. 54)	Use the Dist		seball game is \$12, an mentally find the tota soning.	0

6. MENTAL MATH A cheetah can run 65 miles per hour at maximum speed. At this rate, how far could a cheetah run in 2 hours? Use the Distributive Property to multiply mentally. Explain your reasoning.

Example 4

```
4 Find each expression mentally. Justify each step.
```

(p. 54)

```
8. 50 • (33 • 2)
```

Exercises

HOMEWO	Use the D	
For Exercises	See Examples	9. 2(6 + 7
9–12	1, 2	Find each
13–22	4	13 . (8 + 27
23, 24	3	15. 91 + (1

Use the Distributive Property to rewrite each expression. Then evaluate it.

9. $2(6+7)$ 10. $5(8+9)$ 11. $4(3) + 4(8)$ 12. $7(3)$	(3) + 7(6)
---	------------

Find each expression mentally. Justify each step.

13 . (8 + 27) + 52	14 . (13 + 31) + 17
15 . 91 + (15 + 9)	16. 85 + (46 + 15)
17 . (4 • 18) • 25	18 . (5 • 3) • 8
19. 15 • (8 • 2)	20 . 2 • (16 • 50)
21 . 5 • (30 • 12)	22. 20 • (48 • 5)

MENTAL MATH For Exercises 23 and 24, use the Distributive Property to multiply mentally. Explain your reasoning.

- **23. TRAVEL** Each year about 27 million people visit Paris, France. About how many people will visit Paris over a five-year period?
- 24. **ROLLER COASTERS** One ride on a roller coaster lasts 108 seconds. How long will it take to ride this coaster three times?

The Distributive Property also can be applied to subtraction. Use the Distributive Property to rewrite each expression. Then evaluate it.

25. 7(9) - 7(3) **26.** 12(8) - 12(6) **27.** 9(7) - 9(3) **28.** 6(12) - 6(5)

ALGEBRA Use one or more properties to rewrite each expression as an equivalent expression that does not use parentheses.

29. (y+1)+4**30.** 2 + (x+4)**31.** 4(8b)**32.** (3a)2**33.** 2(x+3)**34.** 4(2+b)**35.** 6(c+1)**36.** 3(f+4)+2f

EXTRAPRACTICE	>
See pages 681, 715.	
Math 🎱 🛛 🔟 C	
Self-Check Quiz at <u>ca.gr6math.com</u>	

MILEAGE For Exercises 37 and 38, use the table that shows the driving distance between certain cities in Alaska.

37. Write a sentence that compares the mileage from Petersburg to Eagle to Fairbanks and the mileage from Fairbanks to Eagle to Petersburg.

From	То	Driving Distance (mi)
Petersburg	Eagle	610
Eagle	Fairbanks	195

- 38. Name the property that is illustrated by this sentence.
- **H.O.T. Problems** **39. OPEN ENDED** Write an equation that illustrates the Associative Property of Addition.
 - **40. NUMBER SENSE** Analyze the statement $(18 + 35) \times 4 = 18 + 35 \times 4$. Then tell whether the statement is *true* or *false*. Explain your reasoning.
 - **41. CHALLENGE** A *counterexample* is an example showing that a statement is not true. Provide a counterexample to the following statement.

Division of whole numbers is associative.

42. **WRITING IN MATH** Write about a real-world situation that can be solved using the Distributive Property. Then use it to solve the problem.

STANDARDS PRACTICE

- **43**. Which expression can be written as 6(9 + 8)?
 - $\mathbf{A} \ \mathbf{8} \boldsymbol{\cdot} \mathbf{6} + \mathbf{8} \boldsymbol{\cdot} \mathbf{9}$
 - **B** $6 \cdot 9 + 6 \cdot 8$
 - **C** 6 9 6 8
 - **D** $6 + 9 \cdot 6 + 8$

44. Jared deposited \$5 into his savings account. Six months later, his account balance had doubled. If his old balance was *b* dollars, which of the following would be equivalent to his new balance of 2(b + 5) dollars?

F	2b + 5	Η	b + 10
G	2b + 7	J	2b + 10



Name the number that is the solution of the given equation. (Lesson 1-7)

45. 7.3 = *t* - 4; 10.3, 11.3, 12.3

46. 35.5 = 5*n*; 5.1, 7.1, 9.1

- **47. PETS** It is believed that a dog ages 7 human years for every calendar year. This situation can be represented by the expression 7*y* where *y* is the age of the dog in calendar years. Find the human age of a dog that has lived for 12 calendar years. (Lesson 1-6)
- **48.** Evaluate $(14 9)^4$. (Lesson 1-4)

GET READY for the Next Lesson

PREREQUISITE SKILL Find the next number in each pattern.

49. 2, 4, 6, 8,

50. 10, 21, 32, 43,

51. 1.4, 2.2, 3.0, 3.8,



Algebra: Arithmetic Sequences

Main IDEA

Describe the relationships and extend terms in arithmetic sequences.

Standard 6AF1.2 Write and evaluate an algebraic expression for a given situation, using up to three variables.

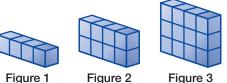
NEW Vocabulary

sequence term arithmetic sequence

MINI Lab

Use centimeter cubes to make the three figures shown.

1. How many centimeter cubes are used to make each figure?



- Figure 1
- Figure 3
- 2. What pattern do you see? Describe it in words.
- 3. Suppose this pattern continues. Copy and complete the table to find the number of cubes needed to make each figure.

Figure	1	2	3	4	5	6	7	8
Cubes Needed	4	8	12					

4. How many cubes would you need to make the 10th figure? Explain your reasoning.

A **sequence** is an ordered list of numbers. Each number in a sequence is called a term. In an arithmetic sequence, each term is found by adding the same number to the previous term. An example of an arithmetic sequence is shown.

In this sequence, each term s found by adding 3 to the previous term.

EXAMPLE Describe and Extend Sequences

Describe the relationship between the terms in the arithmetic sequence 8, 13, 18, 23, ... Then write the next three terms in the sequence.

Each term is found by adding 5 to the previous term. Continue the pattern to find the next three terms.

> 23 + 5 = 2828 + 5 = 3333 + 5 = 38

The next three terms are 28, 33, and 38.

CHECK Your Progress

Describe the relationship between the terms in each arithmetic sequence. Then write the next three terms in the sequence.

a. 0, 13, 26, 39, ... **b**. 4, 7, 10, 13 ... Arithmetic sequences can also involve decimals.

EXAMPLE Describe and Extend Sequences

2 Describe the relationship between the terms in the arithmetic sequence 0.4, 0.6, 0.8, 1.0, ... Then write the next three terms in the sequence.

$$0.4, 0.6, 0.8, 1.0, \dots \\ +0.2 + 0.2 + 0.2$$

Each term is found by adding 0.2 to the previous term. Continue the pattern to find the next three terms.

1.0 + 0.2 = 1.2 1.2 + 0.2 = 1.4 1.4 + 0.2 = 1.6

The next three terms are 1.2, 1.4, and 1.6.

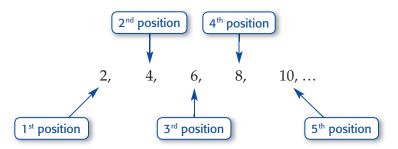
CHECK Your Progress

Describe the relationship between the terms in each arithmetic sequence. Then write the next three terms in the sequence.

c. 1.0, 1.3, 1.6, 1.9, ... d. 2.5, 3.0, 3.5, 4.0, ...

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In a sequence, each term has a specific position within the sequence. Consider the sequence 2, 4, 6, 8, 10, ...

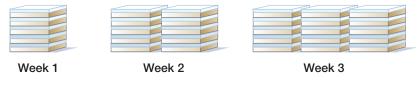


The table below shows the position of each term in this sequence. Notice that as the position number increases by 1, the value of the term increases by 2.

	Position	Operation	Value of Term	
	1	$1 \cdot 2 = 2$	2	
+1	2	$2 \cdot 2 = 4$	4	₹
+1	3	$3 \cdot 2 = 6$	6	K
+1	4	4 • 2 = 8	8	₹
T I 🗸	5	5 • 2 = 10	10	*

You can also write an algebraic expression to represent the relationship between any term in a sequence and its position in the sequence. In this case, if n represents the position in the sequence, the value of the term is 2n.

Concepts in Motion Animation ca.gr6math.com Arithmetic Sequences When looking for a pattern between the position number and each term in the sequence, it is often helpful to make a table. **GREETING CARDS** The homemade greeting cards that Meredith makes are sold in boxes at a local gift store. Each week, the store sells five more boxes than the previous week.



If this pattern continues, what algebraic expression can be used to help her find the total number of boxes sold at the end of the 100th week? Use the expression to find the total.

Make a table to display the sequence.

Position	Operation	Value of Term
1	1 • 5	5
2	2 • 5	10
3	3 • 5	15
п	<i>n</i> • 5	5 <i>n</i>

Each term is 5 times its position number. So, the expression is 5*n*.

5 <mark>n</mark>	Write the expression.
5 (100) = 500	Replace <i>n</i> with 100.

So, at the end of 100 weeks, 500 boxes will have been sold.

CHECK Your Progress

e. **GEOMETRY** If the pattern continues, what algebraic expression can be used to find the number of circles used in the 50th figure? How many circles will be in the 50th figure?

A		1		
SIN.	CUECK	Your	Underst	anding
B/		10.00	enecis:	

Examples 1, 2
(pp. 57-58)Describe the relationship between the terms in each arithmetic sequence.Then write the next three terms in each sequence.

1. 0, 9, 18, 27, ...

- **2**. 4, 9, 14, 19, ...
- **3**. 1, 1.1, 1.2, 1.3, ...
- **4**. 5, 5.4, 5.8, 6.2, ...

Example 3 (p. 59) **5. PLANTS** The table shows the height of a certain plant each month after being planted. If this pattern continues, what algebraic expression can be used to find the height of the plant at the end of twelve months? Find the plant's height after 12 months.

Month	Height (in.)
1	3
2	6
3	9
4	12

000000000

Figure 3

000000

Figure 2

0

õ

Figure 1



Exercises

HOMEWORKHELP		
For Exercises	See Examples	
6-11	1	
12–17	2	
18, 19	3	

Describe the relationship between the terms in each arithmetic sequence. Then write the next three terms in each sequence.

6 . 0, 7, 14, 21,	7 . 1, 7, 13, 19,	8 . 26, 34, 42, 50,
9 . 19, 31, 43, 55,	10 . 6, 16, 26, 36,	11. 33, 38, 43, 48,
12 . 0.1, 0.4, 0.7, 1.0,	13 . 2.4, 3.2, 4.0, 4.8,	14 . 2.0, 3.1, 4.2, 5.3,
15 . 4.5, 6.0, 7.5, 9.0,	16 . 1.2, 3.2, 5.2, 7.2,	17 . 4.6, 8.6, 12.6, 16.6,

- 18. COLLECTIONS Hannah is starting a doll collection. Each year, she buys 6 dolls. Suppose she continues this pattern. What algebraic expression can be used to find the number of dolls in her collection after any number of years? How many dolls will Hannah have after 25 years?
- **19. EXERCISE** The table shows the number of laps that Jorge swims each week. Jorge's goal is to continue this pace. What algebraic expression can be used to find the total number of laps he will swim after any given number of weeks? How many laps will Jorge swim after 6 weeks?

Week	Number of Laps
1	7
2	14
3	21
4	28

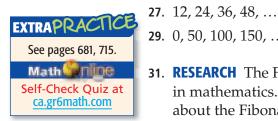
Describe the relationship between the terms in each arithmetic sequence. Then write the next three terms in each sequence.

In a *geometric sequence*, each term is found by multiplying the previous term by the same number. Write the next three terms of each geometric sequence.

- **23.** 1, 4, 16, 64, ... **24.** 2, 6, 18, 54, ... **25.** 4, 12, 36, 108, ...
- **26. GEOMETRY** Kendra is stacking boxes of tissues for a store display. Each minute, she stacks another layer of boxes. If the pattern continues, how many boxes will be displayed after 45 minutes?



NUMBER SENSE Find the 100th number in each sequence.



29. 0, 50, 100, 150, ...
30. 0, 75, 150, 225, ...
31. RESEARCH The Fibonacci sequence is one of the most well

31. RESEARCH The Fibonacci sequence is one of the most well-known sequences in mathematics. Use the Internet or another source to write a paragraph about the Fibonacci sequence.

28. 14, 28, 42, 56, ...

H.O.T. Problems CHALLENGE Not all sequences are arithmetic. But, there is still a pattern. Describe the relationship between the terms in each sequence. Then write the next three terms in the sequence.

32. 1, 2, 4, 7, 11, ...

33. 0, 2, 6, 12, 20, ...

- **34. OPEN ENDED** Write five terms of an arithmetic sequence and describe the rule for finding the terms.
- **35. SELECT A TOOL** Suppose you want to begin saving \$15 each month. Which of the following tools would you use to determine the amount you will have saved after 2 years? Justify your selection(s). Then use the tool(s) to solve the problem.

paper/pencil	real object	technology

36. WRITING IN MATH Janice earns \$6.50 per hour running errands for her neighbor. Explain how the hourly earnings form an arithmetic sequence.

STANDARDS PRACTICE

- **37**. Which sequence follows the rule 3n 2, where *n* represents the position of a term in the sequence?
 - **A** 21, 18, 15, 12, 9, ...
 - **B** 3, 6, 9, 12, 15, ...
 - **C** 1, 7, 10, 13, 16, ...
 - **D** 1, 4, 7, 10, 13, ...

38. Which expression can be used to find the *n*th term in this sequence?

Position	1	2	3	4	5	n th
Value of Term	2	5	10	17	26	
F $n^2 + 1$						
G 2 <i>n</i> + 1						
H <i>n</i> + 1						
J $2n^2 + 2$	2					

Ý

Spiral Review

Find each expression mentally. Justify each step. (Lesson 1-8)

39. (23 + 18) + 7

40. 5 • (12 • 20)

Solve each equation mentally. (Lesson 1-7)

41. $f - 26 = 3$	42 . $\frac{a}{4} = 8$	43. $30 + y = 50$
-------------------------	-------------------------------	--------------------------

44. SCIENCE At normal temperatures, sound travels through water at a rate of $5 \cdot 10^3$ feet per second. Write this rate in standard form. (Lesson 1-2)

GET READY for the Next Lesson

PREREQUISITE SKILL Find the value of each expression. (Lesson 1-6)

45. 2x if x = 4 **46.** d - 5 if d = 8 **47.** 3m - 3 if m = 2

Algebra Lab Exploring Sequences

Main IDEA

Explore patterns in sequences of geometric figures.

Extend

1 _ _ _)

Standard 6AF1.2 Write and evaluate
an algebraic
expression for a given
situation, using up to
three variables.
Standard 6MR2.4
Use a variety of methods,
such as words, numbers,
symbols, charts, graphs,
tables, diagrams, and
models, to explain

mathematical reasoning.





Figure 1

ACTIVITY

- Figure 3
- Make a table like the one shown and record the figure number and number of toothpicks used in each figure.

Figure 2

STEP3 Construct the next figure in this pattern. Record your results.

Figure Number	Number of Toothpicks
1	4
2	
3	
•	

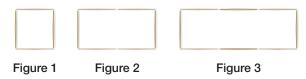
Repeat Step 3 until you have found the next four figures in the pattern.

ANALYZE THE RESULTS

- 1. How many additional toothpicks were used each time to form the next figure in the pattern? Where is this pattern found in the table?
- **2**. Based on your answer to Exercise 1, how many toothpicks would be in Figure 0 of this pattern?
- **3.** Remove one toothpick from your pattern so that Figure 1 is made up of just three toothpicks as shown. Then create a table showing the number of toothpicks that would be in the first 7 figures by continuing the same pattern as above.

	ļ

- **4**. How many toothpicks would there be in Figure *n* of this new pattern?
- **5.** How could you adapt the expression you wrote in Exercise 4 to find the number of toothpicks in Figure *n* of the original pattern?
- 6. MAKE A PREDICTION How many toothpicks would there be in Figure 10 of the original pattern? Explain your reasoning. Then check your answer by constructing the figure.
- **7**. Find the number of toothpicks in Figure *n* of the pattern below, and predict the number of toothpicks in Figure 12. Justify your answer.



Algebra: Equations and Functions

Main IDEA

Make function tables and write equations.

-10

Standard 6AF1.2 Write and evaluate an algebraic expression for a given situation, using up to three variables. Standard 6MR2.4 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.

NEW Vocabulary

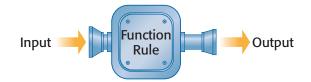
function function rule function table domain range

GET READY for the Lesson

- **FAST FOOD** Suppose you can buy hamburgers for \$2 each.
- 1. Copy and complete the table to find the cost of 2, 3, and 4 hamburgers.
- 2. Describe the pattern in the table between the cost and the number of hamburgers.

	Hamburgers	
Number	Multiply by 2	Cost (\$)
1	2 × 1	2
2		
3		
4		

A relationship that assigns exactly one *output* value for each *input* value is called a **function**. In a function, you start with an input number, perform one or more operations on it, and get an output number. The operation performed on the input is given by the **function rule**.



You can organize the input numbers, output numbers, and the function rule in a **function table**. The set of input values is called the **domain**, and the set of output values is called the **range**.

EXAMPLE Make a Function Table

MONEY MATTERS Suppose you earn \$5 each week. Make a function table that shows your total earnings after 1, 2, 3, and 4 weeks. Then identify the domain and range.

The domain is {1, 2, 3, 4}, and the range is {5, 10, 15, 20}.

CHECK Your Progress

Function Rule Input Output Multiply Number Total of Weeks by 5 Earnings (\$) 1 5×1 5 2 5×2 10 3 5×3 15 4 5×4 20

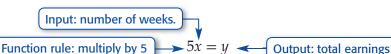
a. Suppose a student movie ticket costs \$3. Make a function table that shows the total cost for 1, 2, 3, and 4 tickets. Then identify the domain and range.

Concepts in Motion Interactive Lab ca.gr6math.com **Input and Output** When x and y are used in an equation, x usually represents the input, and y usually represents the output.

NOY TI

Functions are often written as equations with two variables—one to represent the input and one to represent the output. Here's an equation for the situation in Example 1.

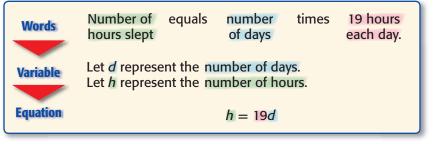
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Real-World EXAMPLES

ANIMALS An armadillo sleeps 19 hours each day. Write an equation using two variables to show the relationship between the number of hours *h* an armadillo sleeps in *d* days.

Input	Function Rule	Output
Number of Days (<i>d</i>)	Multiply by 19	Number of Hours Slept (<i>h</i>)
1	1 × 19	19
2	2 × 19	38
3	3 × 19	57
d	$d \times 19$	19 <i>d</i>



How many hours does an armadillo sleep in 4 days?

- h = 19d Write the equation.
- h = 19(4) Replace *d* with 4.
- h = 76 Multiply.

An armadillo sleeps 76 hours in 4 days.

CHECK Your Progress

- •• **BOTANIST** A botanist discovers that a certain species of bamboo grows 4 inches each hour.
 - **b**. Write an equation using two variables to show the relationship between the growth *g* in inches of this bamboo plant in *h* hours.
 - **c.** Use your equation to explain how to find the growth in inches of this species of bamboo after 6 hours.

Personal Tutor at ca.gr6math.com

Real-World Career ...

How Does a Botanist Use Math? A botanist gathers and studies plant statistics to solve problems and draw conclusions about various plants.

Math Color For more information, go to ca.gr6math.com.

Your Understanding

Example 1 (p. 63)

Copy and complete each function table. Then identify the domain and range.

1.
$$y = 3x$$

x	3 <i>x</i>	y
1	3•1	3
2	3 • 2	
3	3 • 3	
4		

2 3

3. MUSIC Jonas downloads 8 songs each month onto his digital music player. Make a function table that shows the total number of songs downloaded after 1, 2, 3, and 4 months. Then identify the domain and range.

Examples 2, 3

(p. 64)

SPORTS For Exercises 4 and 5, use the following information.

The top speed reached by a standing skateboarder is 80 feet per second.

- **4**. Write an equation using two variables to show the relationship between the number of feet *f* that a skateboarder can travel in *s* seconds.
- **5.** Use your equation to explain how to find the distance in feet the skateboarder will travel in 4 seconds.

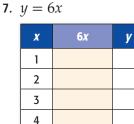
Exercises

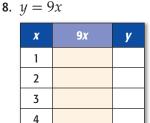
HOMEWO	RKHELP
For Exercises	See Examples
6–10	1
11–14	2, 3

Copy and complete each function table. Then identify the domain and range.

0		
x	2 <i>x</i>	y
0	2•0	0
1	2•1	
2		
3		

6. y = 2x





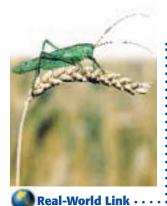
Make a function table for each situation. Then identify the domain and range.

- **9. PIZZA** A pizza shops sells 25 pizzas each hour. Find the number of pizzas sold after 1, 2, 3, and 4 hours.
- **10. TYPING** Suppose you can type 60 words per minute. What is the total number of words typed after 5, 10, 15, and 20 minutes?

INTERNET For Exercises 11 and 12, use the following information.

An Internet provider charges a customer \$20 each month of service.

- 11. Write an equation using two variables to show the relationship between the total amount charged *c*, after *m* months of Internet service.
- **12**. Use your equation to explain how to find the total cost for 6 months of Internet service.



Crickets are among the 800,000 different types of insects in the world. **Source:** kidsport.com

•**INSECTS** For Exercises 13 and 14, use the following information.

A cricket will chirp approximately 35 times per minute when the outside temperature is 72°F.

- **13**. Write an equation using two variables to show the relationship between the total number of times a cricket will chirp *t*, after *m* minutes at this temperature.
- 14. Use your equation to explain how to find the number of times a cricket will have chirped after 15 minutes at this temperature.

Copy and complete each function table. Then identify the domain and range.

15.	y = x	- 1	
	x	<i>x</i> – 1	y
	1		
	2		
	3		
	4		

17. y = x + 0.25

x	<i>x</i> + 0.25	y
0		
1		
2		
3		

16. y = x + 5

X	<i>x</i> + 5	y
1		
2		
3		
4		

8.
$$y = x - 1.5$$

x	x — 1.5	y
2		
3		
4		
5		

MEASUREMENT For Exercises 19 and 20, use the following information.

The formula for the area of a rectangle whose length is 6 units is A = 6w.

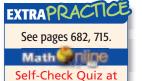
- **19**. Make a function table that shows the area in square units of a rectangle whose width is 2, 3, 4, and 5 units.
- **20**. Study the pattern in your table. Explain how the area of a rectangle whose length is 6 units changes when the width is increased by 1 unit.

ANALYZE TABLES For Exercises 21–23, use the table that shows the approximate velocity of certain planets as they orbit the Sun.

21. Write an equation to show the relationship between the total number of miles *m* Jupiter travels in *s* seconds as it orbits the Sun.

Orbital Veloci	ity Around Sun
Planet	Velocity (mi/s)
Mercury	30
Earth	19
Jupiter	8
Saturn	6
Neptune	5

- **22**. What equation can be used to show the total number of miles Earth travels?
- **23**. Use your equation to explain how to find the number of miles Jupiter and Earth each travel in 1 minute.



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H.O.T. Problems CHALLENGE Write an equation for the function shown in each table.

24.	X	у
	1	3
	2	4
	3	5
	4	6

X	у
2	6
4	12
6	18
8	24
	2 4 6

X	У
1	3
2	5
3	7
4	9

26.

- **27. OPEN ENDED** Write about a real-world situation that can be represented by the equation y = 3x.
- **28. WRITING IN MATH** Explain the relationship among an *input*, an *output*, and a *function rule*.

STANDARDS PRACTICE

29. The table shows the number of handpainted T-shirts Mi-Ling can make after a given number of days.

Number of Days (x)	Total Number of T-Shirts (y)
1	6
2	12
3	18
4	24

Which function rule represents the data?

Α	y = 4x	C $y = 6x$
B	y = 5x	D $y = 12x$

30. Cristina needs to have 50 posters printed to advertise a community book fair. The printing company charges \$3 to print each poster. Which table represents this situation?

F	posters	cost (\$)	Н	posters	cost (\$)
	3	3		1	3
	6	6		2	6
	9	9		3	9
	р	р		р	3 + <i>p</i>
G	posters	cost (\$)	J	posters	cost (\$)
G	posters	cost (\$) 3	J	posters 3	cost (\$) 1
G	-		J	-	
G	1	3	J	3	1



31. ALGEBRA Write the next three terms of the sequence 27, 36, 45, 54, ... (Lesson 1-9) Use the Distributive Property to rewrite each expression. Then evaluate it. (Lesson 1-8) **32.** 5(9 + 7) **33.** (12 + 4)4 **34.** 8(7) - 8(2) **35.** 10(6) - 10(5)

ALGEBRA Evaluate each expression if a = 2 and b = 5. (Lesson 1-6)

36. $8 + a$ 37. $a + b$ 38. $2b - a$ 39. $3a^2 - b$

40. ALLOWANCE If Karen receives a weekly allowance of \$8, about how much money in all will she receive in two years? (Lesson 1-1)

Graphing Calculator Lab Functions and Tables

Main IDEA

Use technology to represent and compare functions.

Extend

1-10



Standard 6AF1.2 Write and evaluate

an algebraic expression for a given situation, using up to three variables.

Standard 6MR2.4 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning. You can use a graphing calculator to represent functions.

ACTIVITY

STEP 2

1 ENTER

GROCERIES A grocery store has 12-ounce bottles of sports drink on sale for \$1.80 each, with no limit on how many you can buy. In addition, you can use a coupon for \$1 off one bottle. Make a table showing the cost for 3, 4, 5, 6, and 7 bottles of this drink.

Write an equation to show the relationship between the number of bottles purchased *x* and their cost *y*.

Cost	is	\$1.80 per bottle	less \$1.
<u> </u>			<u> </u>
y	=	1.80x	-1
0			
		6	100

STEP 3

Next, set up a table of x- and y-values. Press 2nd [TBLSET] to display the table setup screen. Then press $\downarrow \downarrow \rightarrow ENTER$ to highlight Indpnt: Ask.



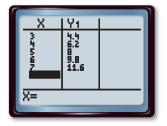
Press Y= on your calculator.

Then enter the function into

 Y_1 by pressing 1.80 X, T, θ, n –

Access the table by pressing 2nd [TABLE]. Then key in each number of bottles, pressing ENTER after each entry.





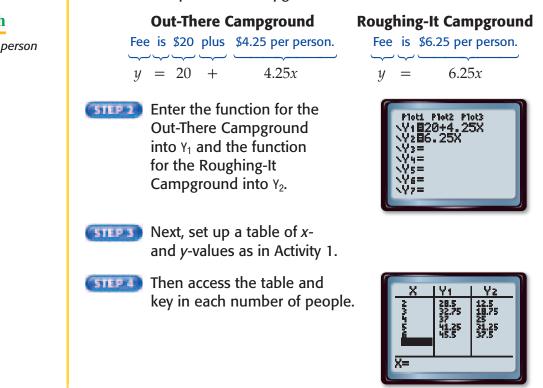
ANALYZE THE RESULTS

- Analyze the table to determine how many bottles you can buy for \$10. Explain your reasoning.
- 2. MAKE A CONJECTURE Notice that you can purchase 5 bottles for the whole dollar amount of \$8. How many bottles will you be able to purchase for \$9, the next whole dollar amount? Use the calculator to test your conjecture.



CAMPING Out-There Campground charges each group a camping fee of \$20 plus \$4.25 per person per night. Roughing-It Campground charges \$6.25 per person per night. Make a table showing the one-night fee for 2, 3, 4, 5, and 6 people to camp at each campground.

Write an equation to show the relationship between the number of people *x* and the one-night fee *y* for them to camp at each campground.



ANALYZE THE RESULTS

- **3.** For 2, 3, 4, 5, and 6 people, which campground charges the greater total nightly cost to camp?
- 4. **MAKE A CONJECTURE** Will the total nightly cost to camp at each campground ever be the same? If so, for what number of people?
- **5**. Use the graphing calculator to test your conjecture from Exercise 4. Were you correct? If not, use the graphing calculator to guess and check until you find the correct number of people.
- **6.** If all other aspects of these two campgrounds are equal, write a recommendation as to which campground a group of *n* people should choose based on your cost analysis.

READING Math

The phrase \$4.25 per person means \$4.25 for each person.

Study Guide and Review



Download Vocabulary Review from ca.gr6math.com

OLDABLES

CHAPTER

READY to Study

Be sure the following Key Concepts are noted in your Foldable.



Key Concepts

Squares and Square Roots (Lesson 1-3)

- The square of a number is the product of a number and itself.
- A square root of a number is one of its two equal factors.

Order of Operations (Lesson 1-4)

• Do all operations within grouping symbols first. Evaluate all powers before other operations. Multiply and divide in order from left to right. Add and subtract in order from left to right.

Properties (Lesson 1-8)

- Distributive Property $5(2+4) = 5 \cdot 2 + 5 \cdot 4$ $(3+2)4 = 3 \cdot 4 + 2 \cdot 4$
- Commutative Property 3 + 2 = 2 + 3 7 • 4 = 4 • 7
- Associative Property 6 + (3 + 8) = (6 + 3) + 8 $5 \cdot (2 \cdot 3) = (5 \cdot 2) \cdot 3$
- Identity Property 4 + 0 = 4
- $4 \cdot 1 = 4$

Functions (Lesson 1-10)

- A function is a relationship that assigns exactly one *output* value for each *input* value.
- In a function, the function rule gives the operation to perform on the input.

Key Vocabulary

algebra (p. 44)	function rule (p. 63)
algebraic expression (p. 44)	numerical expression (p. 38)
arithmetic sequence (p. 57)	order of operations (p. 38)
base (p. 30)	perfect square (p. 34)
coefficient (p. 45)	powers (p. 30)
defining the variable (p. 50)	radical sign (p. 35)
domain (p. 63)	range (p. 63)
equation (p. 49)	sequence (p. 57)
equivalent expressions	solution (p. 49)
(p. 53)	square (p. 34)
evaluate (p. 31)	square root (p. 35)
exponent (p. 30)	term (p. 57)
factors (p. 30)	variable (p. 44)
function (p. 63)	

Vocabulary Check

State whether each sentence is *true* or *false*. If *false*, replace the underlined word or number to make a true sentence.

- 1. <u>Numerical expressions</u> have the same value.
- **2.** Two or more numbers that are multiplied together are called <u>powers</u>.
- **3.** The <u>range</u> of a function is the set of input values.
- **4**. A function assigns exactly <u>two</u> *output* values for each *input* value.
- 5. An <u>equation</u> is a sentence that contains an equals sign.
- 6. A <u>sequence</u> is an ordered list of numbers.
- 7. The product of a number and itself is the square root of the number.



Lesson-by-Lesson Review

1-1

A Plan for Problem Solving (pp. 25–29)

Use the four-step plan to solve each problem.

- 8. **CELLULAR PHONES** Sherita's service charges a monthly fee of \$20.00 plus \$0.15 per minute. One monthly bill is \$31.25. How many minutes did Sherita use during the month?
- 9. CAR RENTAL ABC Car Rental charges \$25 per day to rent a mid-sized car plus \$0.20 per mile driven. Mr. Ruiz rents a mid-sized car for 3 days and drives a total of 72 miles. Find the amount of Mr. Ruiz's bill.
- **10. WORK** Alan was paid \$9 per hour and earned \$128.25. How many hours did he work?

Example 1 A bag of mulch covers 25 square feet of garden space. Taylor uses 7 bags of mulch to cover her garden. How large is Taylor's garden?

Explore	Taylor used 7 bags of mulch, each covering 25 square feet.
Plan	Multiply 25 by 7.
Solve	$25 \cdot 7 = 175$ Taylor's garden is 175 square feet.
Check	$175 \div 7 = 25$, so the answer is reasonable.

1-2 Powers and Exponents (pp. 30–33)

Write each power as a product of the same factor.

- **11.** 3⁴ **12.** 9⁶
- **13.** 5¹ **14.** 7⁵
- **15**. Write *5* to the fourth power as a product of the same factor.

Evaluate each expression.

- **16.** 3⁵ **17.** 7⁹
- **18.** 2⁸ **19.** 18²
- **20.** 10⁴ **21.** 100¹
- **22**. Write $15 \cdot 15 \cdot 15$ in exponential form.
- **23. PATHS** At the edge of a forest, there are two paths. At the end of each path, there are two additional paths. If at the end of each of those paths there are two more paths, how many paths are there at the end?

Example 2 Write 2^3 as a product of the same factor.

The base is 2. The exponent 3 means that 2 is used as a factor 3 times.

 $2^3 = 2 \cdot 2 \cdot 2$

Example 3 Evaluate 4⁵.

The base is 4. The exponent 5 means that 4 is used as a factor 5 times.

$$4^{5} = \mathbf{4} \cdot \mathbf{4} \cdot \mathbf{4} \cdot \mathbf{4} \cdot \mathbf{4}$$
$$= 1,024$$



1-3

1-4

1-5

Squares and Square Roots (pp. 34–37)

Find the square of each number.

24. 4 **25**. 13

Find each square root.

26. $\sqrt{81}$ **27.** $\sqrt{324}$

28. MEASUREMENT The area of a certain kind of ceramic tile is 25 square inches. What is the length of one side?

Order of Operations (pp. 38–41)

Evaluate each expression.

- **29.** $24 8 + 3^2$ **30.** $48 \div 6 + 2 \cdot 5$
- **31.** $9 + 3(7 5)^3$ **32.** $15 + 9 \div 3 7$
- 33. SEATING In planning for a ceremony, 36 guests need to be seated with 4 guests per table. An additional 12 guests need to be seated with 3 guests per table. Write an expression to determine how many tables are needed. Then evaluate the expression.

PSI: Guess and Check (pp. 42–43)

Solve. Use the *guess and check* strategy.

- **34. TRAVEL** Lucinda is driving away from Redding at 50 miles per hour. When she is 100 miles away, Tom leaves Redding, driving at 60 miles per hour in the same direction. After how many hours will Tom pass Lucinda?
- **35. FARMING** A farmer sells a bushel of soybeans for \$5 and a bushel of corn for \$3. If he hopes to earn \$164 and plans to sell 40 bushels in all, how many bushels of soybeans does he need to sell?

Example 4 Find the square of 15. $15 \cdot 15 = 225$ Multiply 15 by itself. **Example 5** Find the square root of 441. $21 \cdot 21 = 441$, so $\sqrt{441} = 21$.

Example 6 Evaluate $24 - (8 \div 4)^4$. $24 - (8 \div 4)^4 = 24 - 2^4$ Divide 8 by 4. = 24 - 16 Find the value of 2^4 .

= 8 Subtract.

Example 7 Find two numbers with a product of 30 and a difference of 13.

Make a guess, and check to see if it is correct. Then adjust the guess until it is correct.

5 and 6 $5 \cdot 6 = 30$ and 6 - 5 = 1
incorrect3 and 10 $3 \cdot 10 = 30$ and 10 - 3 = 7
incorrect2 and 15 $2 \cdot 15 = 30$ and 15 - 2 = 13

 $2 \text{ and } 15 \qquad 2 \cdot 15 = 50 \text{ and } 15 - 2 = 13$ correct

The two numbers are 2 and 15.

Algebra: Variables and Expressions (pp. 44–47)

Evaluate each expression if a = 10, b = 4, and c = 8.

36. $(a-b)^2$ **37.** $ab \div c$ **38.** $3b^2 + c$ **39.** $\frac{(b+c)^2}{3}$

40. PRODUCTION The cost of producing T-shirts is given by the expression 350 + 0.82x, where *x* is the number of T-shirts produced. Find the cost of producing 750 T-shirts.

Example 8 Evaluate $2m^2 - 5n$ if m = 4 and n = 3.

$2m^2 - 5n = 2(4)^2 - 5(3)$	Replace <i>m</i> with 4 and <i>n</i> with 3.
= 2(16) - 5(3)	Find the value of 4 ² .
= 32 - 15	Multiply.
= 17	Subtract.

Example 9	Solve $14 = 5 + x$ mentally.
14 = 5 + x	Write the equation.
14 = 5 + 9	You know that $5 + 9 = 14$.
14 = 14	Simplify.

The solution is 9.

Example 10	Find 8 + (17 + 22)
mentally. Just	tify each step.

8 + (17 + 22) = 8 + (22 + 17)Commutative Property of Addition = (8 + 22) + 17Associative Property of Addition = 30 + 17 or 47Add 30 and 17 mentally.

1-7

1-6

Algebra: Equations (pp. 49–52)

Solve each equation mentally.

41. $h + 9 = 17$	42 . $31 - y = 8$
43. $\frac{t}{9} = 12$	44. $100 = 20g$

45. COUNTY FAIRS Five friends wish to ride the Ferris wheel, which requires 3 tickets per person. The group has a total of 9 tickets. Write and solve an equation to find the number of additional tickets needed for everyone to ride the Ferris wheel.

1-8

Algebra: Properties (pp. 53–56)

Find each expression mentally. Justify each step.

- **46**. (25 15) 4
- **47**. 14 + (38 + 16)
- **48**. 8 (11 5)
- **49. ROSES** Wesley sold roses in his neighborhood for \$2 a rose. He sold 15 roses on Monday and 12 roses on Tuesday. Use the Distributive Property to mentally find the total amount Wesley earned. Explain your reasoning.



1-9

Algebra: Arithmetic Sequences (pp. 57–61)

Describe the relationship between the terms in each arithmetic sequence. Then find the next three terms in each sequence.

- **50**. 3, 9, 15, 21, 27, ...
- **51**. 2.6, 3.4, 4.2, 5, 5.8, ...
- **52**. 0, 7, 14, 21, 28, ...

MONEY For Exercises 53 and 54, use the following information.

Tanya collected \$4.50 for the first car washed at a band fundraiser. After the second and third car were washed, the donations totaled \$9 and \$13.50, respectively.

- **53.** If this donation pattern continues, what algebraic expression can be used to find the amount of money earned for any number of cars washed?
- **54.** How much money will be collected after a total of 8 cars have been washed?

Example 11 At the end of day 1, Sierra read 25 pages of a novel. By the end of days 2 and 3, she read a total of 50 and 75 pages, respectively. If the pattern continues, what expression will give the total number of pages read after any number of days?

Make a table to display the sequence.

Position	Operation	Value of Term
1	1 • 25	25
2	2 • 25	50
3	3 • 25	75
п	n • 25	25 <i>n</i>

Each term is 25 times its position number. So, the expression is 25n.

1-10

Algebra: Equations and Functions (pp. 63–67)

Copy and complete the function table. Then identify the domain and range.



x	4 <i>x</i>	y
5		
6		
7		
8		

56. NAME TAGS Charmaine can make 32 name tags per hour. Make a function table that shows the number of name tags she can make in 3, 4, 5, and 6 hours.

Example 12 Create and complete a function table for y = 3x. Then identify the domain and range.

Select any four values for the input *x*.

x	3 <i>x</i>	y
3	3(3)	9
4	3(4)	12
5	3(5)	15
6	3(6)	18

The domain is {3, 4, 5, 6}. The range is {9, 12, 15, 18}.

Practice Test

1. **PIZZA** Ms. Carter manages a pizza parlor. The average daily costs are \$40, plus \$52 to pay each employee. It also costs \$2 to make each pizza. If 42 pizzas were made one day, requiring the work of 7 employees, what were her total costs that day?

Write each power as a product of the same factor. Then evaluate the expression.

2. 3⁵ **3.** 15⁴

CHAPTER

4. **MEASUREMENT** Gregory wants to stain the 15-foot-by-15-foot deck in his backyard. One can of stain covers 200 square feet of surface. Is one can of stain enough to cover his entire deck? Explain your reasoning.

Find each square root.

- 5. $\sqrt{121}$ 6. $\sqrt{900}$
- **STANDARDS PRACTICE** What is the 7. 👗 value of $8 + (12 \div 3)^3 - 5 \times 9?$

Α	603	C	27
В	135	D	19

8. **ANIMALS** Irene has 6 pets, some dogs and some birds. Her animals have a total of 16 legs. How many of each pet does Irene have?

Evaluate each expression if x = 12, y = 5, and z = 3.

9.
$$x - 9$$

10. $8y$
11. $(y - z)^3$
12. $\frac{xz}{y + 13}$

Solve each equation mentally.

13. $9 + m = 16$	14 . $d - 14 = 37$
15. $32 = \frac{96}{t}$	16 . $6x = 126$

17. SAVINGS Deb is saving \$54 per month to buy a new camera. Use the Distributive Property to mentally find how much she has saved after 7 months. Explain.

Find each expression mentally. Justify each step.

18. 13 + (34 + 17) **19.** $50 \cdot (17 \cdot 2)$

20. **STANDARDS PRACTICE** The table shows the number of hours Teodoro spent studying for his biology test over four days. If the pattern continues, how many hours will Teodoro study on Sunday?

Day	Study Time (hours)	
Monday	0.5	
Tuesday	0.75	
Wednesday	1.0	
Thursday	1.25	
F 1.5 hours	H 2.0 hours	
G 1.75 hours	J 2.5 hours	

Describe the relationship between the terms in each arithmetic sequence. Then write the next three terms in the sequence.

21. 7, 16, 25, 34, ... **22.** 59, 72, 85, 98, ...

23. **TRAVEL** Beth drove at the rate of 65 miles per hour for several hours. Make a function table that shows her distance traveled after 2, 3, 4, and 5 hours. Then identify the domain and range.

MONEY For Exercises 24 and 25, use the following information.

Anthony earns extra money after school doing yard work for his neighbors. He charges \$12 for each lawn he mows.

- 24. Write an equation using two variables to show the relationship between the number of lawns mowed *m* and number of dollars earned d.
- 25. Then find the number of dollars earned if he mows 14 lawns.

CHAPTER

California Standards Practice



Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.

- 1 A store owner bought some paperback books and then sold them for \$4.50 each. He sold 35 books on Monday and 52 books on Tuesday. What piece of information is needed to find the amount of profit made from sales on Monday and Tuesday?
 - A Number of books sold on Wednesday
 - **B** Number of hardback books sold on Monday and Tuesday
 - C Total number of paperback books sold
 - **D** How much the owner paid for each of the paperback books
- 2 The table shows the number of milkshakes sold at an ice cream shop each day last week.

Day of Week	Number of Milkshakes
Sunday	31
Monday	9
Tuesday	11
Wednesday	15
Thursday	18
Friday	24
Saturday	28

Which statement is *not* supported by these data?

- **F** There were almost three times as many milkshakes sold on Sunday as on Tuesday.
- **G** There were half as many milkshakes sold on Monday as on Thursday.
- H There were 11 more milkshakes sold on Tuesday than on Saturday.
- J The total number of milkshakes sold during the week was 136.

3 Which description shows the relationship between a term and *n*, its position in the sequence?

Position	1	2	3	4	5	п
Value of Term	3	6	9	12	15	

- A Add 2 to n
- **C** Multiply n by 3
- **B** Divide *n* by 3 **D** Subtract *n* from 2

FEST-TAKING TIP

Question 3 Have students eliminate unlikely answer choices. Since the value of each term is greater than its position, answer choices B and D can be eliminated.

4 Andrew spent $\frac{1}{2}$ of his Saturday earnings on a pair of jeans and $\frac{1}{2}$ of the remaining amount on a DVD. After he spent \$7.40 on lunch, he had \$6.10 left. How much in

dollars did Andrew earn on Saturday?

- **F** \$13.50
- **G** \$27
- **H** \$54
- **J** \$108
- Lemisha drove an average of 50 miles per hour on Sunday, 55 miles per hour on Monday, and 53 miles per hour on Tuesday. If *s* represents the number of hours she drove on Sunday, *m* represents the number of hours she drove on Monday, and *t* represents the number of hours she drove on Tuesday, which of the following expressions gives the total distance Lemisha traveled?
 - **A** 50s + 53m + 55t
 - **B** 55s + 50m + 53t
 - **C** 50s + 55m + 53t
 - **D** 53s + 55m + 50t

More California Standards Practice For practice by standard, see pages CA1–CA39.

- 6 Mrs. Albert drove 850 miles and the average price of gasoline was \$2.50 per gallon. What information is needed to find the amount Mrs. Albert spent on gasoline for the trip?
 - F Number of hours the trip took
 - G Number of miles per hour traveled
 - H Average number of miles the car traveled per gallon of gasoline
 - J Average number of miles Mrs. Albert drove per day
- 7 Mr. Thompson wants to estimate the total amount he spends on insurance and fuel for his car each month. Insurance costs about \$300 per month, and he expects to drive an average of 150 miles per week. What else does he need to estimate his monthly expenses?
 - A The cost of fuel and the one-way distance to work
 - **B** The cost of fuel and the number of miles per gallon his car gets
 - **C** The cost of fuel and his weekly pay
 - D The gallons of fuel needed per week
- 8 Jeremy bought 3 hamburgers at \$1.99 each,
 2 orders of onion rings at \$0.89 each, and
 4 soft drinks at \$1.25 each. He paid 6.75%
 tax on the whole order. What other
 information is necessary to find Jeremy's
 correct change?
 - **F** Total cost of the order
 - **G** Amount he paid in tax

NEED EXTRA HELP?

- H Reason for buying the food
- J Amount he gave the cashier

- **9** Emily bought 2.5 pounds of salami for \$1.99 per pound. About how much did she pay?
 - A Less than \$4.00
 - **B** Between \$4 and \$4.50
 - C Between \$4.50 and \$5.50
 - D More than \$5.50
- 10 Which of the following is true when correctly evaluating the expression $4 \times (5 + 4) 27$?
 - **F** Add first since 5 + 4 is in parentheses.
 - **G** Multiply first since multiplication comes before addition and subtraction.
 - H Subtract first since subtraction comes before multiplication.
 - J Multiply first since all operations occur in order from left to right.

Pre-AP

Record your answers on a sheet of paper. Show your work.

11 Figures 1, 2, and 3 are made of equal-size squares.



Each side in Figure 1 is 2 units in length. The table shows the perimeter of the first 2 figures.

Figure	1	2	3	4	5	6
Perimeter	8	12				

- a. Extend the pattern to find the perimeters of Figures 3–6.
- **b.** Is the sequence of perimeters arithmetic? Explain.

If You Missed Question	1	2	3	4	5	6	7	8	9	10	11
Go to Lesson	1-1	1-1	1-9	1-1	1-6	1-1	1-1	1-1	1-1	1-4	1-9
For Help with Standard	MR1.1	MR1.1	AF1.2	MR2.7	AF1.2	MR1.1	MR1.1	MR1.1	MR2.1	AF1.3	AF1.2

Chapter 1 California Standards Practice 77

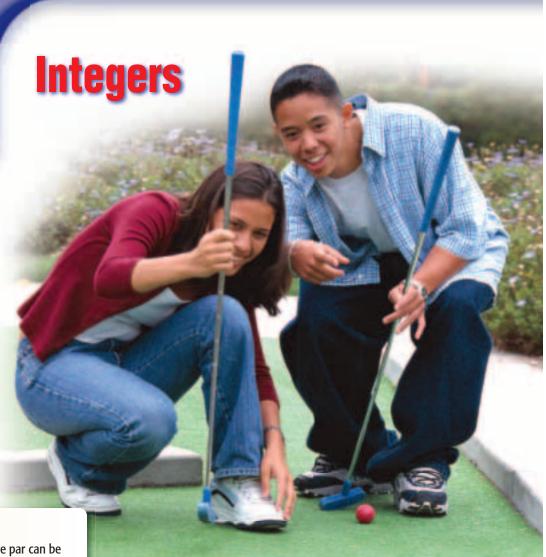




 Standard 6NS2.0
 Calculate and solve problems involving addition, subtraction, multiplication, and division.

Key Vocabulary

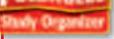
graph (p. 80) integer (p. 80) negative integer (p. 80) positive integer (p. 80)



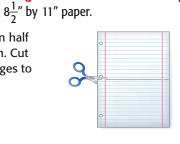
Real-World Link

Sports In miniature golf, a score above par can be written as a positive integer and a score below par can be written as a negative integer.

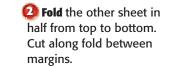
FOLDABLES



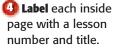
10 Fold one sheet in half from top to bottom. Cut along fold from edges to margin.



Insert first sheet through second sheet and align folds.



Integers Make this Foldable to help you organize your notes. Begin with two sheets of







GET READY for Chapter 2

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 2

Option 1

Math Dilos Take the Online Readiness Quiz at ca.gr6math.com

Take the Quick Check below. Refer to the Quick Review for help.

QUICKCheck

Replace each ● with < or > to make a true sentence. (Prior Grade)

1. 1,458 **1**,548 **2**. 36 **3**4

- **3.** 1.02 **1.**20 **4.** 76.7 **7**7.6
- **5. COINS** Philippe has \$5.17 in coins and Garrett has \$5.71 in coins. Who has the greater amount? (Prior Grade)

Evaluate each expression if a = 7, b = 2, and c = 11. (Prior Grade)

6. <i>a</i> + 8	7 . $a + b + c$
8 . <i>c</i> – <i>b</i>	9 . $a - b + 4$

10. **TEMPERATURE** At 8 A.M., it was 63°F. By noon, the temperature had risen 9 degrees Fahrenheit. What was the temperature at noon? (Prior Grade)

Evaluate each expression if m = 9 and n = 4. (Prior Grade)

11 . 6 <i>mn</i>	12. <i>n</i> ÷ 2 − 1
-------------------------	-----------------------------

- **13**. $m + 5 \times n$ **14**. $m^2 \div (n + 5)$
- **15. PLANES** The distance in miles that an airplane travels is given by rtwhere r is the rate of travel and t is the time. Find the distance an airplane traveled if t = 4 hours and r = 475 miles per hour. (Prior Grade)

QUICKReview

Example 1

Replace the ● with < or > to make a true sentence.

3.14 3.41

3.14	Line up the decimal points.
3.41	Starting at the left, compare the digits in each place-value
1	position.

The digits in the tenths place are not the same. Since 1 tenth < 4 tenths, 3.14 < 3.41.

Example 2

Evaluate the expression 11 - a + b if a = 2 and b = 8.

11 - a + b = 11 - 2 + 8 = 9 + 8	Replace <i>a</i> with 2 and <i>b</i> with 8. Subtract 2 from 11.
= 17	Add 9 and 8.

Example 3

Evaluate the expression $n^2 \div 16 + m$ if m = 3 and n = 8. $n^2 \div 16 + m = 8^2 \div 16 + 3$ Replace m with 3 and n with 8. $= 64 \div 16 + 3$ Evaluate 8^2 . = 4 + 3 Divide 64 by 16. = 7 Add 4 and 3.

Integers and Absolute Value

Main IDEA

Read and write integers, and find the absolute value of a number.



Preparation for Standard 6NS1.1

Compare and order positive and negative fractions, decimals, and mixed numbers and place them on a number line.

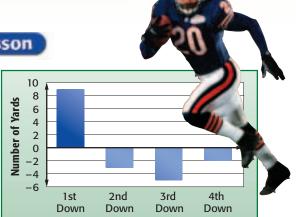
NEW Vocabulary

integer negative integer positive integer graph absolute value

GET READY for the Lesson

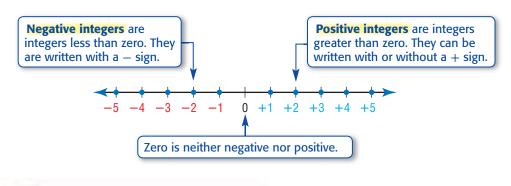
FOOTBALL The graph shows the number of yards the Bears gained or lost on the first four downs. A value of -3 represents a 3-yard loss.

- 1. What does a value of -2 represent?
- 2. On which down did they lose the most yards?



3. How can you represent a gain of 9 yards?

Numbers like 9 and -2 are called integers. An **integer** is any number from the set {..., -4, -3, -2, -1, 0, 1, 2, 3, 4, ...} where ... means *continues without end*.



Real-World EXAMPLES

- + 3 positive three
- 3 negative three

READING Math

WEATHER Write an integer for each situation.

an average temperature of 5 degrees below normal

Because it represents *below* normal, the integer is -5.

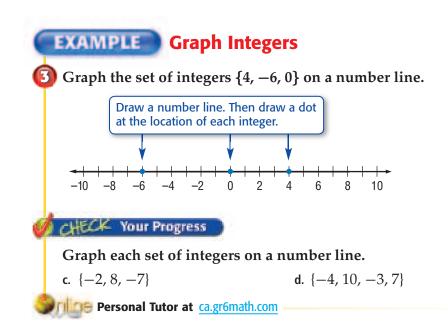
an average rainfall of 5 inches above normal

Because it represents *above* normal, the integer is +5 or 5.

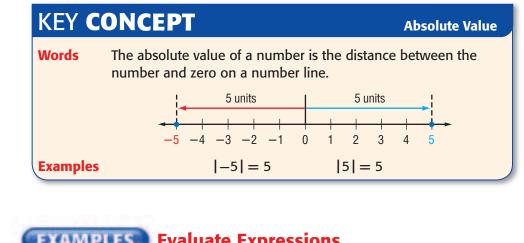
CHECK Your Progress Write an integer for each situation.

a. 6 degrees above normal b. 2 inches below normal

Integers can be graphed on a number line. To **graph** a point on the number line, draw a point on the line at its location.



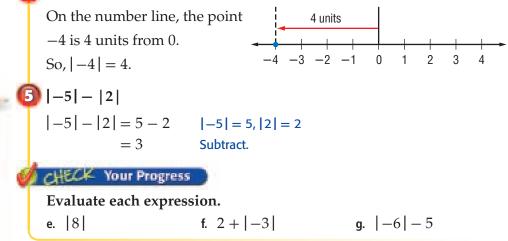
On the number line below, notice that -5 and 5 are each 5 units from 0, even though they are on opposite sides of 0. Numbers that are the same distance from zero on a number line have the same **absolute value**.

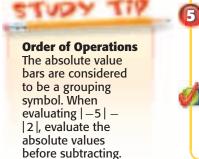




Evaluate each expression.

4 | -4 |





of negative five

READING Math

Absolute Value |-5| *absolute value*

CHEC	Your Understan	ding
Examples 1, 2	Write an integer for each situ	ation.
(p. 80)	1. a loss of 11 yards	2 . 6°F below zero
	3 . a deposit of \$16	4. 250 meters above sea level
Example 3	1	of a company's stock fell 21 points in one week ent the amount the stock price fell. n a number line.
(p. 81)	6. $\{11, -5, -8\}$	7 . {2, -1, -9, 1}
Examples 4, 5	Evaluate each expression.	
(p. 81)	8. -9 9.	1 + 7 10. $ -6 - 1 $

Exercises

HOMEWORKHELP			
For Exercises	See Examples		
11–20	1, 2		
21–24	3		
25–30	4, 5		

Write an integer for each situation.

- a profit of \$9
 53°C below zero
- **15**. 2 feet below flood level
- **17**. an elevator goes up 12 floors
- **12**. a bank withdrawl of \$50
- 14. 7 inches more than normal
- **16**. 160 feet above sea level
- 18. no gains or losses on first down
- **19. GOLF** In golf, scores are often written in relationship to *par*, the average score for a round at a certain course. Write an integer to represent a score that is 7 under par.
- **20. PETS** Javier's pet guinea pig gained 8 ounces in one month. Write an integer to describe the amount of weight his pet gained.

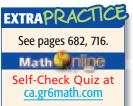
Graph each set of integers on a number line.

21 . {0, 1, -3}	22 . {3, -7, 6}
23 . {-5, -1, 10, -9}	24. $\{-2, -4, -6, -8\}$

Evaluate each expression.

25. 10	26 . -12	27 . −7 −5
28 . 7 + 4	29. $ -9 + -5 $	30 . $ 8 - -2 $
31. $ -10 \div 2 \times 5 $	32 . 12 - -8 + 7	33 . 27 ÷ 3 − −4

- **34. WEATHER** A meteorologist reports a 20° change in the temperature from yesterday to today. Explain what this could mean.
 - **35. SCIENCE** Suppose you rub a balloon through your hair to make the balloon stick to a wall. There are 17 positive charges on the wall and 25 negative charges on the balloon. Write an integer for each charge.

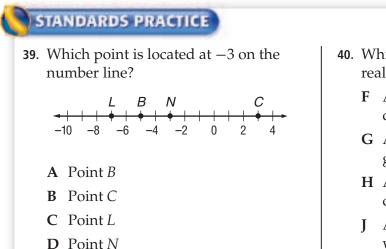


H.O.T. Problems **36. REASONING** If |x| = 3, what is the value of *x*?

> **37. CHALLENGE** Determine whether the following statement is *true* or *false*. If *false*, give a counterexample.

> > *The absolute value of every integer is positive.*

38. **WRITING IN MATH** Write about a real-world situation that uses negative integers. Explain what the negative integer means in that situation.



- **40**. Which statement about these real-world situations is not true?
 - **F** A \$100 check deposited in a bank can be represented by +100.
 - **G** A loss of 15 yards in a football game can be represented by -15.
 - **H** A temperature of 20 below zero can be represented by -20.
 - J A submarine diving 300 feet under water can be represented by +300.

Spiral Review

Copy and complete each function table. Identify the domain and range. (Lesson 1-10)

41. y = x - 4

x	<i>x</i> – 4	y
4		
5		
6		
7		

42.	<i>y</i> =	9 <i>x</i>	
	x	9 <i>x</i>	y
	0		
	1		
	2		
	3		

	•	
43.	y = 5x + 1	

/		
X	5 <i>x</i> + 1	у
1		
2		
3		
4		

44. GEOMETRY The table shows the side length and perimeter of several equilateral triangles. Write an expression that describes the perimeter if *x* represents the side length. (Lesson 1-9)

Side Length (in.) 2 3 4 5 6 Perimeter (in.) 6 9 12 15 18

GET READY for the Next Lesson

PREREQUISITE SKILL Replace each • with < or > to make a true sentence.

45. 16 • 6 **46**. 101 **1**11

47. 87.3 **83.7 48.** 1,051 **1**,015

Comparing and Ordering Integers

Main IDEA

Compare and order integers.



Preparation for Standard 6NS1.1

Compare and order positive and negative fractions, decimals, and mixed numbers and place them on a number line.

GET READY for the Lesson

WEATHER The wind chill table shows how cold air feels on human skin.

1. What is the wind chill if there is a wind at 20 miles per hour and the temperature is 5°?

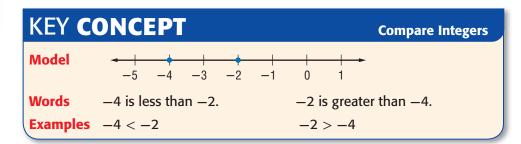
2. Which feels colder, a

	WIND CHILL				
Wind		Temperature (°F)			
(mph)	15	10	5	0	- <mark>5</mark>
5	7	1	-5	-11	-16
10	3	-4	-10	-16	-22
15	0	-7	-13	-19	-26
20	-2	_9	-15	-22	-29

temperature of 15° with a 20 mile-per-hour wind or a temperature of 10° with a 10 mile-per-hour wind?

3. Graph both wind chills in Exercise 2 on a number line.

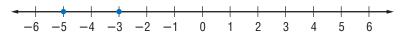
When two numbers are graphed on a number line, the number to the left is always less than the number to the right. The number to the right is always greater than the number to the left.



EXAMPLE Compare Two Integers

Replace the \bullet with < or > to make $-5 \bullet -3$ a true sentence.

Graph each integer on a number line.



Since -5 is to the left of -3, -5 < -3.

CHECK Your Progress

Replace each ● with < or > to make a true sentence.

c. −10 **•** −13 a. −8 ● −4 **b**. 5 ● −1

COncepts in MOtion

Interactive Lab ca.gr6math.com

READING in the Content Area

For strategies in reading this lesson, visit ca.gr6math.com.

Test-Taking Tip

Eliminating Answer Choices

If you are unsure of the correct answer, eliminate the choices you know are incorrect. Then consider the remaining choices. You can eliminate choice C since the list begins with a positive number.

STANDARDS EXAMPLE

2 The lowest temperatures in Alaska, Florida, Hawaii, and Montana are listed in the table. Which list shows these temperatures in order from coldest to warmest?

A -80, -70, 12, -2
B -80, -70, -2, 12
C 12, -2, -70, -80
D -2, 12, -70, -80

State	Record Low Temperature (°F)
Alaska	-80
Florida	-2
Hawaii	12
Montana	-70

Source: The World Almanac and Book of Facts

Read the Item

To order the integers, graph them on a number line.

Solve the Item

A M F H -90 -80 -70 -60 -50 -40 -30 -20 -10 0 10 20

Order the integers from coldest to warmest by reading from left to right: -80, -70, -2, 12. So, the answer is B.

CHECK Your Progress

d. A newspaper reporter lists the third round scores of the top five finishers in a golf tournament. Which list shows these scores from least to greatest?

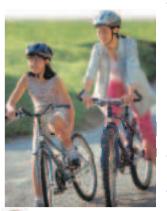
Personal Tutor at ca.gr6math.com

CHECK Your Understanding

Example 1 (p. 84	1						
Example 2 (p. 85	6						
	6. STANDARDS PRACTICE The elevations, in feet, for the lowest points in California, Oklahoma, Lousiana, and Kentucky are listed. Which list shows the elevations in order from highest to lowest?						
	A 289, -282, 257, -8 C -282, -8, 257, 289 B -8, 257, -282, 289 D 289, 257, -8, -282						

Exercises

HOMEWORKHELP					
For Exercises	See Examples				
7–14	1				
15–20	2				
35–36	2				



Real-World Link . . . About 20 million bicycles are sold each year in the U.S. Source: bicyclinginfo.org

Replace each \bullet with < or > to make a true sentence.

7 . −7 • −3	8. −21 ● −12	9 . −6 • −11	10 . −15 • −33
11 . 17 ● −20	12 . 4 ● −4	13 . −5 1 7	14 . −12 ● 8

Order the integers in each set from least to greatest.

15.	{-8, 11, 6, -5, -3}
17.	{5, -6, -7, -4, 1, 3}

- **16.** {7, −2, 14, −9, 2} **18.** {−12, 15, 8, −15, −23, 10}
- **19. ANALYZE TABLES** The ocean floor is divided into five zones according to how deep sunlight penetrates. Order the zones from closest to the surface to nearest to the ocean floor.
- **20. STOCK MARKET** Kevin's dad owns stock in five companies. The change in the stock value for each company was as follows:
- ZoneBeginning
Ocean DepthAbyssal-4,000 mHadal-6,000 mMidnight-1,000 mSunlight0 mTwilight-200 m

Company A, +12; Company B, -5; Company C, -25; Company D, +18; Company E, -10. Order the companies from the worst performing to best performing.

 Replace each
 with <, >, or = to make a true sentence.

 21. $-13 \bullet |-14|$ 22. $|36| \bullet -37$ 23. $-12 \bullet |12|$ 24. $|-29| \bullet |92|$

ANALYZE TABLES For Exercises 25 and 26, use the information in the table. It shows the low temperatures in Albuquerque, New Mexico, for January 3–9 of a recent year.

Day	Jan. 3	Jan. 4	Jan. 5	Jan. 6	Jan. 7	Jan. 8	Jan. 9
Temperature (°F)	3	-4	-15	-12	-17	-8	2
Source: weather com							

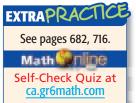
- 25. Order the dates from the coldest temperature to the warmest.
- 26. Which temperature is the middle, or *median*, temperature?
- •27. **MONEY** Marva is saving money for a new bike and has already saved \$21. She keeps track of her money in a log. Write the integers she should use to represent each entry.

Determine whether each sentence is *true* or *false*. If *false*, change one number to make the sentence true.

28. -8 > 5 **29.** -7 < 0

 30. |5| < -6 **31.** 10 > |-8|





H.O.T. Problems

- **32. NUMBER SENSE** If 0 is the greatest integer in a set of five integers, what can you conclude about the other four integers?
- **33. CHALLENGE** What is the greatest integer value of *n* such that n < 0?
- 34. **WRITING IN MATH** Develop a method for ordering a set of negative integers from least to greatest without the aid of a number line.
- Explain your method and use it to order the set $\{-5, -8, -1, -3\}$.

STANDARDS PRACTICE

- **35**. On a certain game show, contestants receive positive numbers of points for correct responses and negative numbers of points for incorrect responses. Which list gives the points a contestant received during one round of the game in order from highest to lowest?
 - A -200, -400, -1000, 200, 600
 - **B** 600, -1000, -400, -200, 200
 - **C** 600, 200, -200, -400, -1000
 - **D** -1000, -400, -200, 600, 200

36. Which statement about the values shown is *not* true?

State	Low Temperature (°F)			
AR	-29			
GA	-17			
MS	-19			
VA	-30			
TX	-23			
Source: The World Almanac				

Source: The World Almanac

- **F** Virginia's record low is less than the record low for Arkansas.
- **G** Arkansas' record low is less than the record low for Georgia.
- H Mississippi's record low is greater than the record low for Texas.
- J Texas' record low is less than the record low for Arkansas.

Spiral Review

Write an integer for each situation. (Lesson 2-1)

37. 9°C below zero

38. a gain of 20 feet

HOBBIES For Exercises 39 and 40, use the following information. (Lesson 1-10)

Sophia estimates that she knits 6 rows of an afghan each hour.

- **39**. Write an equation using two variables to represent the total number of rows *r* completed by Sophia after time *t*.
- 40. How many rows will Sophia have completed after 4 hours?

GET READY for the Next Lesson

PREREQUISITE SKILL Graph each point on a vertical number line that goes from -10 on the bottom to 10 at the top. (Lesson 2-1)

41. -3 **42.** 0 **43.** 4 **44.** -7



The Coordinate Plane

Main IDEA

Graph points on a coordinate plane.



Reinforcement of

Standard 5AF1.4 Identify and graph ordered pairs in the four quadrants of the coordinate plane.

Standard 6MR2.4 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.

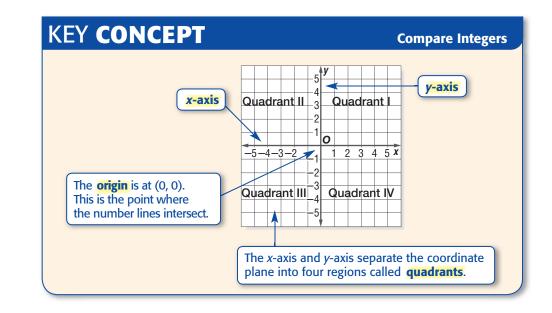
GET READY for the Lesson

MAPS A map of Terrell's neighborhood is shown.

- 1. Suppose Terrell starts at the corner of Russel and Main and walks 2 blocks east and 1 block north. Name the intersection of his location.
- 2. Using the words *north*, south, west, and east, write directions to go from the corner of School and Highland to the corner of Main and Oak.

W ↔ E S	Edward Ave.	Fairway Ave.	Buffalo Ave.	Eastwood Ave.	Elmhurst Ave.	Russel St.	School St.	Mobile St.
						Higl	land	St.
Oak St.	Ma	in St.				Thor	nas S	

On city maps, towns and streets are often located on a grid. In mathematics, we use a grid called a **coordinate plane**, to locate points.



An **ordered pair** is a pair of numbers, such as (5, -4), used to locate a point in the coordinate plane.

(5, -4)

The first number is the *x***-coordinate** and corresponds to a number on the x-axis.

The second number is the y-coordinate and corresponds to a number on the y-axis.

NEW Vocabulary

coordinate plane x-axis y-axis origin quadrant ordered pair x-coordinate y-coordinate

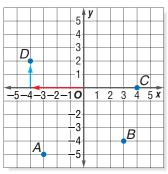
When locating an ordered pair, moving *right* or *up* on a coordinate plane is in the *positive* direction. Moving *left* or *down* is in the *negative* direction.

EXAMPLE Naming Points Using Ordered Pairs

Write the ordered pair that corresponds to point *D*. Then state the quadrant in which the point is located.

- Start at the origin.
- Move left on the *x*-axis to find the *x*-coordinate of point *D*, which is -4.
- Move up to find the *y*-coordinate, which is 2.

So, point *D* corresponds to the ordered pair (-4, 2). Point *D* is located in Quadrant II.



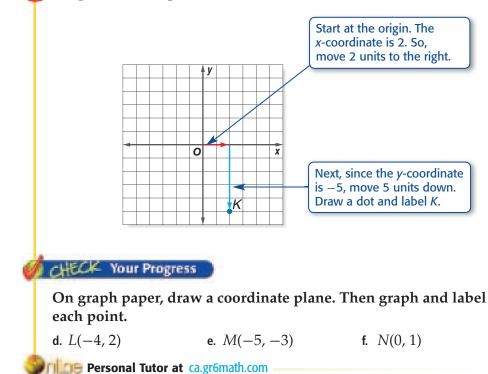
CHECK Your Progress

Write the ordered pair that corresponds to each point. Then state the quadrant or axis on which the point is located.

a. A b. B c. C

EXAMPLE Graph an Ordered Pair

2 Graph and label point K at (2, -5).



READING Math

Scale When no numbers are shown on the *x*- or *y*-axis, you can assume that each square is 1 unit long on each side.



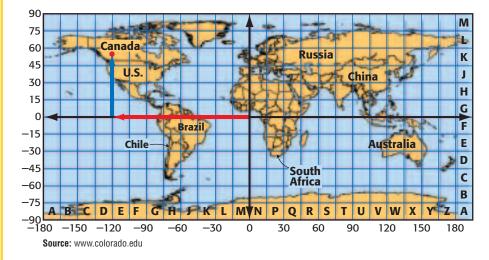
How Does a Cartographer Use Math? Cartographers use coordinates to prepare geographic, political, and cultural maps of large areas.

Math Online

For more information, go to ca.gr6math.com.

Real-World EXAMPLES

3 GEOGRAPHY The world map can be divided into a coordinate plane where (*x*, *y*) represents (degrees longitude, degrees latitude). In what country is the point (–120° longitude, 55° latitude) located?



Start at the origin. Move -120° left and then 55° up. This point is located in Canada.

Which of the countries labeled is located entirely in quadrant III? Quadrant III is the bottom-left quadrant. Of the countries labeled, Chile is the only country located entirely in Quadrant III.

CHECK Your Progress For Exercises g and h, use the map above.

- **g**. In what country is the point (20° longitude, -35° latitude) located?
- **h**. Name a country labeled on the map that is located in Quadrant I.

CHECK Your Understanding

Example 1 Write the ordered pair corresponding to each point (p. 89) graphed at the right. Then state the quadrant or axis on which each point is located.

1. <i>P</i>	2 . Q
3 . <i>R</i>	4. <i>S</i>

Example 2
(p. 89)On graph paper, draw a coordinate plane.(p. 89)Then graph and label each point.

5. <i>T</i> (2, 3)	6. $U(-4, 6)$
7. $V(-5, 0)$	8 . W(1, −2)

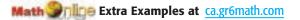
R

x

Q

Examples 3, 4 (p. 90) **GEOGRAPHY** For Exercises 9 and 10, use the map in Example 3 above.

- 9. In what country is the point (105° longitude, 30° latitude) located?
- **10**. In which quadrant is Australia located?

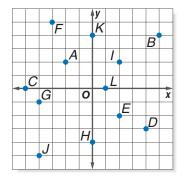


Exercises

HOMEWORKHELP			
For Exercises	See Examples		
11–22, 37	1		
23–34, 38	2		
35-36	3		

Write the ordered pair corresponding to each point graphed at the right. Then state the quadrant or axis on which each point is located.

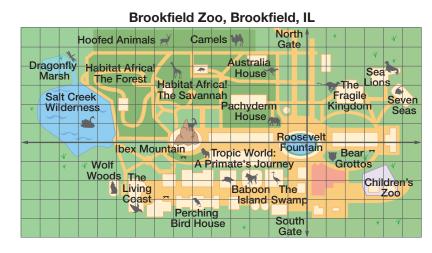
11 . <i>A</i>	12. <i>B</i>	13 . C
14. D	15. <i>E</i>	16 . <i>F</i>
17 . G	18. <i>H</i>	19. <i>I</i>
20 . J	21 . <i>K</i>	22. L



On graph paper, draw a coordinate plane. Then graph and label each point.

23 . <i>M</i> (5, 6)	24 . N(-2, 10)	25 . <i>P</i> (7, −8)	26 . Q(3, 0)
27 . <i>R</i> (−1, −7)	28 . <i>S</i> (8, 1)	29. <i>T</i> (-3, 7)	30 . <i>U</i> (5, −2)
31 . <i>V</i> (0, 6)	32 . <i>W</i> (−5, −7)	33 . <i>X</i> (-4, 0)	34 . <i>Y</i> (0, −5)

•• **ZOOS** For Exercises 35–38, use the map of the Brookfield Zoo.



35. What exhibit is located at (4, -2)?

- 36. In which quadrant is the Dragonfly Marsh exhibit located?
- **37**. Find the ordered pair that represents the location of Baboon Island.
- **38**. What is located at the origin?

On graph paper, draw a coordinate plane. Then graph and label each point.

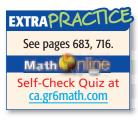
39 . X(1.5, 3.5)	40. $Y\left(3\frac{1}{4}, 2\frac{1}{2}\right)$	41. $Z(2, 1\frac{2}{3})$
-------------------------	---	---------------------------------

42. GEOMETRY Graph the points A(-3, 2), B(2, 2), C(2, -4), and D(-3, -4) on the same coordinate plane. Connect points *A* and *B*, *B* and *C*, *C* and *D*, and *D* and *A*. Name the figure.

43. RESEARCH Use the Internet or other resources to explain why the coordinate plane is sometimes called the Cartesian plane and the myth behind its invention.



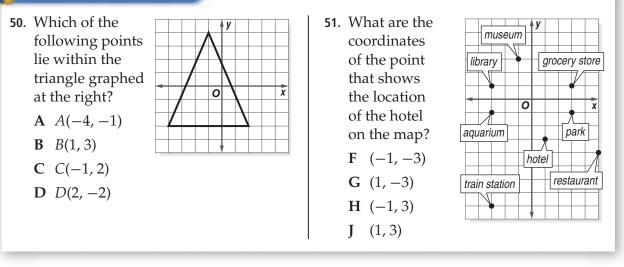
Real-World Link Polar bears are just one of the more than 400 species at the Brookfield Zoo. Source: brookfieldzoo.org

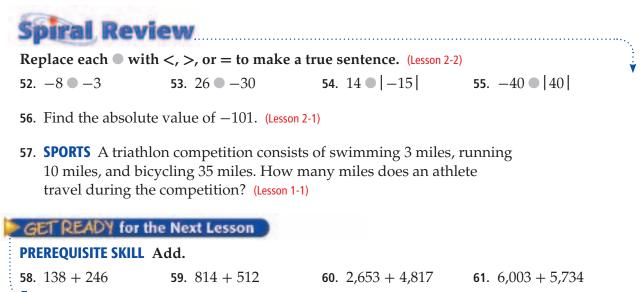


Determine whether each statement is *sometimes, always,* or *never* true. Explain or give a counterexample to support your answer.

- **44**. Both *x* and *y*-coordinates of a point in quadrant I are negative.
- **45**. The *x*-coordinate of a point that lies on the *x*-axis is negative.
- **46**. The *y*-coordinate of a point in quadrant IV is negative.
- H.O.T. Problems 47. OPEN ENDED Create a display that shows how to determine in what quadrant a point is located without graphing. Then provide an example that demonstrates how your graphic is used.
 - **48. CHALLENGE** Find the possible locations for any ordered pair whose *x* and *y*-coordinates are always the same integer. Explain.
 - **49. WRITING IN** MATH Explain why the location of point A(1, -2) is different than the location of point B(-2, 1).

STANDARDS PRACTICE





Algebra Lab Adding Integers

Main IDEA Use counters to model the addition of integers. Standard 6MR3.3 Develop generalizations of the results obtained and the strategies used and apply them in new problem situations. Standard 6NS2.3 Solve addition, subtraction, multiplication, and division problems, including those arising in concrete situations, that use positive and negative integers and ACTIVITY combinations of these operations.

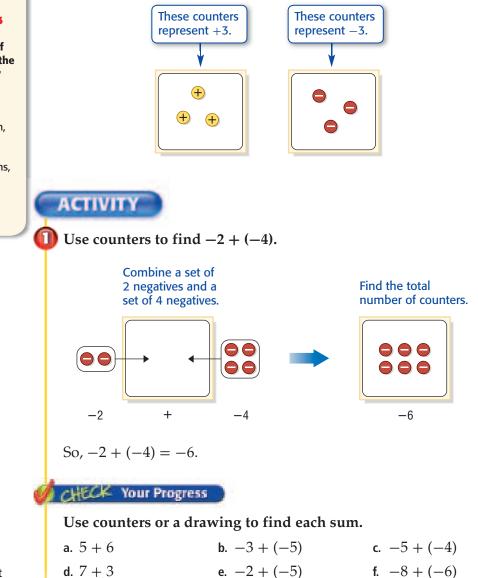
Explore

READING Math

Addends and Sums

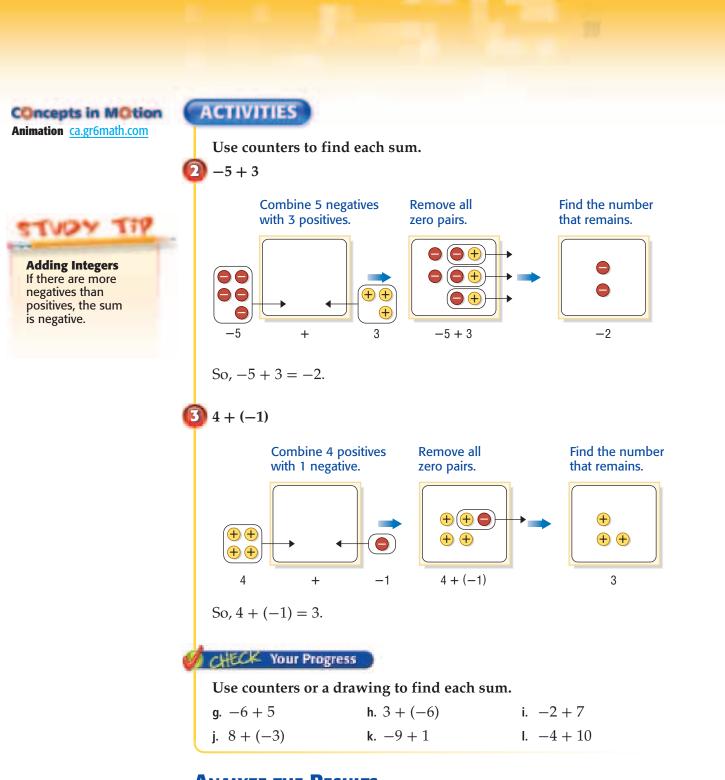
The numbers you add are called *addends*. The result is called the *sum*.

You can use positive and negative counters to model the addition of integers. The counter \oplus represents 1, and the counter \bigoplus represents -1. Remember that addition means *combining* two sets.



The following two properties are important when modeling operations with integers.

- When one positive counter is paired with one negative counter, the result is called a **zero pair**. The value of a zero pair is 0.
- You can add or remove zero pairs from a mat because adding or removing zero does not change the value of the counters on the mat.



ANALYZE THE RESULTS

- 1. Write two addition sentences where the sum is positive. In each sentence, one addend should be positive and the other negative.
- 2. Write two addition sentences where the sum is negative. In each sentence, one addend should be positive and the other negative.
- **3. MAKE A CONJECTURE** What is a rule you can use to determine how to find the sum of two integers with the same sign? two integers with different signs?



Adding Integers

Main IDEA

Add integers.



subtraction, multiplication, and division problems, including those arising in concrete situations, that use positive and negative integers and combinations of these operations.

NEW Vocabulary

opposites additive inverse



Adding Integers You can also use counters to add integers.

GET READY for the Lesson

EARTH SCIENCE Thunderstorms are made of both positive and negative electrical charges. There are extra negative charges (electrons) at the bottom of a thundercloud, and extra positive charges (protons) at the top.

1. What is the charge at the top of a cloud where there are more protons than electrons?



2. What is the charge at the bottom of a cloud where there are more electrons than protons?

Combining positive and negative electrical charges in a thunderstorm is similar to adding integers.

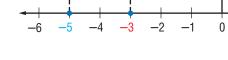
EXAMPLE Add Integers with the Same Sign

1 Find -3 + (-2).

Use a number line.

- Start at 0.
- Move 3 units left to show -3.
- From there, move 2 units left to show -2.

So, -3 + (-2) = -5.

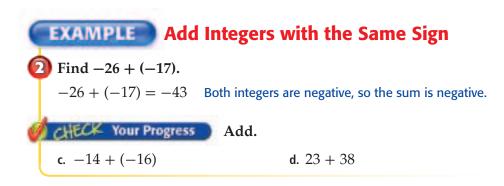


CHECK Your Progress Add. a. -5 + (-7)

b. -10 + (-4)

These and other examples suggest the following rule.

KEY CO	ONCEPT Add Integers with the Same Sign				
Words To add integers with the same sign, add their absolute values. The sum is:					
	 positive if both integers are positive. 				
 negative if both integers are negative. 					
Examples	7 + 4 = 11 $-7 + (-4) = -11$				



•• The integers 5 and -5 are called **opposites** because they are the same distance from 0, but on opposite sides of 0. Two integers that are

opposites are also called **additive inverses**.

KEY CONCEPTAdditive Inverse PropertyWordsThe sum of any number and its additive inverse is 0.Examples5 + (-5) = 0

Models can also help you add integers with different signs.

EXAMPLES Add Integers with Different Signs

Find 5 + (-3).

Use a number line.

• Start at zero.

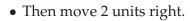
e. 6 + (-7)

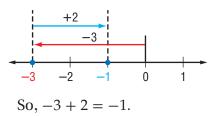
- Move 5 units right.
- Then move 3 units left.

 Find —3 + 2.

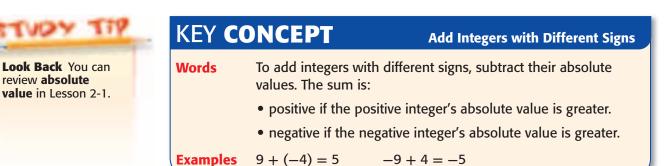
Use a number line.

- Start at zero.
- Move 3 units left.





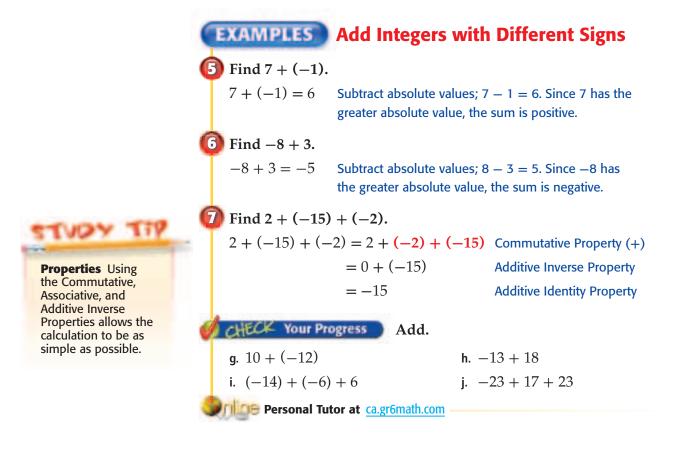
f. −15 + 19



Vocabulary Link . . Opposite

Everyday Use something that is across from or is facing the other way, as in running the opposite way.

Math Use two numbers that are the same distance from 0, but on opposite sides of 0 on the number line.





OCEANOGRAPHY Anna was scuba diving 16 meters below the surface of the water near the Great Barrier Reef. She rose 7 meters to swim next to a dolphin. Then she descended 25 meters to investigate a coral formation. Write an addition sentence to describe this situation. Then find the sum and explain its meaning.

Anna is 16 meters under water, rises 7 meters, and descends 25 meters. So, her new depth can be represented by the sentence -16 + 7 + (-25).

-16 + 7 + (-25) = (-16 + 7) + (-25) Associative Property (+)

= -34

$$= (-16 + 7) + (-25)$$
 Associative Property (+
= $-9 + (-25)$ $-16 + 7 = -9$; Subtrac

-16 + 7 = -9; Subtract absolute values; since -16 has the greater absolute value, the sum is negative.

Add absolute values. Both integers are negative, so the sum is negative.

The coral formation is 34 meters below the surface of the water.

CHECK Your Progress

k. WEATHER The temperature is -3° F. An hour later, it drops 6° and 2 hours later, it rises 4° . Write an addition sentence to describe this situation. Then find the sum and explain its meaning.



Real-World Link . . . The Great Barrier Reef off the coast of Australia is home to 1,500 species of fish. Source: deh.gov.au



HECK Your Understanding

Examples 1–6 (pp. 95–97)	Add.		
	1. –		
	4. –		
Example 7 (p. 97)	7. –		
Example 8	9. N		
(p. 97)	e		
	ťł		

Auu.		
1. $-6 + (-8)$	2. 4 + 5	3 . −3 + 10
4. $-15 + 8$	5. $7 + (-11)$	6. $14 + (-6)$
7 . −27 + 27	8. 15 + 9 +	(-9)

2. MONEY Camilia owes her brother \$25, so she gives her brother the \$18 she earned dog-sitting for the neighbors. Write an addition sentence to describe this situation. Then find the sum and explain its meaning.

Exercises

HOMEWO	RKHELP	Add.			
For	See	10. $-22 + (-16)$	11 . $-10 + (-15)$	12 . 6 + 10	13 . 17 + 11
Exercises	Examples	14. $18 + (-5)$	15 . 13 + (-19)	16. $13 + (-7)$	17. $7 + (-20)$
10–13	1, 2	18. $-19 + 24$	19. $-12 + 10$	20. $-30 + 16$	21 . −9 + 11
14–21	3–6	10. $-19 + 24$	19. $-12 + 10$	20. -30 ± 10	21 . =9 + 11
22–27	7	22 . 21 + (-21)	23. $-8 + 8$:	24. $-34 + 25 + (-25)$
28–31	8	25 16 + 16 + 22	26. 25 + 3 +	- (-25)	27. $7 + (-19) + (-7)$

Write an addition expression to describe each situation. Then find each sum and explain its meaning.

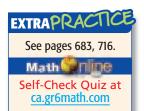
- **28. SUBMARINE** A submarine dives 106 feet below the water. Then it rises 63 feet.
- **29. SKATEBOARDING** Hakeem starts at the top of a half pipe 8 feet above street level. He descends 14 feet to the lowest point in his run.
- **30. BANKING** Stephanie has \$152 in the bank. She withdraws \$20. Then she deposits \$84.
- **31. FOOTBALL** A quarterback is sacked for a loss of 5 yards. On the next play, his team receives a penalty and loses 15 more yards. Then the team gains 12 yards on the third play.

ALGEBRA Evaluate each expression if x = -10, y = 7, and z = -8.

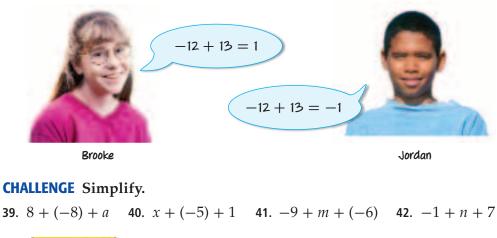
- **32.** x + 14 **33.** z + (-5) **34.** x + y **35.** x + z
- **36. ANALYZE TABLES** In golf, the person with the lowest total score is the winner. The table lists the scores for each round in reference to par of the top two finishers in the 2005 Open Championship.

Player	Round 1	Round 2	Round 3	Round 4
Tiger Woods	-6	-5	-1	-2
Colin Montgomerie	-1	-6	-2	0

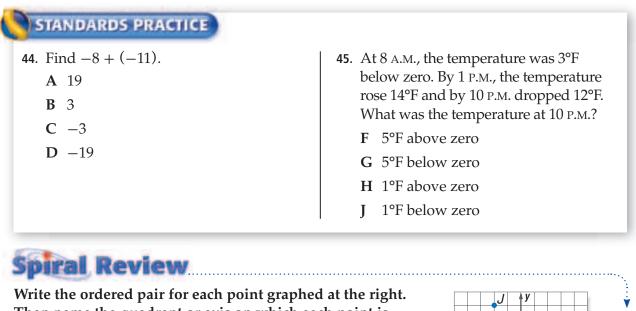
Who had the better score, Woods or Montgomerie? Justify your answer.



- **37. FIND THE DATA** Refer to the California Data File on pages 16–19 of your book. Choose some data and write a real-world problem in which you would add a positive and a negative integer. Then find the sum and explain its meaning.
- **H.O.T.** Problems **38.** FIND THE ERROR Brooke and Jordan are finding -12 + 13. Who is correct? Explain your reasoning.



43. WRITING IN MATH Explain how you know whether a sum is positive, negative, or zero without actually adding.



Write the ordered pair for each point graphed at the right. Then name the quadrant or axis on which each point is located. (Lesson 2-3)

- **46**. J **47**. K **48**. L **49**. M
- **50**. Order 6, -3, 0, 4, -8, 1, and -4 from least to greatest. (Lesson 2-2)

GET READY fo	r the Next Lesson		
PREREQUISITE SKI	L Subtract.		
51. 287 – 125	52 . 420 - 317	53 . 5,684 - 2,419	54. 7,000 - 3,891

M

0

L

Mid-Chapter Quiz

Lessons 2-1 through 2-4

Write an integer for each situation. (Lesson 2-1)

1. dropped 45 feet

CHAPTER

- 2. a bank deposit of \$100
- 3. gained 8 pounds
- 4. lost a \$5 bill
- 5. **OCEANS** The deepest point in the world is the Mariana Trench in the Western Pacific Ocean at a depth of 35,840 feet below sea level. Write this depth as an integer. (Lesson 2-1)

Evaluate each expression. (Lesson 2-1)

6 . -16	7. 24
8. -9 - 3	9 . $ -13 + -1 $

10. ANALYZE TABLES The table shows two temperature changes over the course of 15 minutes.

Location	Year	Temperature Change
Rapid City, SD	1911	—47°F
Ft. Assiniboine, MT	1892	+42°F

Source: infoplease.com

Which location had the greater change in temperature? (Lesson 2-1)

- **STANDARDS PRACTICE** The local news 11. records the following changes in average daily temperature for the past week: 4°, -7°, -3°, 2°, 9°, -8°, 1°. Which list shows the temperatures from least to greatest? (Lesson 2-2)
 - A 9°, 4°, 2°, 1°, -3°, -7°, -8°
 - **B** -7°, -8°, 1°, -3°, 2°, 4°, 9°
 - **C** −8°, −7°, −3°, 1°, 2°, 4°, 9°
 - **D** -8°, -7°, 1°, 2°, 3°, 4°, 9°

Replace each with <, >, or = to make a true sentence. (Lesson 2-2)

12 . −4 ● 4	13 . −8 ● −11
14 . −14 • 3	15 . −12 ● 12

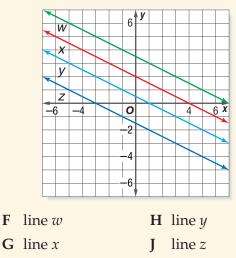
On graph paper, draw a coordinate plane. Then graph and label each point. (Lesson 2-3)

16 . <i>D</i> (4, −3)	17 . <i>E</i> (-1, 2)
18 . <i>F</i> (0, −5)	19. $G(-3, 0)$

STANDARDS PRACTICE Which line contains the ordered pair (-1, 4)?

(Lesson 2-3)

20.



Add. (Lesson 2-4)

21 . 3 + 4 + (-3)	22 . 7 + (-11)
23. $-5 + (-6)$	24. 8 + (-1) + 1

- **STANDARDS PRACTICE** Kendra 25. deposited \$78 into her savings account. Two weeks later, she deposited a check for \$50 into her account and withdrew \$27. Which of the following expressions represents the amount of money left in her account? (Lesson 2-4)
 - A \$78 + (-\$50) + (-\$27)
 - **B** \$78 + (-\$50) + \$27
 - C \$78 + \$50 + (-\$27)
 - **D** \$78 + \$50 + \$27

Algebra Lab Subtracting Integers

Main IDEA

Use counters to model the subtraction of integers.

Explore

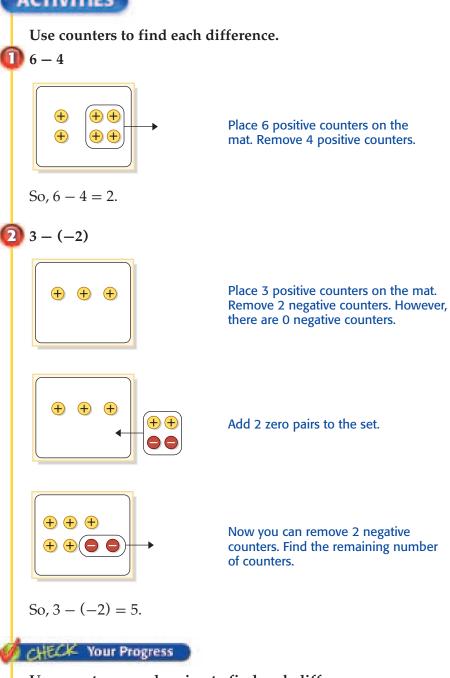
725

Standard 6MR3.3 Develop

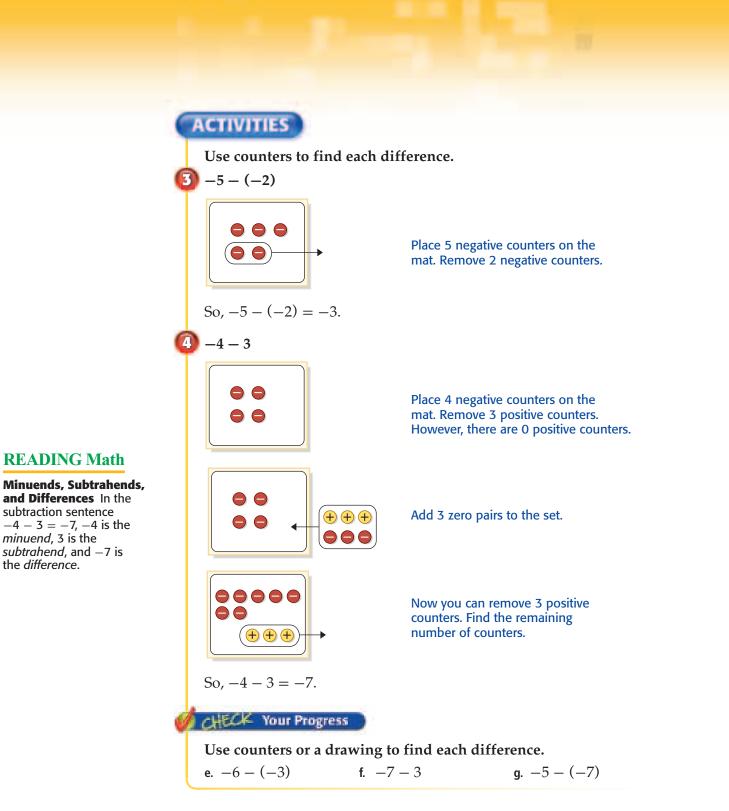
generalizations of the results obtained and the strategies used and apply them in new problem situations.

Standard 6NS2.3 Solve addition, subtraction, multiplication, and division problems, including those arising in concrete situations, that use positive and negative integers and combinations of these operations. You can also use counters to model subtraction of integers. Remember one meaning of subtraction is to *take away*.

ACTIVITIES



Use counters or a drawing to find each difference. a. 7-6 b. 5-(-3) c. 6-(-3) d. 5-8

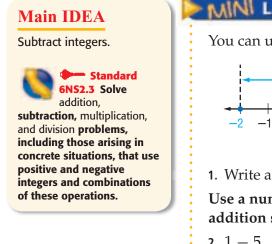


ANALYZE THE RESULTS

- 1. Write two subtraction sentences where the difference is positive. Use a combination of positive and negative integers.
- **2**. Write two subtraction sentences where the difference is negative. Use a combination of positive and negative integers.
- **3. MAKE A CONJECTURE** Write a rule that will help you determine the sign of the difference of two integers.

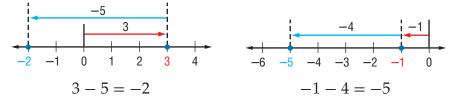


Subtracting Integers



MINI Lab

You can use number lines to model subtraction problems.

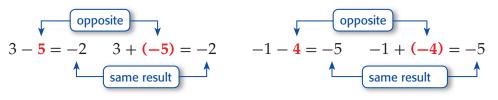


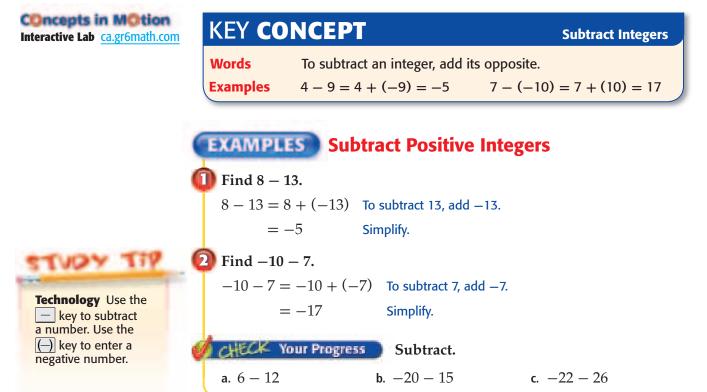
1. Write a related addition sentence for each subtraction sentence.

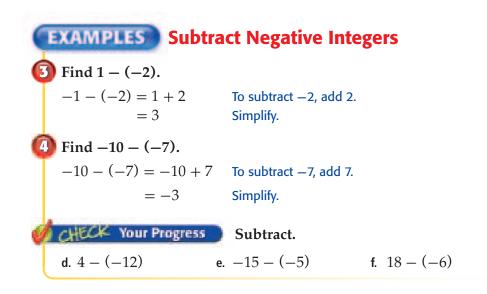
Use a number line to find each difference. Write an equivalent addition sentence for each.

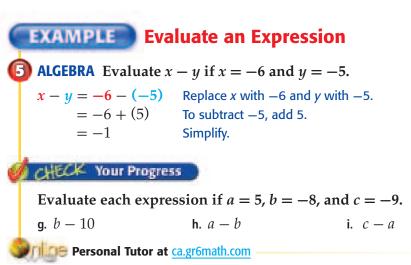
2. 1 − 5 3. -2 - 14. -3 - 45. 0 - 5

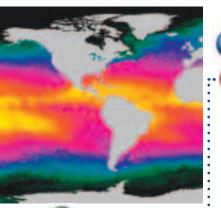
When you subtract 5, the result is the same as adding its opposite, -5. When you subtract 4, the result is the same as adding its opposite, -4.











Real-World Link

A sea-surface temperature map shows the minimum temperature at -2°C and the maximum temperature at 31°C.

Real-World EXAMPLE

EARTH SCIENCE Refer to the information at the left. What is the difference between the maximum and the minimum temperatures on the map?

To find the difference in temperatures, subtract the lower temperature from the higher temperature.

31 - (-2) = 31 + 2 To subtract -2, add 2. = 33 Simplify.

So, the difference between the temperatures is 33°C.

CHECK Your Progress

j. **GEOGRAPHY** The Dead Sea's deepest part is 799 meters below sea level. A plateau to the east of the Dead Sea rises to about 1,340 meters above sea level. What is the difference between the top of the plateau and the deepest part of the Dead Sea?



CHECK Your Understanding

Examples 1, 2	Subtract.		
(p. 103)	1 . 14 – 17	2. 10 - 30	
	3 . $-4-8$	4. -2 - 23	
Examples 3, 4	5 . 14 - (-10)	6 . 5 - (-16)	
(p. 104)	73 - (-1)	8 11 - (-9)	
Example 5			
(p. 104)	9. <i>r</i> – 15	10. $q - r$ 11. $p - q$	
Example 6 (p. 104)	1		

Exercises

HOMEWORKHELP		
See Examples		
1, 2		
3, 4		
5		
6		

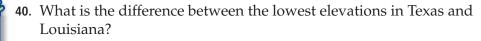
Subtract.

Subtlucti			
13. 0 - 10	14. 13 – 17	15 . −9 − 5	16 . −8 − 9
17 . 4 – (–19)	18. 27 - (-8)	19 11 - (-42)	20 27 - (-19)
21. 12 – 26	22. 31 - 48	23 25 - 5	24. -44 - 41
25 . 52 - (-52)	26. 15 - (-14)	27 27 - (-33)	28 18 - (-20)
ALGEBRA Evaluate	each expression if	f = -6, g = 7, and h	= 9.
29. <i>g</i> - 7	30 . <i>f</i> – 6	31. $-h - (-9)$	32. <i>f</i> − <i>g</i>
33. <i>h</i> – <i>f</i>	34. <i>g</i> − <i>h</i>	35 . 5 − <i>f</i>	36. 4 - (-g)

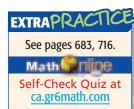
ANALYZE TABLES For Exercises 37–40, use the information below.

State	California	Georgia	Louisiana	New Mexico	Texas
Lowest Elevation (ft)	-282	0	-8	2,842	0
Highest Elevation (ft)	14,494	4,784	535	13,161	8,749

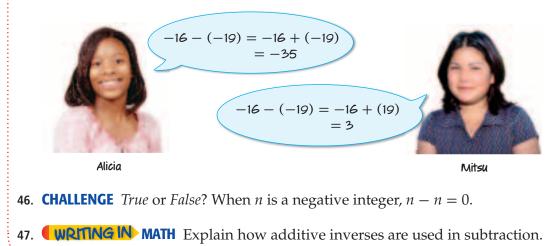
- **37**. What is the difference between the highest elevation in Texas and the lowest elevation in Louisiana?
- **38**. Find the difference between the lowest elevation in New Mexico and the lowest elevation in California.
- **39**. Find the difference between the highest elevation in Georgia and the lowest elevation in California.



ALGEBRA Evaluate each expression if h = -12, j = 4, and k = 15. 41. -j + h - k 42. |h - j| 43. k - j - h



- **H.O.T.** Problems 44. **OPEN ENDED** Write a subtraction sentence using integers. Then, write the equivalent addition sentence, and explain how to find the sum.
 - **45. FIND THE ERROR** Alicia and Mitsu are finding -16 (-19). Who is correct? Explain your reasoning.



STANDARDS PRACTICE

- **48**. Which sentence about integers is *not* always true?
 - A positive positive = positive
 - **B** positive + positive = positive
 - **C** negative + negative = negative
 - **D** positive negative = positive
- **49**. Morgan drove from Los Angeles (elevation 330 feet) to Death Valley (elevation -282 feet). What is the difference in elevation between Los Angeles and Death Valley?

F	48 feet	H 582 feet
G	148 feet	J 612 feet

Spiral Review

Add. (Lesson 2-4)

50. 10 + (-3)

51. -2 + (-9) **52.** -7 + (-6) **53.** -18 + 4

54. In which quadrant does the ordered pair (5, -6) lie? (Lesson 2-3)

55. **NUMBERS** A number times 2 is added to 7. The result is 23. What is the number? Use the *guess and check* strategy. (Lesson 1-5)

GET READY for the Next Lesson

Add. (Lesson 2-4) **56.** -6 + (-6) + (-6) + (-6)**57.** -11 + (-11) + (-11)58. -2 + (-2) + (-2) + (-2)**59.** -8 + (-8) + (-8)

106 Chapter 2 Integers (I)Cleve Bryant/PhotoEdit, (r)David Young-Wolff/PhotoEdit



Multiplying Integers

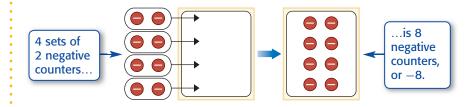
Main IDEA

Multiply integers.

Standard 6NS2.3 Solve addition, subtraction, multiplication, and division problems, including those arising in concrete situations, that use positive and negative integers and combinations of these operations.

MINI Lab

Counters can be used to multiply integers.



1. Write a multiplication sentence that describes the model above.

Find each product using counters or a drawing.

2. 3(-2)**3.** 4(-3)**4.** 1(-7)**5.** 5(-2)

Remember that multiplication is the same as repeated addition. The multiplication expression 4(-2) in the Mini Lab means that -2 is used as an addend four times.

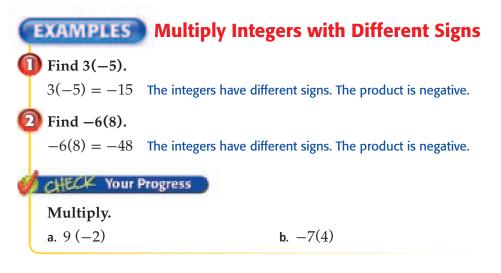
$$4(-2) = (-2) + (-2) + (-2) + (-2)$$

$$= -8$$

$$-8 -7 -6 -5 -4 -3 -2 -1 0 -1$$

By the Commutative Property of Multiplication, 4(-2) = -2(4). When two integers have different signs, the following rule applies.

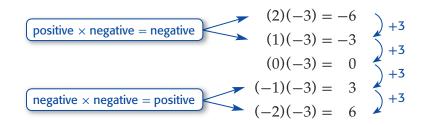
KEY CO	NCEPT	Multiply Integers with Different Signs
Words	The product of tw	o integers with different signs is negative.
Examples	6(-4) = -24	-5(7) = -35



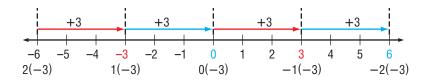


Multiplying by Zero The Multiplicative

Property of Zero states that when any number is multiplied by zero, the product is zero. The product of two positive integers is positive. You can use a pattern to find the sign of the product of two negative integers.

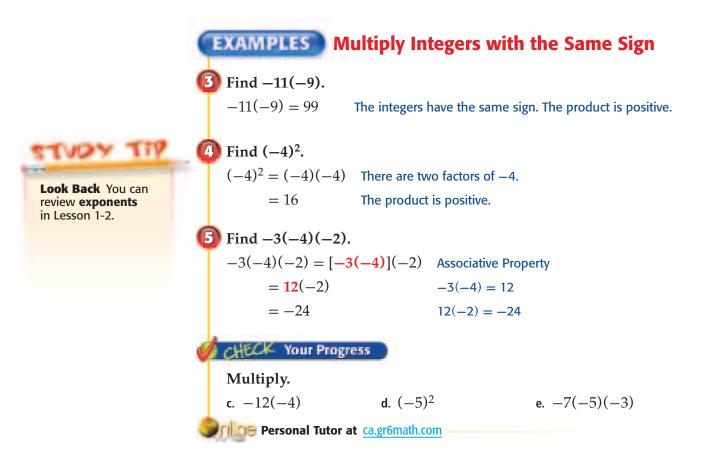


Each product is 3 more than the previous product. This pattern can also be shown on a number line.



These and other examples suggest the following rule.

KEY C	ONCEPT	Multiply Integers with Same Sign
Words	The product o	f two integers with the same sign is positive.
Examples	2(6) = 12	-10(-6) = 60





Real-World Link: The MIR submersible that explored the Titanic shipwreck was able to descend to -20,000 feet. **Source:** spaceadventures.com

Real-World EXAMPLE

SUBMERSIBLES A submersible is diving from the surface of the water at a rate of 90 feet per minute. What is the depth of the submersible after 7 minutes?

If the submersible descends 90 feet per minute, then after 7 minutes, the vessel will be -90(7) or 630 feet below the surface. Thus, the submersible will descend to -630 feet.

CHECK Your Progress

f. **MONEY** Mr. Simon's bank automatically deducts a \$4 monthly maintenance fee from his savings account. What integer represents a change in his savings account from one year of fees?

Negative numbers are often used when evaluating algebraic expressions.

EXAMPLE Evaluate Expressions

D ALGEBRA Evaluate pqr if p = -3, q = 4, and r = -1.

pqr = -3(4)(-1)Replace p with -3, q with 4, and r with -1. = (-12)(-1)
Multiply -3 and 4. = 12
Multiply -12 and -1.

CHECK Your Progress

g. Evaluate xyz if x = -7, y = -4, and z = 2.

CHECK Your Understanding

Examples 1, 2 (p. 107)	Multiply. 1. 6(-10)	2 . 11(-4)	3 2(14)	4. -8(5)
Examples 3–5 (p. 108)	Multiply. 515(-3) 8. (-3) ³	67(-9) 91(-3)(-	-4)	7. $(-8)^2$ 10. 2(4)(5)
Example 6 (p. 109)	stock drops by S		multiplication	x. Suppose the price of the n expression to find the er.
Example 7 (p. 109)	ALGEBRA Evaluate 12. 5 <i>f</i>	each expression if <i>f</i>	= −1, g = 7, a 13. <i>fgh</i>	and $h = -10$.

Exercises

HOMEWORKHELP		
For Exercises	See Examples	
14–19, 28	1, 2	
20–27, 29	3–5	
30–37	7	
38–39	6	

Multiply.

14 . 8(-12)	15 . 11(-20)	16 15(4)	17 . –7(10)
18 . –7(11)	19 . 25(-2)	20 20(-8)	21 16(-5
22. $(-6)^2$	23 . (-5) ³	24 . $(-4)^3$	25 . (-9) ²
26 4(-2)(-8)		27 9(-1)(-5)	
28. Find the prod	duct of 10 and -10 .	29 . Find –7 squ	ared.

ALGEBRA Evaluate each expression if w = 4, x = -8, y = 5, and z = -3.

30. $-4w$	31. 3 <i>x</i>	32. <i>xy</i>	33. <i>xz</i>
34. 7 <i>wz</i>	35. $-2wx$	36. <i>xyz</i>	37 . wyx

Write a multiplication expression to represent each situation. Then find each product and explain its meaning.

- **38. ECOLOGY** Wave erosion causes a certain coastline to recede at a rate of 3 centimeters each year. This occurs uninterrupted for a period of 8 years.
- **39. EXERCISE** Ethan burns 650 Calories when he runs for 1 hour. Suppose he runs 5 hours in one week.

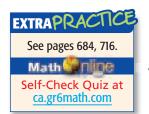
ALGEBRA Evaluate each expression if a = -6, b = -4, c = 3, and d = 9. 40. $-3a^2$ 41. $-cd^2$ 42. -2a + b 43. $b^2 - 4ac$

- 44. **BANKING** Tamika's aunt writes a check for \$150 each month for her car loan. She writes another check for \$300 twice a year to pay for car insurance. Write an expression involving multiplication and addition to describe how these expenses affect her checking account balance on a yearly basis. Then evaluate the expression and explain its meaning.
- **45. FIND THE DATA** Refer to the California Data File on pages 16–19 of your book. Choose some data and write a real-world problem in which you would multiply integers.

GEOMETRY For Exercises 46–48, use the graph at the right.

- **46**. Name the ordered pairs for *P*, *Q*, and *R*. Multiply each *x* and *y*-coordinate by −1 to get three new ordered pairs.
- **47**. Graph the ordered pairs and connect them to form a new triangle. Describe its position with respect to the original triangle.

5)



48. In which quadrant would a new triangle lie if only the *y*-coordinates of the original triangle are multiplied by −2?

H.O.T. Problems ..., 49. OPEN ENDED Write a multiplication sentence whose product is -18.

50. NUMBER SENSE Explain how to evaluate each expression as simply as possible.

a. (-9)(-6)(15)(-7+7) **b.** (-15)(-26) + (-15)(25)

- **51. CHALLENGE** Evaluate $(-1)^{50}$. Explain your reasoning.
- **52. SELECT A TECHNIQUE** Luis is trying to determine whether the product of three negative integers is negative or positive. Which of the following techniques might he use to determine the answer? Justify your selections. Then provide an example that illustrates the answer.

mental math	number sense	estimation	

53. WRITING IN MATH Explain when the product of three integers is positive.

STANDARDS PRACTICE

54. An oil rig is drilling into the ground at a rate of 7 feet per minute. What integer represents the position of the drill after 42 minutes?

A-294C35B-35D294

- **55**. Which of the following numbers is the 7th number in the sequence shown?
 - 1, -2, 4, -8, 16, ... F -64 H 32 G -32 J 64



56. TEMPERATURE The highest and lowest recorded temperatures in Europe are 122°F and -67°F, respectively. Find the difference in these temperatures. (Lesson 2-5)

Subtract. (Lesson 2-5)

57. -25 - (-33) **58.** -6 - 14 **59.** 9 - 30 **60.** 13 - (-12)

ALGEBRA Evaluate each expression if x = -4, y = 6, and z = 1. (Lesson 2-4)

61. $x + (-2)$	62. $-1 + z$	63 . $-15 + y$	64. $x + y$
-----------------------	---------------------	-----------------------	--------------------

65. SCIENCE The low temperatures in degrees Fahrenheit for ten cities one day were -3, 27, 13, -6, -14, 36, 47, 52, -2, and 0. Order these temperatures from greatest to least. (Lesson 2-2)

GET READY for the Next Lesson

66. NUMBERS A number is multiplied by -4. Then 15 is added to the product, and the result is 3. What is the number? Use the *guess and check* strategy. (Lesson 1-5)

V

2-7 Problem-Solving Investigation

MAIN IDEA: Solve problems by looking for a pattern.

Standard 6MR1.1 Analyze problems by identifying relationships, ..., and **observing patterns. Standard 6NS2.3** Solve addition, subtraction, multiplication, and division problems, including those arising in concrete situations, that use positive and negative integers and combinations of these operations.

P.S.I. TERM +

I-M: LOOK FOR A PATTERN

Your MISSION: Look for a pattern to solve the problem.

THE PROBLEM: How long will it take Antonia to save enough money to buy a digital music player that costs \$330?



ERIC: Hi, Antonia! I hear that you are saving to buy a digital music player?

ANTONIA: After one month, I had saved \$50. After 2 months, I had \$85. After three months, I had \$120. After four months, I had \$155. I plan to keep saving at this rate.

EXPLORE	She began with \$50 and added more money to her savings every month. You need to find the number of months when she will have \$330.	
PLAN	Look for a pattern. Then extend the pattern to find the solution.	
SOLVE	After the initial \$50, she saved \$35 each month. Extend the pattern.	
	\$50, \$85, \$120, \$155, \$190, \$225, \$260, \$295 \$330 +\$35 +\$35 +\$35 +\$35 +\$35 +\$35 +\$35 +\$35	1
	She will have enough money saved in 9 months.	
CHECK	She saved 8 \times \$35 or \$280 in 8 months. So, 9 months is a reasonable answer.	
		190

Analyze The Strategy

- **1**. Explain when you would use the *look for a pattern* strategy to solve a problem.
- **2**. Describe how to solve a problem using the *look for a pattern* strategy.
- 3. **WRITING IN MATH** Write a problem that could be solved by looking for a pattern.

Mixed Problem Soluing



Use the *look for a pattern* strategy to solve Exercises 4–6.

4. **DISPLAYS** A display of cereal boxes is stacked as shown below.



If the display contains 7 rows of boxes and the top three rows are shown, how many boxes are in the display?

- **5. SPORTS** Laura makes 3 free throws out of every 5 she attempts. Find the number of free throws she will make after 15, 20, and 30 attempts.
- 6. **INSECTS** The table shows about how many times a firefly flashes at different temperatures. About how many times will a firefly flash when the temperature is 36°C?

Outside Temperature (°C)	Flashes per Minute
16	8
20	9
24	11
28	14

Use any strategy to solve Exercises 7–10. Some strategies are shown below.

PROBLEM-SOLVING STRATEGIES	
 Use the four-step plan. 	l
·Guess and check.	
· Look for a pattern.	

7. COINS Olivia has seven coins that total \$1.32. What are the coins?

- 8. ELEVATION The lowest point in Mexico is Laguna Salada with an elevation of -10 meters. The highest point in Mexico is Volcan Pico de Orizaba with an elevation of 5,700 meters. What is the difference in these elevations?
- MONEY While on vacation, Francisco sent postcards and letters to his friends. He spent \$3.18 on postage. A stamp for a letter costs 39¢, and a stamp for a postcard costs 24¢. How many postcards and letters did he send?
- **10. GEOMETRY** What is the next figure in the pattern shown?



Select the Operation

For Exercises 11–13, select the appropriate operation(s) to solve the problem. Justify your selection(s) and solve the problem.

- 11. **POPULATION** The total land area of North Carolina is about 48,711 square miles. If an average of 175 persons were living in each square mile of North Carolina in 2004, what was the population of North Carolina in 2004?
- **12. GOLF** Allie's golf scores for the first five holes are given in the table. What is her total score after the first five holes?

Hole	Score
1	0
2	1
3	-1
4	-2
5	3

13. SCIENCE Hydrothermal vents are similar to geysers, but are found on the ocean floor. A hydrothermal vent chimney can grow at an average rate of 9 meters in 18 months. What is the average rate of growth per month?



Dividing Integers

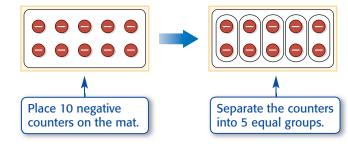
Main IDEA

Divide integers.

Standard 6NS2.3 Solve addition, subtraction, multiplication, and division problems, including those arising in concrete situations, that use positive and negative integers and combinations of these operations.

MINI Lab

You can use counters to model division of integers. Follow these steps to find $-10 \div 5$.

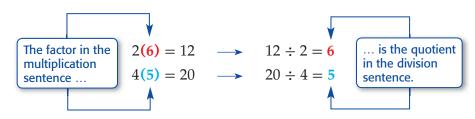


There are 2 negative counters in each group. So, $-10 \div 5 = -2$.

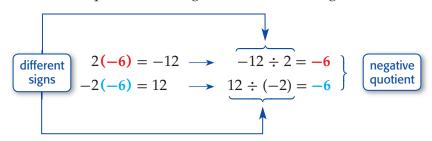
Find each quotient using counters or a drawing.

1. $-6 \div 2$ **2.** $-12 \div 3$

Division of numbers is related to multiplication. When finding the quotient of two integers, you can use a related multiplication sentence.



Since multiplication and division sentences are related, you can use them to find the quotient of integers with different signs.



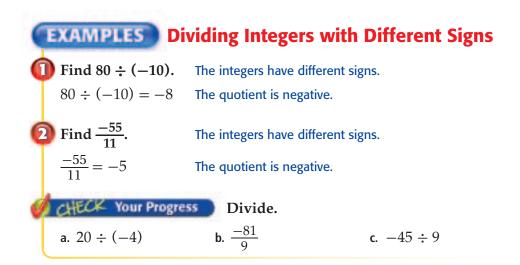
These related sentences lead to the following rule.

KEY CO	NCEPT	Dividing Integers with Different Signs
Words	The quotient of two	integers with different signs is negative.
Examples	$33 \div (-11) = -3$	$-64 \div 8 = -8$

READING Math

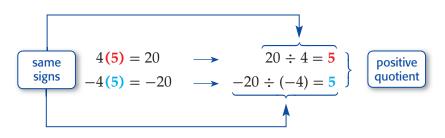
Division Sentence

In the division sentence $80 \div (-10) = -8$, 80 is called the *dividend*, -10 is called the *divisor*, and -8 is called the *quotient*.



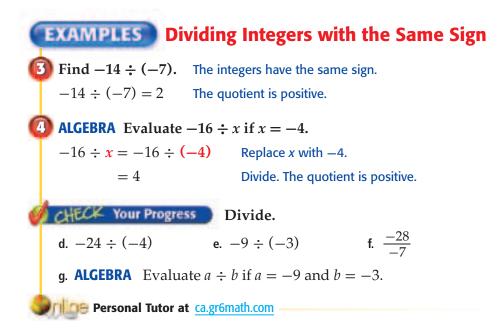


Dividing Integers Dividing integers with the same or different signs follow the same rules as multiplication. You can also use multiplication and division sentences to find the quotient of integers with the same sign.



These related sentences lead to the following rule.

KEY CO	NCEPT	Divide Integers with the Same Sign
Words	The quotient of t	wo integers with the same sign is positive.
Examples	$15 \div 5 = 3$	$-64 \div (-8) = 8$



Real-World EXAMPLE

ASTRONOMY The average surface temperature on Mars is -81° F. Use the expression $\frac{5(F-32)}{9}$, where *F* represents the number of degrees Fahrenheit, to find the temperature on Mars in degrees Celsius.

$$\frac{5(F-32)}{9} = \frac{5(-81-32)}{9} = \frac{5(-113)}{9} = \frac{-565}{9} \approx -62.8$$

Replace F with -81. Subtract inside the parentheses first. Multiply 5 and -113. Divide.

The average temperature on the surface of Mars is about -63 °C.

CHECK Your Progress

h. WEATHER The average temperature in January for North Pole, Alaska, is -24.4° C. Use the expression $\frac{9C + 160}{5}$, where *C* represents the number of degrees Celsius, to find this temperature in degrees Fahrenheit.

CONCEPT	Summary Operations with Integers		
Operation	Rule		
Add	Same Sign: Add absolute values. The sum has the same sign as the integers.		
	Different Signs: Subtract absolute values. The sum has the sign of the integer with greater absolute value.		
Subtract	To subtract an integer, add its opposite.		
Multiply and Divide	Same Signs: The product or quotient is positive. Different Signs: The product or quotient is negative.		

CHECK Your Understanding

Examples 1–3 (p. 115)	 Divide. 1. 32 ÷ (−8) 4. −30 ÷ (−5) 	 2. −16 ÷ 2 5. 55 ÷ 11 	3. $\frac{42}{-7}$ 6. $\frac{-16}{-4}$
Example 4 (p. 115)	ALGEBRA Evaluate each expression if $x = 8$ and $y = -5$.7. $15 \div y$ 8. $xy \div (-10)$		
Example 5 (p. 116)	9. HISTORY The lowest recorded temperature in California is -45° F on January 20, 1937. Use the expression in Example 5 to find this temperature in degrees Celsius. Round to the nearest tenth.		

Real-World Link

In January 2004, Mars Exploration Rover

successfully sent signals to Earth after landing on Mars.

Source: nasa.gov

Math@nlipe Extra Examples at ca.gr6math.com

Exercises

HOMEWORK HELF		
For Exercises	See Examples	
10–13, 16–19	1, 2	
14–15, 20–23	3	
24-31	4	
32–33	5	

Divide.

10 . 50 ÷ (−5)	11 . 56 ÷ (−8)	12 . −18 ÷ 9	13 . −36 ÷ 4
14 . −15 ÷ (−3)	15 . −100 ÷ (−10)	16. $\frac{22}{-2}$	17. $\frac{84}{-12}$
18 . $\frac{-26}{13}$	19. $\frac{-27}{3}$	20. $\frac{-21}{-7}$	21. $\frac{-54}{-6}$

22. Divide -200 by -100.

23. Find the quotient of -65 and -13.

ALGEBRA Evaluate each expression if r = 12, s = -4, and t = -6.

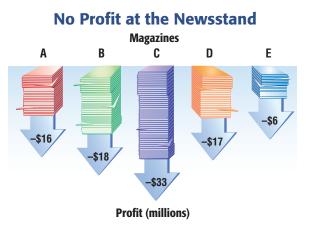
24. $-12 \div r$ **25.** $72 \div t$ **26.** $r \div s$ **27.** $rs \div 16$ **28.** $\frac{t-r}{3}$ **29.** $\frac{8-r}{-2}$ **30.** $\frac{s+t}{5}$ **31.** $\frac{t+9}{-3}$

- **32. MONEY** Last year, Mr. Engle's total income was \$52,000, while his total expenses were \$53,800. Use the expression, $\frac{I-E}{12}$ where *I* represents total income and *E* represents total expenses, to find the average difference between his income and expenses each month.
- **33. SCIENCE** The boiling point of water is affected by changes in elevation. Use the expression $\frac{-2A}{1,000}$, where *A* represents the altitude in feet, to find the number of degrees Fahrenheit the boiling point of water changes at an altitude of 5,000 feet.

ALGEBRA Evaluate each expression if d = -9, f = 36, and g = -6.

34. $\frac{-f}{d}$ **35.** $\frac{12 - (-f)}{-g}$ **36.** $\frac{f^2}{d^2}$ **37.** $g^2 \div f$

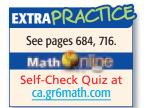
- **38. ANIMALS** Ten years ago, the estimated Australian koala population was 1,000,000. Today, there are about 100,000 koalas. Use the expression $\frac{N-P}{10}$, where *N* represents the new population and *P* the previous population to find the average change in the koala population per year for the 10 year period.
 - **39. ANALYZE GRAPHS** The *mean* of a set of data is the sum of the data divided by the number of items in the data set. The graph shows the profit made by five magazines that experienced poor sales in a recent year. What is the mean profit for these five magazines?

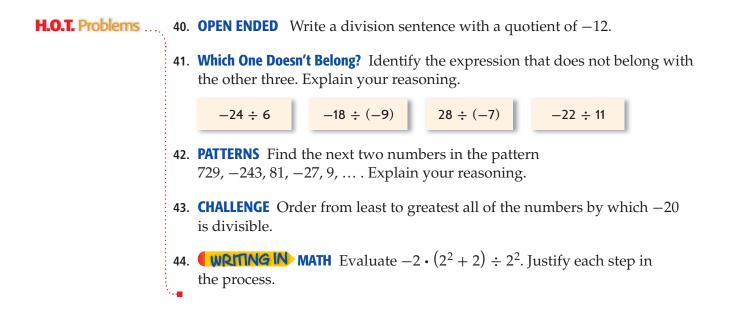




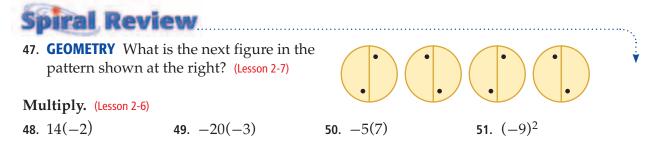
Real-World Link

An adult koala is 25–30 inches long and weighs 15–30 pounds. **Source:** koalaexpress.com





STANDARDS PRACTICE **45**. Find $18 \div (-3)$. 46. The width of a beach at 8:00 P.M. is 107 feet. At 3:00 A.M., the width of the A - 6beach narrows to 23 feet due to the $\mathbf{B} = \frac{-1}{2}$ high tide. What is the average change 6 **C** 6 in the width of the beach per hour? **D** 15 F -15 ft/h**G** -13 ft/h **H** −12 ft/h $I - 10 \, \text{ft/h}$



- **52.** Find 6 (-12). (Lesson 2-5)
- **53. DIVING** Valentina jumped into 12 feet of water and touched the bottom of the pool before she surfaced. Write an integer to describe where Valentina was in relation to the surface of the water when she touched the bottom of the pool. (Lesson 2-1)

Find each square root. (Lesson 1-3)

54. $\sqrt{324}$ 55	. √900
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Study Guide and Review



Download Vocabulary Review from ca.gr6math.com

OLDA BLES

CHAPTER

Be sure the following Key Concepts are noted in your Foldable.



READY to Study

Key Concepts

Absolute Value (Lesson 2-1)

• The absolute value of a number is the distance the number is from zero on a number line.

GET

Comparing and Ordering Integers (Lesson 2-2)

• When two numbers are graphed on a number line, the number to the left is always less than the number to the right.

Graphing Points (Lesson 2-3)

• On a coordinate plane, the horizontal number line is the *x*-axis and the vertical number line is the *y*-axis. The origin is at (0, 0) and is the point where the number lines intersect. The *x*-axis and *y*-axis separate the plane into four quadrants.

Integer Operations (Lessons 2-4, 2-5, 2-6, 2-8)

- To add integers with the same sign, add their absolute value. The sum is positive if both integers are positive and negative if both integers are negative.
- The sum of any number and its additive inverse is 0.
- To add integers with different signs, subtract their absolute values. The sum is positive if the positive integer's absolute value is greater and negative if the negative integer's absolute value is greater.
- To subtract an integer, add its opposite.
- The product or quotient of two integers with different signs is negative.
- The product or quotient of two integers with the same sign is positive.

Key Vocabulary

absolute value (p. 81) additive inverse (p. 96) coordinate plane (p. 88) graph (p. 80) integer (p. 80) negative integer (p. 80) opposites (p. 96) ordered pair (p. 88) origin (p. 88) positive integer (p. 80) quadrant (p. 88) *x*-axis (p. 88) *x*-coordinate (p. 88) *y*-axis (p. 88) *y*-coordinate (p. 88)

Vocabulary Check

State whether each sentence is *true* or *false*. If *false*, replace the underlined word or number to make a true sentence.

- 1. Integers less than zero are <u>positive</u> integers.
- 2. The <u>origin</u> is the point where the *x*-axis and *y*-axis intersect.
- **3**. The <u>absolute value</u> of 7 is -7.
- 4. The sum of two negative integers is <u>positive</u>.
- 5. The <u>*x*-coordinate</u> of the ordered pair (2, -3) is -3.
- **6**. Two integers that are opposites are also called <u>additive inverses</u>.
- **7.** The product of a positive and a negative integer is <u>negative</u>.
- **8.** The *x*-axis and the *y*-axis separate the plane into four <u>coordinates</u>.
- **9**. The quotient of two negative integers is <u>negative</u>.



Lesson-by-Lesson Review

2-1

2-2

Integers and Absolute Value (pp. 80–83)

Write an integer for each situation.

- **10**. a loss of \$150
- **11**. 350 feet above sea level
- 12. a gain of 8 yards
- **13**. 12°F below 0

Evaluate each expression.

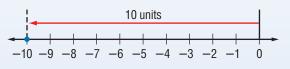
- **14**. |100|
- **15**. |-32|
- **16**. |-16| + |9|
- **17. JUICE** Mavis drank 48 milliliters of apple juice before replacing the carton in the refrigerator. Write an integer that shows the change in the volume of juice in the carton.

Example 1 Write an integer for 8 feet below sea level.

Since this situation represents an elevation *below* sea level, -8 represents the situation.

Example 2 Evaluate |-10|.

On the number line, the graph of -10 is 10 units from 0.



Comparing and Ordering Integers (pp. 84–87)

Replace each ● with < or > to make a true sentence.

18 . −3 ● −9	19 . 8 ● −12
20. −3 ● 3	21 . −10 ● −13
22 . 25 • 8	23 . 0 ● −4

Order each set of integers from least to greatest.

- **24.** $\{-3, 8, -10, 0, 5, -12, 9\}$
- **25**. {-21, 19, -23, 14, -32, 25}
- **26.** {-17, -18, 18, 15, -16, 16}
- 27. EARTH SCIENCE The predicted low temperatures for Monday through Friday are 3°, -1°, -2°, 0°, and 1°. Order the temperatures from greatest to least.

Example 3 Replace • with < or > to make $-4 \circ -7$ a true sentence.

Graph each integer on a number line.

Since -4 is to the right of -7, -4 > -7.

Example 4 Order the integers -4, -3, 5, 3, 0, -2 from least to greatest.

Graph the integers on a number line.



Order the integers by reading from left to right: -4, -3, -2, 0, 3, 5.

2-3

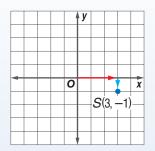
The Coordinate Plane (pp. 88–92)

On graph paper, draw a coordinate plane. Then graph and label each point.

- **28.** *E*(1, −4)
- **29**. *F*(-5, 2)
- **30**. *G*(-2, -3)
- **31**. *H*(4, 0)
- **32. ROUTES** Starting at the school, Pilar walked 1 block east and 3 blocks south. From there, she walked 5 blocks west and 4 blocks north to the park. If the school represents the origin, what is the ordered pair for the park?

Example 5 Graph and label the point S(3, -1).

Draw a coordinate plane. Move 3 units to the right. Then move 1 unit down. Draw a dot and label it S(3, -1).

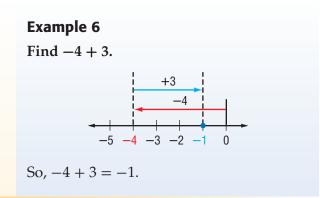


2-4

Adding Integers (pp. 95–99)

Add.	
33 6 + 8	34 4 + (-9)
35 . 7 + (-12)	36 18 + 18

FOOTBALL On the first play of the game, the Bulldogs lost 8 yards. On the second and third plays, they gained 5 yards and then lost 2 yards. Find the result of the first three plays.



2-5	Subtracting Integers	(pp. 103–106)
	Subtract.	
	38 . −5 − 8	39. 3 – 6
	40 . 5 - (-2)	41 4 - (-8)

42. GOLF Owen shot 2 under par while his friend Nathan shot 3 above par. By how many shots was Owen's score better than Nathan's? **Example 7** Find -3 - 9. -3 - 9 = -3 + (-9) To subtract 9, add -9. = -12 Simplify.



2-6

2-7

Multiplying Integers (pp. 107–111)

Multiply.	
43 4(3)	44. 8(-6)
45 5(-7)	46. $-2(40)$

ALGEBRA Evaluate each expression if a = -4, b = -7, and c = 5.

47. *ab* **48.** -3*c* **49**. *bc* **50**. *abc*

Example 8 Find -4(3). -4(3) = -12 The integers have different signs. The product is negative. **Example 9** Evaluate xyz if x = -6,

y = 11, and z = -10. xyz= (-6)(11)(-10) x = -6, y = 11, z = -10.=(-66)(-10)Multiply –6 and 11. = 660Multiply -66 and -10.

PSI: Look for a Pattern (pp. 112–113)

Solve. Look for a pattern.

- **51. HEALTH** The average person blinks 12 times per minute. At this rate, how many times does the average person blink in one day?
- **52. SALARY** Suki gets a job that pays \$31,000 per year. She is promised a \$2,200 raise each year. At this rate, what will her salary be in 7 years?
- **53. DOGS** A kennel determined that they need 144 feet of fencing to board 2 dogs, 216 feet to board 3 dogs, and 288 feet to board 4 dogs. If this pattern continues, how many feet of fencing is needed to board 8 dogs?

Example 10 A theater has 18 seats in the first row, 24 seats in the second row, 30 seats in the third row, and so on. If this pattern continues, how many seats are in the sixth row?

Begin with 18 seats and add 6 seats for each additional row. So, there are 48 seats in the ninth row.

Row	Number of Seats
1	18
2	24
3	30
4	36
5	42
6	48

2-8

Dividing Integers (pp. 114–118)

Divide.

54. $-45 \div (-9)$	55 . 36 ÷ (−12)
56 . −12 ÷ 6	57 . −81 ÷ (−9)

Example 11 Find $-72 \div (-9)$.

 $-72 \div (-9) = 8$ The integers have the is positive.

same sign. The quotient

Practice Test

1. **WEATHER** Adam is recording the change in the outside air temperature for a science project. At 8:00 A.M., the high temperature was 42°F. By noon, the outside temperature had fallen 11°F. By mid-afternoon, the outside air temperature had fallen 12°F and by evening, it had fallen an additional 5°F. Write an integer that describes the final change in temperature.

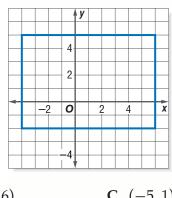
Evaluate each expression.

CHAPTER

2. |-3| **3**. |-18| - |6|

Replace each ● with <, >, or = to make a true sentence.

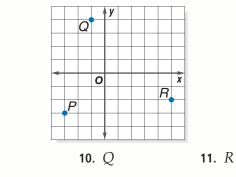
- **4**. $-3 \bullet -9$ **5**. $|9| \bullet |-12|$
- **6.** The Iowa Hawkeyes recorded the following yardage in six plays: 9, -2, 5, 0, 12, and -7. Order these integers from least to greatest.
- 7. **STANDARDS PRACTICE** Which of the following coordinates lie within the rectangle graphed below?



Α	(5, 6)	С	(-5, 1)
B	(0, -3)	D	(-3, 0)

8. **DEBT** Amanda owes her brother \$24. If she plans to pay him back an equal amount from her piggy bank each day for six days, describe the change in the amount of money in her piggy bank each day.

Write the ordered pair for each point graphed. Then name the quadrant in which each point is located.



Add, subtract, multiply, or divide.

9. P

12. 12 + (-9)	13 3 - 4
14 7 - (-20)	15 7(-3)
16 . 5(-11)	17 . −36 ÷ (−9)
18. $-15 + (-7)$	19. $8 + (-6) + (-4)$
20. −9 − 7	21 . −13 + 7

22. **STANDARDS PRACTICE** Kendrick created a 6-week schedule for practicing the piano. If the pattern continues, how many hours will he practice during the sixth week?

The table shows the number of hours he practiced in the first three weeks.

	Week	1	2	3				
	Hours	4	7	10				
F	15 hou	ırs	H 19	H 19 hours				
G	18 hou	Irs	J 22	22 hours				

Evaluate each expression if a = -5, b = 4, and c = -12.

23.
$$ac \div b$$
 24. $\frac{a-b}{3}$

25. STOCK MARKET The value of a stock went down \$3 each week for a period of seven weeks. Describe the change in the value of the stock at the end of the seven week period.

CHAPTER

California Standards Practice Cumulative, Chapters 1-2



Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.

- 1 The daily low temperatures for Cleveland, Ohio, over the last five days were 15°F, -2°F, 8°F, -6°F, and 5°F. Which expression can be used to find the average daily low temperature during the last five days?
 - A $(15 + 2 + 8 + 6 + 5) \div 5$
 - **B** $15 + 2 + 8 + 6 + 5 \div 5$
 - C $[15 + (-2) + 8 + (-6) + 5] \div 5$
 - D $15 + (-2) + 8 + (-6) + 5 \div 5$

TEST-TAKING TIP

Question 1 Check every answer choice of a multiple-choice question. Each time you find an incorrect answer, cross it off so you remember that you've eliminated it.

- 2 Marcia runs *r* miles on Mondays, Tuesdays, and Thursdays. She bicycles for *b* miles on Wednesday and Saturdays. If she rests on Fridays and Sundays, which equation represents the total number of miles *M* she exercises each week?
 - $\mathbf{F} \quad M = 3r + 2b$
 - $\mathbf{G} \ M = r + b$
 - $\mathbf{H} \ M = 2r + 3b$
 - $\mathbf{J} \quad M = 5(r+b)$
- 3 Simplify the expression below.

 $3 + 6(10 - 7) - 3^2$

- **A** 0
- **B** 12
- **C** 18
- **D** 74

- 4 At 8 A.M., the temperature was 13°F below zero. By 1 P.M., the temperature rose 22°F and by 6 P.M. dropped 14°F. What was the temperature at 6 P.M.?
 - **F** 5°F above zero
 - **G** 5°F below zero
 - H 21°F above zero
 - J 21°F below zero
- 5 Sue typically spends between \$175 and\$250 each month on clothes. Which of the following is the best estimate for the amount she spends in 6 months?
 - A From \$600 to \$1,200
 - **B** From \$900 to \$1,300
 - **C** From \$1,050 to \$1,500
 - **D** From \$1,200 to \$1,500
- 6 On their first play, a football team gained 17 yards. On their next play, they lost 22 yards. On their third play, they gained 14 yards. Which expression represents the total number of yards gained after the third play?
 - **F** 17 + (-22) + 14
 - **G** 17 + 22 + (-14)
 - H -17 + (-22) + (-14)
 - J -17 + 22 + 14
- 7 The top four runners of a race were Alicia, Kyle, Drew, and Juanita. Drew finished before Juanita. Alicia finished after both boys, but before Juanita. What information is needed to determine the order of the runners from first to fourth?
 - A Did Kyle finish before or after Drew?
 - **B** Did Alicia finish before or after Juanita?
 - C Did Drew finish before or after Alicia?
 - **D** Did Kyle finish before or after Alicia?

More California Standards Practice For practice by standard, see pages CA1-CA39.

- 8 The lowest point in Japan is Hachiro-gata (elevation -4 meters), and the highest point is Mount Fuji (elevation 3,776 meters). What is the difference in elevation between Hachiro-gata and Mount Fuji?
 - **F** 3,780 meters
 - **G** 3,772 meters
 - H 3,080 meters
 - J 944 meters
- **9** Which of the following relationships is best represented by the data in the table?

X	У
1	36
2	72
3	108
4	144
5	180

- A Conversion of feet to inches
- **B** Conversion of inches to yards
- C Conversion of feet to yards
- **D** Conversion of yards to inches
- 10 A storeowner has *n* employees and pays each employee \$440 per week. If the owner also pays \$*d* weekly to rent the building and \$*w* for utilities, which equation below represents the total *E* of these weekly expenses?

F
$$E = 440w + n + w$$

$$\mathbf{G} \ E = 440n + dw$$

$$\mathbf{H} \ E = 440n + d + w$$

$$\mathbf{J} \quad E = 440(n+d+w)$$

NEED EVTDA HELDO

11 Nick spends a total of 75 hours per week at work and at the gym. He goes to the gym from 6:45 A.M. to 8:45 A.M., Monday through Friday. Which equation can be used to find *t*, the maximum number of hours Nick works at his job each week?

A $t = 75 - (5 \times 2)$ B t = 75 + 5 + 2C t = 75 - 2 + 2 + 2 + 2 + 2D $t = 5 \times 2 - 75$

Pre-AP

Record your answers on a sheet of paper. Show your work.

12 Use the table of ordered pairs to answer the questions below.

X	у
-2	1
3	2
-1	—4

- a. Plot the ordered pairs in the table on a coordinate plane. Then connect the points on the graph.
- **b.** In which quadrant is one of the above points not represented?
- **c**. What shape is formed in the graph above?
- d. How could you increase the size of the figure you drew above?
- e. Add four more columns to the table. Label the columns x + y, x - y, xy, and $x \div y$. Complete the table.

If You Missed Question	1	2	3	4	5	6	7	8	9	10	11	12
Go to Lesson	1–6	1–7	1–4	2–4	1-1	2–4	1-1	2–5	2–7	1–6	1–7	2–8
For Help with Standard	AF1.4	AF1.1	AF1.3	NS2.3	MR1.1	NS2.3	MR1.1	NS2.3	NS2.3	AF1.2	AF1.1	NS2.3





Standard 6AF1.0 Write verbal expressions and sentences as algebraic expressions and equations; evaluate algebraic expressions, solve simple linear equations, and graph and interpret their results.

Key Vocabulary

formula (p. 144) linear equation (p. 164) two-step equation (p. 151) work backward strategy (p. 148)

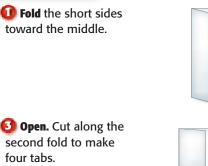
Real-World Link

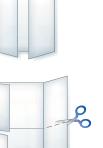
Airplanes You can use the linear equation d = rt to determine the distance d that an airplane travels at a certain rate r for time t.

FOLDABLES

Algebra: Linear Equations and Functions Make this Foldable to help you organize your notes. Begin with a sheet of 11" by 17" paper.

as shown.





2 Fold the top to the bottom.

4 Label each of the tabs







Algebra: Linear

Equations and Functions

Skyscan/CORBIS

GET READY for Chapter 3

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 2

Option 1

Math Online Take the Online Readiness Quiz at ca.gr6math.com.

Take the Quick Check below. Refer to the Quick Review for help.

QUIICKCheck

Name the number that is the solution of the given equation. (Lesson 1-6)

1. a + 15 = 19; 4, 5, 6

2. 11k = 77; 6, 7, 8

3. x + 9 = -2; 7, -11, 11

Graph each point on a coordinate plane. (Lesson 2-3)

4. (-4, 3) **5**. (-2, -1)

6. **HIKING** Keith hiked 4 miles north and 2 miles west from the campground before he rested. If the origin represents the campground, graph Keith's resting point. (Lesson 2-3)

Add. (Lesson 2-4)

7 3 + (-5)	8 . −8 + 3
9 . 9 + (-5)	10. $-10 + 15$

Subtract. (Lesson 2-5)

11 . —5 — 6	12. 8 - 10
13. 8 — (—6)	14 3 - (-1)

Divide. (Lesson 2-8)

15 . −6 ÷ (−3)	16 . −12 ÷ 3
17 . 10 ÷ (−5)	18 24 ÷ (-4)

QUICKReview

Example 1 Name the number that is the solution of $24 \div a = 3$; 7, 8, or 9.

 $24 \div a = 3$ Write the equation. $24 \div 7 = 3$? No.Substitute a = 7. $24 \div 8 = 3$? Yes.Substitute a = 8. $24 \div 9 = 3$? No.Substitute a = 9.The solution is 8.Substitute a = 9.

Example 2 Graph the point (-1, 3) on a coordinate plane.

	-4 -3 -2	<i>y</i>			
-4-3-2	 0 -2 -3 -4	,	2 (3 4	1 X

The first number in an ordered pair tells you to move left or right from the origin. The second number tells you to move up or down.

Example 3 Find -4 + (-2).

-4 + (-2) = -6	9
	ē

Since –4 and –2 are both negative, add their absolute values. The sum is negative also.

Example 4 Find 9 – (–7).

9 - (-7) = 9 + (7) Subtracting -7 is the same as adding 7. = 16 Add.

Example 5 Find $-16 \div 2$.

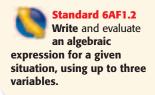
 $-16 \div 2 = -8$

Since – 16 and 2 have opposite signs, their quotient is negative.

Writing Expressions and Equations

Main IDEA

Write verbal phrases and sentences as simple algebraic expressions and equations.



GET READY for the Lesson

PLANETS Earth has only one moon, but other planets have many moons. For example, Uranus has 21 moons, and Saturn has 10 more moons than Uranus.

- 1. What operation would you use to find how many moons Saturn has? Explain.
- 2. Jupiter has about three times as many moons as Uranus. What operation would you use to find how many moons Jupiter has?

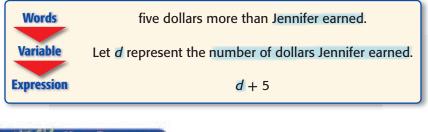


Words and phrases in problems often suggest addition, subtraction, multiplication, and division. Here are some examples.

Addition and Subtraction		Multiplication and Division	
sum	difference	each	divide
more than	less than	product	quotient
increased by	less	multiplied	per
in all	decreased by	twice	separate

EXAMPLE Write a Phrase as an Expression

Write the phrase *five dollars more than Jennifer earned* as an algebraic expression.



CHECK Your Progress

Write the phrase as an algebraic expression.

a. 3 more runs than the Pirates scored

REVIEW Vocabulary

algebraic expression a combination of variables, numbers, and at least one operation; Example: d + 5 (Lesson 1-4)

Remember, an equation is a sentence in mathematics that contains an equals sign. When you write a verbal sentence as an equation, you can use the equals sign (=) for the words *equals* or *is*.

EXAMPLES Write Sentences as Equations

Write each sentence as an algebraic equation.

2) Six less than a number is 20.

Six less than a number is 20.

Let *n* represent the number.

n - 6 = 20

3) Three times Jack's age equals 12.

Three times Jack's age equals 12.

Let *a* represent Jack's age.

3a = 12

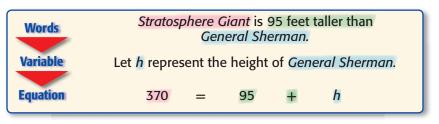
CHECK Your Progress

Write each sentence as an algebraic equation.

- **b**. Seven more than a number is 15.
- c. Five times the number of students is 250.

Real-World EXAMPLE

TREES The world's largest living tree is the Stratosphere Giant, which is 370 feet tall. This is 95 feet taller than General Sherman, the tallest giant sequoia in the world. What is the height of General Sherman? Write an equation that models this situation.



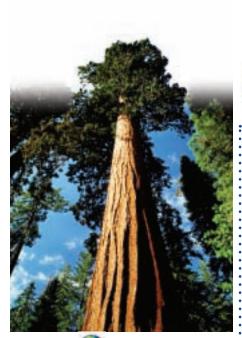
The equation is 370 = 95 + h.

CHECK Your Progress

d. **ANIMALS** North American cougars are about 1.5 times as long as cougars found in the tropical jungles of Central America. If North American cougars are about 75 inches long, how long is the tropical cougar? Write an equation that models this situation.

READING Math

Less Than You can write six more than a number as either 6 + n or n + 6. But six less than a number can only be written as n - 6.





Rockefeller Forest, near Weott, California, is home to 40 of the largest living trees in the world, including the Stratosphere Giant. Source: humboldtredwoods.org

STANDARDS EXAMPLE

5) Which problem situation matches the equation x - 5.83 = 3.17?

- **A** Tyler ran 3.17 kilometers. His friend ran the same distance 5.83 seconds faster than Tyler. What is *x*, the time in seconds that Tyler ran?
- **B** Lynn and Heather measured the length of worms in science class. Lynn's worm was 5.83 centimeters long, and Heather's worm was 3.17 centimeters long. What is *x*, the average length of the worms?
- **C** Keisha's lunch cost \$5.83. She received \$3.17 in change when she paid the bill. What is *x*, the amount of money she gave the cashier?
- **D** Mr. Carlos paid \$3.17 for a notebook that originally cost \$5.83. What is *x*, the amount of money that Mr. Carlos saved?

Read the Item

You need to find which problem situation matches the equation x - 5.83 = 3.17.

Solve the Item

- You can eliminate A because you cannot add or subtract different units of measure.
- You can eliminate B because to find an average you add and then divide.
- Act out C. If you gave the cashier *x* dollars and your lunch cost \$5.83, you would subtract to find your change, \$3.17. This is the correct answer.
- Check D, just to be sure. To find the amount Mrs. Carlos saved, you would calculate 5.83 3.17, not x 5.83.

The solution is C.

CHECK Your Progress

- e. Which problem situation matches the equation 4y = 6.76?
 - **F** Mrs. Thomas bought 4 gallons of gas. Her total cost was \$6.76. What is *y*, the cost of one gallon of gas?
 - **G** Jordan bought 4 CDs that were on sale for \$6.76 each. What is *y*, the total cost of the CDs?
 - **H** The width of a rectangle is 4 meters. The length is 6.76 meters more than the width. What is *y*, the length of the rectangle?
 - J The average yearly rainfall is 6.76 inches. What is *y*, the amount of rainfall you might expect in 4 years?

Personal Tutor at ca.gr6math.com

Vocabulary Terms Before taking a standardized test, review the meaning of vocabulary terms such as *average*.

CHECK Your Understanding

Example 1	Write each phrase as an algebraic expression.
(p. 128)	1. a number increased by eight2. ten dollars more than Grace has
Examples 2, 3	Write each sentence as an algebraic equation.
(p. 129)	3 . Nine less than a number equals 24. 4 . Two points less than his score is 4.
	5 . Twice the number of miles is 18. 6 . One half the regular price is \$13.
Example 4 (p. 129)	7. ALGEBRA The median age of people living in Arizona is 1 year younger than the median age of people living in the United States. Use this information and the information at the right to write an equation to find the median age in the United States. Median Age Arizona 34.3 United States ?
Example 5 (p. 130)	8. STANDARDS PRACTICE Which problem situation matches the equation $x - 15 = 46$? A The original price of a jacket is \$46. The sale
	price is \$15 less. What is <i>x</i> , the sale price of the jacket?
	B Mark had several baseball cards. He sold 15 of the cards and had 46 left. What is <i>x</i>, the amount of cards Mark had to start with?

- **C** Sonja scored 46 points in last week's basketball game. Talisa scored 15 points less. What is *x*, the amount of points Talisa scored?
- **D** Katie earned \$15 baby-sitting this week. Last week she earned \$46. What is *x*, her average earnings for the two weeks?

Exercises

HOMEWORKHELP		
For Exercises	See Examples	
9–16	1	
17–22	2, 3	
23-24	4	
41	5	

- Write each phrase as an algebraic expression.
- **9**. fifteen increased by *t*
- **11**. a number decreased by ten
- **13**. the product of r and 8
- **15**. Emily's age divided by 3
- **10**. five years older than Luis
- **12**. three feet less than the length
- 14. twice as many oranges
- **16**. the quotient of a number and -12

Write each sentence as an algebraic equation.

- **17**. The sum of a number and four is equal to -8.
- **18**. Two more than the number of frogs is 4.
- **19**. The product of a number and five is -20.
- **20**. Ten times the number of students is 280.
- **21**. Ten inches less than her height is 26.
- **22**. Five less than a number is 31.



Real-World Link ..

A giraffe's heart can pump 16 gallons of blood in one minute. **Source:** zoo.org

For Exercises 23 and 24, write an equation that models each situation.

- •23. **ANIMALS** A giraffe is 3.5 meters taller than a camel. If a giraffe is 5.5 meters tall, how tall is a camel?
- 24. **FOOTBALL** Brett Favre led the National Football League with 32 touchdown passes in 2003. This was twice as many touchdown passes as Donovan McNabb had. Find the number of touchdown passes for McNabb.

MEASUREMENT For Exercises 25–28, describe the relationship that exists between the length and width of each rectangle.

- **25**. The width is x, and the length is 4x.
- **26.** The length is x + 3, and the width is x.
- **27**. The length is *x*, and the width is x 5.
- **28**. The length is x, and the width is 0.5x.

Write each phrase as an algebraic expression.

- 29. 2 more than twice as many bikes
- 30. nine CDs less than three times the number of CDs Margaret owns
- **31**. 43 dollars off the price of each admission, which is then multiplied by 3 admissions
- **32**. the quotient of a number w and (-8), which is then increased by 7
- **33**. the square of a number k which is then multiplied by 13
- **34**. the sum of a number p and 0.4 which is then decreased by the fifth power of the same number

ANALYZE TABLES For Exercises 35 and 36, use the table.

EXTRAPRACTICE	2
See pages 685, 717.	
Math	
Self-Check Quiz at <u>ca.gr6math.com</u>	

H.O.T. Problems

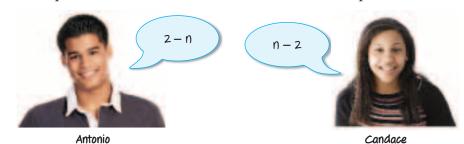
The table shows the average lifespan of several kinds of paper currency in the United States. Let *y* represent the average lifespan of a \$5 bill.

- **35**. Which lifespan can be represented by 2*y*?
- **36.** Write an expression to represent the lifespan of a \$50 bill.
- **37. OPEN ENDED** Write a verbal sentence that translates into the equation n + 5 = 8.

U.S. Currency		
Kind	Lifespan (years)	
\$1	1.5	
\$5	2	
\$10	3	
\$20	4	
\$50	9	
\$100	9	

Source: Federal Reserve System

38. FIND THE ERROR Antonio and Candace are writing an algebraic expression for the phrase 2 *less than a number*. Who is correct? Explain.



132 Chapter 3 Algebra: Linear Equations and Functions (t)CORBIS, (b)/CORBIS, (b)/CORBIS,



39. CHALLENGE If *x* is an odd number, how would you represent the odd number immediately following it? preceding it?

40. WRITING IN MATH Analyze the meaning of the expressions a + 5, a - 3, 2a, and $\frac{a}{2}$ if *a* represents someone's age.

STANDARDS PRACTICE

41. Asha had some change in her purse. After her brother gave her \$0.79, Asha had \$2.24 altogether. Which equation can she use to find the original amount of money *m* she had in her purse?

A 2.24 = m - 0.79

- **B** $m = 2.24 \times 0.79$
- **C** m + 0.79 = 2.24
- **D** m + 2.24 = 0.79

42. Which algebraic equation best describes the total distance *D* traveled in miles after a 6-hour period, if *r* represents the rate of travel in miles per hour?

$$\mathbf{F} \quad D = 6 + r$$

- **G** $D = \frac{r}{6}$
- H D = 6rJ $D = \frac{6}{r}$



Divide (Lesson 2-8)

43. $-42 \div 6$

44. 36 ÷ (−3)

45. $-45 \div (-3)$

46. MONEY Jordan withdraws \$14 per week from his savings account for a period of 7 weeks. Write a multiplication expression to represent this situation. Then find the product and explain its meaning. (Lesson 2-7)

Evaluate each expression. (Lesson 1-4)

47. $3 + 7 \cdot 4 - 6$ **48.** 8(16 - 5) - 6

ANALYZE DATA For Exercises 50–52, use the table that shows the cost of two different plans for downloading music. (Lesson 1-1)

- **50**. Suppose you download 12 songs in one month. Find the cost per song using Plan B.
- **51**. Which plan is less expensive for downloading 9 songs in one month?
- **52**. When is it less expensive to use Plan B instead of Plan A?

GET READY for the Next Lesson

PREREQUISITE SKILL Find each sum. (Lesson 2-4)

53. -8 + (-3)

54. -10 + 9

49. $75 \div 3 + 6(5 - 1)$



55. 12 + (-20)

56. -15 + 15

Algebra Lab Solving Equations Using Models

Main IDEA

Solve equations using models.

Explore

Standard GAF1.1 Write and solve one-step linear equations in one variable. Standard 6MR2.4 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.

COncepts in MOtion

Animation ca.gr6math.com

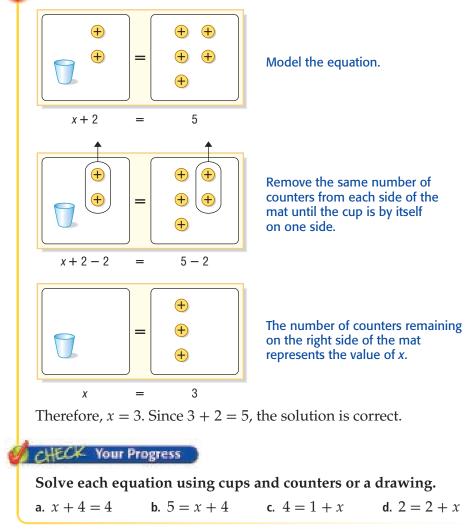
In Chapter 2, you used counters to add, subtract, multiply, and divide integers. Integers can also be modeled using algebra tiles. The table shows how these two types of models are related.

Type of Model	Variable x	Integer 1	Integer — 1
Cups and Counters		+	•
Algebra Tiles	x	1	1

You can use either type of model to solve equations.

ACTIVITY

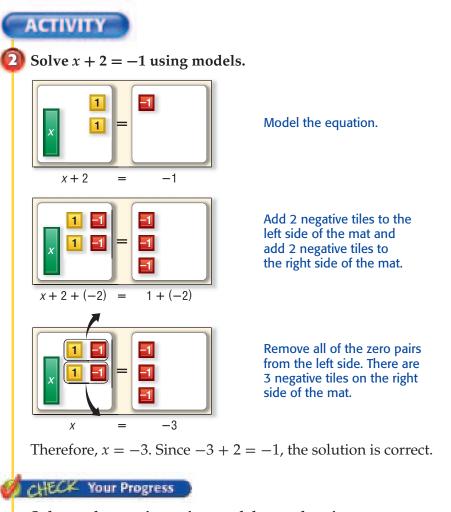
1 Solve x + 2 = 5 using cups and counters or a drawing.



REVIEW Vocabulary

zero pair a number paired with its opposite; Example: 2 and -2. (Explore 2-4)

You can add or subtract a zero pair from either side of an equation without changing its value, because the value of a zero pair is zero.

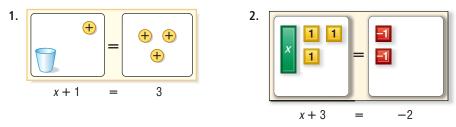


Solve each equation using models or a drawing.

e. -2 = x + 1 f. x - 3 = -2 g. x - 1 = -3 h. 4 = x - 2

ANALYZE THE RESULTS

Explain how to solve each equation using models or a drawing.



3. MAKE A CONJECTURE Write a rule that you can use to solve an equation like x + 3 = 2 without using models or a drawing.

Solving Addition and Subtraction Equations

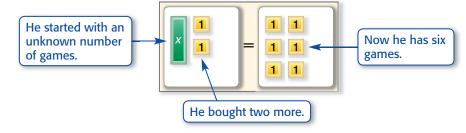
Main IDEA

Solve addition and subtraction equations.

Standard 6AF1.1 Write and solve one-step linear equations in one variable. Standard 6MR2.4 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.

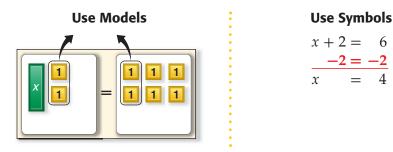
GET READY for the Lesson

VIDEO GAMES Max had some video games, and then he bought two more games. Now he has six games.



- 1. What does *x* represent in the figure?
- 2. What addition equation is shown in the figure?
- 3. Explain how to solve the equation.
- 4. How many games did Max have in the beginning?

You can solve the equation x + 2 = 6 by *removing*, or subtracting, the same number of positive tiles from each side of the mat. You can also subtract 2 from each side of the equation. The variable is now by itself on one side of the equation.



Subtracting 2 from each side of an equation illustrates the Subtraction Property of Equality.

KEY C	ONCEPT	Subtraction Property of Equality
Words If you subtract the same number from each side of an equation, the two sides remain equal.		
Symbols	If $a = b$, then $a - c = b - c$.	
Examples	Numbers	Algebra
	6 = 6	x + 2 = 6
	-2 = -2	-2 = -2
	4 = 4	x = 4

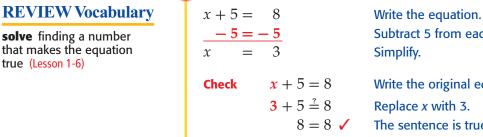
READING in the Content Area

For strategies in reading this lesson, visit ca.gr6math.com.



EXAMPLES Solve Addition Equations

1 Solve x + 5 = 8. Check your solution.



Subtract 5 from each side. Write the original equation. Replace x with 3. The sentence is true.

from each side.

The solution is 3.

Solve x + 6 = 4. Check your solution.

x + 6 = 4	Write the equation.
-6 = -6	Subtract 6 from eac
x = -2	Simplify.
The solution is -2 .	Check the solution.

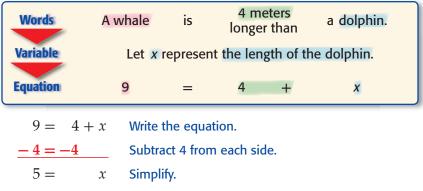
CHECK Your Progress

Solve each equation. Check your solution.

a. y + 6 = 9**b.** x + 3 = 1 c. -3 = a + 4

Real-World EXAMPLE

3 **MARINE BIOLOGY** Bottle-nosed dolphins and killer whales are the best-known species of the dolphin family. A killer whale, which can grow to a length of 9 meters, is 4 meters longer than a bottle-nosed dolphin. How long is a bottle-nosed dolphin?



The bottle-nosed dolphin is 5 meters long.

CHECK Your Progress

d. WEATHER The highest recorded temperature in Truckee, California, is 99°F. This is 130° greater than the lowest recorded temperature. Write and solve an equation to find the lowest recorded temperature.

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solve finding a number that makes the equation

true (Lesson 1-6)

Real-World Career How Does a Marine **Biologist use Math?** A marine biologist uses math to analyze data about marine animals.



Similarly, you can use inverse operations and the Addition Property of Equality to solve equations like x - 2 = 1.

KEY C	ONCEPT	Addition Property of Equality
Words	If you add the same number to each side of an equation, the two sides remain equal.	
Symbols	If $a = b$, then $a + c = b + c$.	
Examples	Numbers Algebra	
	5 = 5	x - 2 = 4
	+3 = +3	+2 = +2
	8 = 8	x = 6

EXAMPLE Solve a Subtraction Equation

Solve x - 2 = 1. Check your solution.

x - 2 = 1	Write the equation.
+2 = +2	Add 2 to each side.
x = 3	Simplify.

Check the solution. Since 3 - 2 = 1, the solution is 3.

CHECK Your Progress

Solve each equation. Check your solution.

e. y - 3 = 4 f. r - 4 = -2 g. q - 8 = -9

Real-World EXAMPLE

5 SHOPPING A pair of shoes costs \$25. This is \$14 less than the cost of a pair of jeans. Find the cost of the jeans.

Words	Shoes	are	\$14 less than jeans
Variable	L	et x repre	esent the cost of jeans.
Equation	25	=	x - 14
25 = x -	· 14 Write	e the equ	ation.
+14 = +	- <u>14</u> Add	14 to eac	ch side.
39 = x	Sim	olify.	

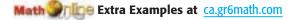
The cost of the jeans is \$39.

CHECK Your Progress

h. ANIMALS The average lifespan of a tiger is 22 years. This is 13 years less than a lion. Write and solve an equation to find the lifespan of a lion.



Check for Reasonableness Ask yourself which costs more: the shoes or the jeans. Then check your answer. Does it show that the jeans cost more than the shoes?



CHECK Your Understanding

Examples 1, 2	Solve each equation. Check your solution.	
(p. 137)	1 . $n + 6 = 8$	2. $7 = y + 2$
	3. $m + 5 = 3$	4. $-2 = a + 6$
Example 3 (p. 137)	Wilbur's flight was 364 feet.	Vright made the first airplane flights in 1903. This was 120 feet longer than Orville's flight. to find the length of Orville's flight.
Example 4	Solve each equation. Check you	ır solution.
(p. 138)	6. $x - 5 = 6$	7. $-1 = c - 6$
Example 5 (p. 138)	8. PRESIDENTS John F. Kennedy youngest president to be ina He was 43 years old. This wa younger than the oldest pres inaugurated—Ronald Reaga solve an equation to find how was when he was inaugurated	ugurated. as 26 years ident to be n. Write and w old Reagan

Exercises

HOMEWORKHELP		
For Exercises	See Examples	
9–12	1	
13–16	2	
17–20	4	
21–24	3, 5	

Solve each equation. Check your solution.

9. $a + 3 = 10$	10. $y + 5 = 11$	11. $9 = r + 2$
12. $14 = s + 7$	13. $x + 8 = 5$	14 . $y + 15 = 11$
15. $r + 6 = -3$	16. $k + 3 = -9$	17. $s - 8 = 9$
18. $w - 7 = 11$	19 . $-1 = q - 8$	20 . $-2 = p - 13$

For Exercises 21–24, write an equation. Then solve the equation.

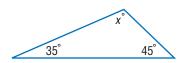
- **21. MUSIC** Last week Tiffany practiced her bassoon a total of 7 hours. This was 2 hours more than she practiced the previous week. How many hours did Tiffany practice the previous week?
- **22. CIVICS** In the 2004 presidential election, Ohio had 20 electoral votes. This is 14 votes less than Texas had. How many electoral votes did Texas have in 2004?
- **23. AGES** Zack is 15 years old. This is 3 years younger than his brother Tyler. How old is Tyler?
- 24. **BASKETBALL** The Mavericks scored 122 points in their last game. This was 5 points less than they scored in the previous game. How many points did they score in their previous game?

Solve each equation. Check your solution.

25 . 34 + <i>r</i> = 95	26. $64 + y = 84$	27 . $-23 = x - 18$
28. $-59 = m - 11$	29. $-18 + c = -30$	30. $-34 = t + 9$
31 . $a - 3.5 = 14.9$	32. $x - 2.8 = 9.5$	33. $r - 8.5 = -2.1$
34. $z - 9.4 = -3.6$	35. $n + 1.4 = 0.72$	36. $b + 2.25 = 1$

For Exercises 37–42, write an equation. Then solve the equation.

- **37**. **MONEY** Suppose you have *d* dollars. After you pay your sister the \$5 you owe her, you have \$18 left. How much money did you have at the beginning?
- **38. MONEY** Suppose you have saved \$38. How much more do you need to save to buy a small television that costs \$65?
- **39. GEOMETRY** The sum of the measures of the angles of a triangle is 180°. Find the missing measure.



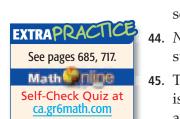
- **40. VOLCANOES** Alaska, Hawaii, and Washington have active volcanoes. Alaska has 43, Hawaii has 5, and Washington has *v*. If they have 52 active volcanoes in all, how many volcanoes does Washington have?
- •41. **GOLF** The table shows Michelle Wie's scores for four rounds of a recent LPGA Championship. Her total score was 0 (even par). What was her score for the third round?
 - **42. BUSINESS** At the end of the day, the closing price of XYZ Stock was \$62.87 per share. This was \$0.62 less than the opening price. Find the opening price.

RoundScoreFirst0Second+2ThirdSFourth+4

ANALYZE TABLES For Exercises 43–45, use the table.

Tallest Steel Roller Coasters in North America	Height (feet)	Drop (feet)	Speed (mph)
Superman The Escape	415	328	S
Millennium Force	h	300	93
Titan	245	d	85
Goliath	235	255	85
Nitro	230	215	80

Source: rcdb.com



- **43**. *Superman The Escape* is 105 feet taller than *Millennium Force*. Write and solve an addition equation to find the height of *Millennium Force*.
- **44**. *Nitro* has a drop that is 40 feet less than *Titan*'s. Write and solve a subtraction equation to find *Titan*'s drop.
- **45**. The difference in the speeds of *Superman The Escape* and *Millennium Force* is 7 miles per hour. If *Superman The Escape* has the greater speed, write and solve a subtraction equation to find its speed.



Real-World Link . . . At age 13, Michelle Wie became the youngest player to win any adult USGA event. Source: thegolfchannel.com

H.O.T. Problems

46. Which One Doesn't Belong? Identify the equation that does not have the same solution as the other three. Explain your reasoning.

x - 1 = -3 $b + 5 = -7$ 10	0 + y = 8 $-6 + a = -8$
----------------------------	-------------------------

- **47. CHALLENGE** Suppose x + y = 10 and the value of *x* increases by 3. If their sum remains the same, what must happen to the value of *y*?
- **48. WRITING IN MATH** Write a problem about a real-world situation that can be represented by the equation p 25 = 50.

STANDARDS PRACTICE

- **49.** The Sears Tower in Chicago is 1,454 feet tall. It is 204 feet taller than the Empire State Building in New York City. Which equation can be used to find the height *h* of the Empire State Building?
 - A 1,454 = h 204
 - **B** h = 1,454 + 204
 - **C** 1,454 = h + 204
 - **D** 204 h = 1,454

- 50. Which of the following statements is true concerning the equation x + 3 = 7?
 - **F** To find the value of *x*, add 3 to each side.
 - **G** To find the value of *x*, add 7 to each side.
 - **H** To find the value of *x*, find the sum of 3 and 7.
 - J To find the value of *x*, subtract 3 from each side.



- **51. SCIENCE** The boiling point of water is 180° higher than its freezing point. If *p* represents the freezing point, write an expression that represents the boiling point of water. (Lesson 3-1)
- **52. ALGEBRA** Evaluate the expression $xy \div (-4)$ if x = 12 and y = -2. (Lesson 2-8)
- **53. ALGEBRA** The table shows the number of pages of a novel Ferguson read each hour. If the pattern continues, how many pages will Ferguson read during the 8th hour? (Lesson 2-7)

Hour	Number of Pages Read
1	11
2	13
3	16
4	20
5	25

GET READY for the Next Lesson

PREREQUISITE SKILL Find each quotient.

54. 15.6 ÷ 13 **55.** 8.84 ÷ 3.4 **56.** 7

56. 75.25 ÷ 0.25 **57.** 0.76 ÷ 0.5

Solving Multiplication Equations

Main IDEA

Solve multiplication equations.

Standard 6AF1.1 Write and solve one-step linear equations in one variable. Standard 6AF2.3 Solve problems involving rates, average speed, distance, and time.

NEW Vocabulary

formula

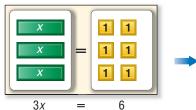
REVIEW Vocabulary

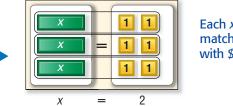
coefficient the numerical factor for a multiplication expression; Example: the coefficient of 4x is 4. (Lesson 1-4)

MINI Lab

COncepts in MOtion BrainPOP® ca.gr6math.com

MONEY Suppose three friends order an appetizer of nachos that costs \$6. They agree to split the cost equally. The figure below illustrates the multiplication equation 3x = 6, where *x* represents the amount each friend pays.

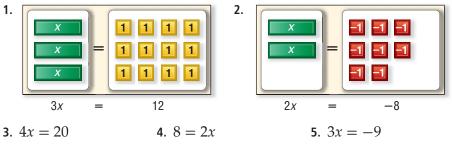




Each x is matched with \$2.

Each friend pays \$2. The solution of 3x = 6 is 2.

Solve each equation using models or a drawing.



6. What operation did you use to find each solution?

7. How can you use the coefficient of *x* to solve 8x = 40?

Equations like 3x = 6 are called multiplication equations because the expression 3*x* means 3 *times the value of x*. So, you can use the Division Property of Equality to solve multiplication equations.

KEY C	ONCEPT	Division Property of Equality
Words	If you divide each side of an equation by the same nonzero number, the two sides remain equal.	
Symbols	If $a = b$ and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$.	
Examples	Numbers Algebra	
	$8 = 8$ $\frac{8}{2} = \frac{8}{2}$ $4 = 4$	$2x = -6$ $\frac{2x}{2} = \frac{-6}{2}$ $x = -3$

EXAMPLES Solve Multiplication Equations **1** Solve 20 = 4x. Check your solution. 20 = 4xWrite the equation. $\frac{20}{4} = \frac{4x}{4}$ Divide each side of the equation by 4. 5 = x $20 \div 4 = 5$ The solution is 5. Check the solution. **2)** Solve -8y = 24. Check your solution. -8y = 24Write the equation. $\frac{-8y}{-8} = \frac{24}{-8}$ Divide each side by -8. y = -3 $24 \div (-8) = -3$ The solution is -3. Check the solution. CHECK Your Progress Solve each equation. Check your solution. **b.** -6a = 36 **c.** -9d = -72a. 30 = 6x

Many real-world situations increase at a constant rate. These can be represented by multiplication equations.

Real-World EXAMPLE

3) TEXT MESSAGING It costs \$0.10 to send a text message. You can spend a total of \$5.00. How many text messages can you send?

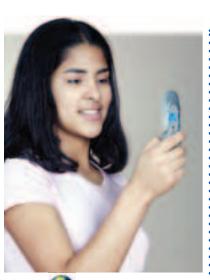
Words	Total	is equal to	cost of each message	times	number of messages.
Variable	Let m	represent	the number of r	nessages	you can send.
Equation	5.00	=	0.10	•	m
	5	5.00 = 0.10) <i>m</i> Write	the equat	ion.
	ŗ	5.00 0.10)m		

$\frac{0.100}{0.10} = \frac{0.10m}{0.10}$	Divide each side by 0.10.
50 = m	$5.00 \div 0.10 = 50$

At \$0.10 per message, you can send 50 text messages for \$5.00.

CHECK Your Progress

d. **TRAVEL** Mrs. Acosta's car can travel an average of 24 miles on each gallon of gasoline. Write and solve an equation to find how many gallons of gasoline she will need for a trip of 348 miles.



Real-World Link Over 60% of teenagers' text messages are sent from their homes even when a landline is available. Source: xerox.com A **formula** is an equation that shows the relationship among certain quantities. One of the most common formulas is the equation d = rt, which gives the relationship among distance d, rate r, and time t.

Real-World EXAMPLE

READING Math

Speed Another name for *rate* is *speed*.

ANIMALS The tortoise is one of the slowest land animals, reaching an average top speed of about 0.25 mile per hour. At this speed, how long will it take a tortoise to travel 1.5 miles?

You are asked to find the time t it will take to travel a distance d of 1.5 miles at a rate r of 0.25 mile per hour.

METHOD 1	Substitute, the	n solve.	
	d = rt	Write the equation.	
	1.5 = 0.25t	Replace <i>d</i> with 1.5 and <i>r</i> with 0.25.	
	$\frac{1.5}{0.25} = \frac{0.25t}{0.25}$	Divide each side by 0.25.	
	6 = t	$1.5 \div 0.25 = 6$	
METHOD 2	Solve, then sul	ostitute.	
	d = rt	Write the equation.	
	d rt		
	$\frac{d}{r} = \frac{rt}{r}$	Divide each side by <i>r</i> to solve the equation for <i>t</i> .	
	$\frac{d}{r} = t$	· · · · · · · · · · · · · · · · · · ·	
		equation for t.	

It would take a tortoise 6 hours to travel 1.5 miles.

CHOOSE Your Method

e. **SCIENCE** A sound wave travels a distance of 700 meters in 2.5 seconds. Find the average speed of the sound wave.

Personal Tutor at <u>ca.gr6math.com</u>

CHECK Your Understanding

Examples 1, 2	Solve each equation. Check your solution.		
(p. 143)	1 . 6 <i>c</i> = 18	2. $15 = 3z$	
	3. $-8x = 24$	4. $-9r = -36$	
Example 3 (p. 143)	5. BABY-SITTING Gracia earns \$5 per hour when she baby-sits. How many hours does she need to work to earn \$75?		
Example 4 (p. 144)	6. SWIMMING A shark can swim at an average speed of about 25 miles per hour. At this rate, how long will it take a shark to swim 60 miles?		

Exercises

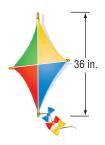
HOMEWORKHELP				
For Exercises	See Examples			
7–12	1			
13–18	2			
19–20	3			
21-22	4			

Solve each equation. Check your solution.

7 . 7 <i>a</i> = 49	8 . 9 <i>e</i> = 27	9. $2x = -6$
10. $3y = -21$	11. $35 = 5v$	12. $72 = 12r$
13. $-4j = 36$	14. $-12y = 60$	15. $-4s = -16$
16. $-6z = -36$	17. $48 = -6r$	18 . $-28 = -7f$

For Exercises 19–22, write an equation. Then solve the equation.

- **19. MONEY** Brandy wants to buy a digital camera that costs \$300. If she saves \$15 each week, in how many weeks will she have enough money for the camera?
- **20. KITES** In a simple kite, the length of the longer stick should be 1.5 times the length of the shorter stick. Find the length of the shorter stick for the kite shown at the right.
- **21. TRAVEL** A Boeing 747 aircraft has an average cruising speed of 600 miles per hour. At that rate, how long will it take to travel 1,500 miles?



22. INSECTS A dragonfly, the fastest insect, can fly a distance of 50 feet in about 2 seconds. Find a dragonfly's average speed in feet per second.

Solve each equation. Check your solution.

23 . (0.4x = 9.2	24. $0.9y = 13.5$	25 . 5.4 = 0.3 <i>p</i>
26 . 9	9.72 = 1.8a	27. $3.9y = 18.33$	28 . 2.6 <i>b</i> = 2.08

ANALYZE TABLES For Exercises 29 and 30, use the table.

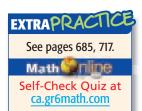
29. Without calculating, explain whether the *Blue Streak* or *Magnum* has the greater average speed.

Name	Track Length (ft)	Time of Ride
Blue Streak	2,558	1 min 45 s
Corkscrew	2,050	2 min
Magnum	5,106	2 min
Mean Streak	5,427	2 min 45 s

30. Find the average speed of each roller coaster in feet per second. Round to the nearest tenth.

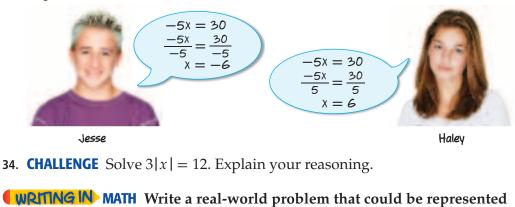
Source: rcdb.com

- **31. EARTHQUAKES** Scientists determine the epicenter of an earthquake by measuring the time it takes for surface waves to travel between two places. Surface waves travel about 6 kilometers per second through Earth's crust. The distance from Los Angeles to Phoenix is 600 kilometers. Write and solve a multiplication equation to find how long it would take surface waves to travel from Los Angeles to Phoenix.
- **32. WATER** A case of water bottles costs \$9.48. If there are 12 water bottles in the case, find the cost per bottle. Then find the decrease in cost per bottle if the cost of a case is reduced to \$8.64.





33. FIND THE ERROR Jesse and Haley are solving -5x = 30. Who is correct? Explain.



by each equation.

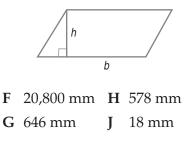
35. 2x = 16

36. 3x = 75 **37.** 4x = -8

STANDARDS PRACTICE

- 38. A football player can run 20 yards in 3.4 seconds. Which equation could be used to find *y*, the number of yards the football player can run in a second?
 - **A** 20y = 3.4
 - **B** 3.4 y = 20
 - **C** 3.4y = 20
 - **D** 20 + y = 3.4

39. Use the formula A = bh to find the height of a parallelogram with a base of 34 millimeters and an area of 612 square millimeters.

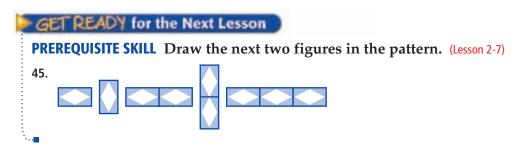


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Spiral Review

ALGEBRA Solve each eq	uation. Check your solution	• (Lesson 3-2)
40 . $y + 8 = -2$	41. $x - 7 = -2$	42. $20 = z + 23$

- **43. ALGEBRA** Write an algebraic expression for the phrase *the product of* -3 *and y.* (Lesson 3-1)
- **44. MONTHS** A lunar month, the time from one new moon to the next, is 29.5 days. How many days longer is our calendar year of 365 days than 12 lunar months? (Lesson 1-1)



146 Chapter 3 Algebra: Linear Equations and Functions ()Ryan McVay/Getty Images, (r)CORBIS

CHAPTER

Mid-Chapter Quiz

Lessons 3-1 through 3-3

Write each sentence as an algebraic equation. (Lesson 3-1)

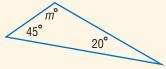
- 1. The product of a number and 3 is -16.
- **2**. 10 less than a number is 45.
- **3. FLYING** An airplane is flying at an altitude of *t* feet before it increases its altitude by 1,000 feet. Write an expression for its new altitude. (Lesson 3-1)
- 4. **STANDARDS PRACTICE** Kim's time for the 5K race was 4 minutes less than Tanya's time. If Tanya's time is *t*, which expression represents Kim's time? (Lesson 3-1)

Α	4 - t	С	t+4
В	t-4	D	4t

Solve each equation. Check your solution. (Lesson 3-2)

5. $21 + m = 33$	6. $a - 5 = -12$
7 . $p + 1.7 = -9.8$	8. $56 = k - (-33)$

GEOMETRY The sum of the measures of the angles of a triangle is 180°. Write and solve an equation to find the missing measure *m*. (Lesson 3-2)



- 10. **STANDARDS PRACTICE** Trevor's test score was 5 points lower than Ursalina's test score. If Ursalina scored 85 on the test, which equation would give Trevor's score *d* when solved? (Lesson 3-2)
 - **F** 85 = d + 5

G
$$d - 5 = 85$$

- **H** 80 = d + 5
- J d 5 = 80

- 11. **PETS** Cameron has 11 adult Fantail goldfish. This is 7 fewer Fantail goldfish than his friend Julia has. Write and solve a subtraction equation to determine the number of Fantail goldfish *g* that Julia has. (Lesson 3-2)
- 12. **MEASUREMENT** The Grand Canyon has a maximum depth of almost 5,280 feet. An average four-story apartment building has a height of 66 feet. Write and solve a multiplication equation to determine the number of apartment buildings *b*, stacked on top of each other, that would fill the depth of the Grand Canyon. (Lesson 3-3)

Solve each equation. Check your solution. (Lesson 3-3)

13. $5f = -75$	14. $-1.6w = 4.8$
15. $63 = 7y$	16. $-28 = -2d$
17. $3.7g = -4.44$	18. $2.25 = 1.5b$

- **STANDARDS PRACTICE** Michelann drove 44 miles per hour and covered a distance of 154 miles. Which equation accurately describes this situation if *h* represents the number of hours Michelann drove? (Lesson 3-3)
 - **A** 154 = 44 + h
 - **B** 44h = 154
 - **C** $154 = 44 \div h$
 - **D** h 44 = 154
- 20. **LAWN SERVICE** Trey estimates he will earn \$470 next summer cutting lawns in his neighborhood. This amount is 2.5 times the amount *a* he earned this summer. Write and solve a multiplication equation to find how much Trey earned this summer. (Lesson 3-3)

3-4 Problem-Solving Investigation

MAIN IDEA: Solve problems using the work backward strategy.

Standard 6MR2.7 Make precise calculations and check the validity of the results from the context of the problem. **Standard 6NS2.3** Solve addition, subtraction, multiplication, and division problems, including those arising in concrete situations, that use positive and negative integers and combinations of these operations.

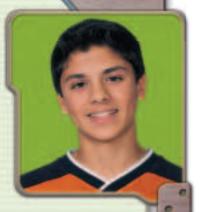
P.S.I. TERM +

e-Mail: WORK BACKWARD

YOUR MISSION: Work backward to solve the problem.

THE PROBLEM: How much money did Carlos take to the movies today?

Carlos: Well, I spent \$9 on movie tickets. Then I spent \$5 on candy, and one half of what was left on popcorn. I have \$3 left.



EXPLORE	You know he has \$3 left and the amounts spent. You need to find the initial amount he had.	
PLAN	Start with the end result and work backward.	
SOLVE	He has \$3 left.	3
	Undo the half spent on popcorn.>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	$\frac{\times 2}{6} \\ \frac{+5}{11}$
	Undo the \$5 spent on candy. >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	$\frac{+5}{11}$
	Undo the \$9 spent on movie tickets. >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	$\frac{+9}{20}$
	So, Carlos initially had \$20.	20
CHECK	Assume that he started with \$20. After buying movie tickets, he had $20 - $ \$ \$11. He spent \$5 on candy, so he had \$11 - \$5 or \$6. Then he spent one ha the rest on popcorn, so he had \$6 \div 2 or \$3. So, our answer of \$20 is correc	lf of

Analyze The Strategy

- 1. Explain when you would use the work backward strategy to solve a problem.
- 2. Describe how to solve a problem by working backward.
- 3. **WRITING IN MATH** Write a problem that could be solved by working backward. Then write the steps you would take to find the solution to your problem.

Mixed Problem Soluing



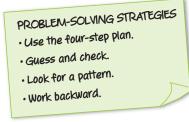
Use the *work backward* strategy to solve Exercises 4–7.

- 4. **MONEY** Mia spent \$4.50 at the bakery and then spent four times that amount at the grocery. She had \$12.80 left. How much did she have initially?
- 5. NUMBER THEORY A number is multiplied by -3. Then 6 is subtracted from the product. After adding -7, the result is -25. What is the number?
- **6. TIME** A portion of a shuttle bus schedule is shown. What is the earliest time after 9 A.M. when the bus departs?

Departs	Arrives
8:55 A.M.	9:20 a.m.
?	10:08 a.m.
10:31 A.M.	10:56 А.М.
11:19 А.М.	11:44 а.м.

7. VIDEOS Jack rented 2 times as many DVDs as Paloma last month. Paloma rented 4 fewer than Greg, but 4 more than Grace. Greg rented 9 DVDs. How many DVDs did each person rent?

Use any strategy to solve Exercises 8–12. Some strategies are shown below.



- 8. **GEOGRAPHY** The land area of North Dakota is 68,976 square miles. This is about 7 times the land area of Vermont. Estimate the land area of Vermont.
- **9. AGE** Maya is two years older than her sister Jenna. Jenna is 5 years older than their brother Terry, who is 9 years younger than their brother Trent. Trent is 17 years old. How old is Maya?

- 10. ELEVATION New Orleans, Lousiana, has an elevation of -8 feet related to sea level. Death Valley, California, is 274 feet lower than New Orleans. What is the elevation of Death Valley?
- **11. GEOMETRY** Draw the sixth figure in the pattern shown.



12. WATERFALLS The Angel waterfall in Venezuela, the highest waterfall in the world, is 3,212 feet high. It is 87 feet higher than 2.5 times the height of the Empire State Building. Find the height of the Empire State Building.

Select the Operation

For Exercises 13 and 14, select the appropriate operation(s) to solve the problem. Justify your selection(s) and solve the problem.

- **13. AIRCRAFT** An aircraft carrier travels about 6 inches per gallon of fuel. Raquel's car travels about 28 miles per gallon of fuel. If there are 5,280 feet in one mile, how many more inches per gallon would Raquel's car get than an aircraft carrier?
- 14. **SCHOOL SUPPLIES** Alexandra wishes to buy 5 pens, 1 ruler, and 7 folders to start the school year. The prices are shown in the table.

Item	Cost	
Pens	\$2.09	
Ruler	\$0.99	
Folder	\$1.19	

If there is no tax, is \$20 enough to pay for Alexandra's school supplies? Explain your reasoning.

READING Word Problems

Simplify the Problem

Have you ever tried to solve a long word problem and didn't know where to start? Try to rewrite the problem using only the most important words. Here's an example.

Read the problem and identify the important words and numbers.

SHOPPING Television shopping networks are a popular way to shop. In addition to the cost of the items, you usually pay a shipping fee. Kylie wants to order several pairs of running shorts that cost \$12 each. The shipping fee is \$7. How many shorts can she order with \$55?

Simplify the problem. Keep all of the important words and numbers, but use fewer of them.

The total cost for some shorts that cost **\$12 each** plus a shipping fee of **\$7** is \$55. How many can she buy?

Simplify it again. Use a variable for the unknown.

The total cost of *x* shorts at \$12 each plus \$7 is \$55.

PRACTICE

Use the method above to simplify each problem.

- MONEY Akira is saving money to buy a scooter that costs \$125. He has already saved \$80 and plans to save an additional \$5 each week. In how many weeks will he have enough money for the scooter?
- **3. TEMPERATURE** The current temperature is 40°. It is expected to rise 5° each hour for the next several hours. In how many hours will the temperature be 60°?
- 2. TRAVEL A taxi company charges \$1.50 per mile plus a \$10 fee. Suppose Olivia can afford to spend \$19 for a taxi ride from her apartment to the mall. How far can she travel by taxi with \$19?
- 4. **MONEY** Joaquin wants to buy some DVDs that are each on sale for \$10 plus a CD that costs \$15. How many DVDs can he buy if he has \$75 to spend?

Standard 6MR1.3 Determine when and how to break a problem into simpler parts. Preparation for -Standard 7AF4.1 Solve twostep linear equations and inequalities in one variable over the rational numbers, interpret the solution or solutions in the context from which they arose, and verify the reasonableness of the results.



Solving Two-Step Equations

Main IDEA

Solve two-step equations.

Preparation for Standard 7AF4.1 Solve twostep linear equations and inequalities in one variable over the rational numbers, interpret the solution or solutions in the context from which they arose, and verify the reasonableness of the results.

NEW Vocabulary

two-step equation

STUDY TIP

Work Backward In 2x + 3 = 9, *x* is first multiplied by 2 and then 3 is added. So, you should "undo" the addition first and then the multiplication.

MINI Lab

MONEY A florist charges \$2 for each balloon in an arrangement and a \$3 delivery fee. You have \$9 to spend. The model illustrates the equation 2x + 3 = 9, where *x* represents the number of balloons.

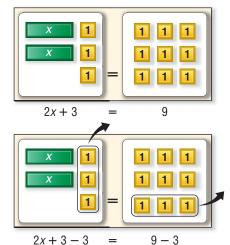
To solve 2x + 3 = 9, remove three 1–tiles from each side of the mat. Then divide the remaining tiles into two equal groups. The solution of 2x + 3 = 9 is 3.

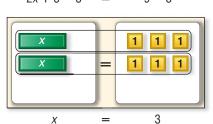
Solve each equation by using models or a drawing.

- 1. 2x + 1 = 5
- **2.** 3x + 2 = 8
- **3.** 2 = 5x + 2

COncepts in MOtion

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A **two-step equation** has two different operations. To solve a two-step equation, undo the operations in reverse order of the order of operations. You can review the order of operations in Lesson 1-4.

EXAMPLE Solve a Two-Step Equation

1 Solve 2x + 3 = 9. Check your solution.

2x +	3 =	9	Write the equation.
	3 = -	- 3	Undo the addition first by subtracting 3 from each side.
2x	=	6	
$\frac{2x}{2}$	=	<u>6</u> 2	Next, undo the multiplication by dividing each side by 2.
x	=	3	Simplify.

Check the solution. Since 2(3) + 3 = 9, the solution is 3.

CHECK Your Progress

Solve each equation. Check your solution.

a. 2x + 4 = 10 **b.** 3x + 1 = 7 **c.** 5 = 2 + 3x

EXAMPLES Solve Two-Step Equations

2 Solve 3x + 2 = 23. Check your solution.

3x + 2 = 23 $-2 = -2$ $3x = 21$	Write the equation. Undo the addition first by subtracting 2 from each side.
$\frac{3x}{3} = \frac{21}{3}$	Divide each side by 3.
x = 7	Simplify.
Check $3x + 2 = 23$	Write the original equation.
3 (7) + 2 ≟ 23	Replace x with 7.
21 + 2 ^² = 23	Simplify.
23 = 23 🗸	The sentence is true.

The solution is 7.

IVOY TH

Order of Operations Multiplication comes before addition in the order of operations. To undo these operations, reverse the order. So, undo the addition first by subtracting. Then, undo the multiplication by dividing.

3 Solve -2y - 7 = 3. Check your solution.

-2y - 7 = 3	Write the equation.
+7 = +7	Undo the subtraction first by adding 7 to each side.
-2y = 10	
$\frac{-2y}{-2} = \frac{10}{-2}$	Divide each side by -2.
y = -5	Simplify.
The solution is -5 .	Check the solution.

4) Solve 4 + 5r = -11. Check your solution.

juation.
ddition of 4 first by 4 from each side.
side by 5.

The solution is -3. Check the solution.

CHECK Your Progress

Solve each equation. Check your solution.

d . $4x + 5 = 13$	e . $8y + 15 = 71$	f. $-3n - 8 = 7$
g. $-5s + 8 = -2$	h. $1 + 2y = -3$	i. $-2 + 6w = 10$

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CONCEPT Summary

Solving Two-Step Equations

To solve a two-step equation like 3x + 4 = 16 or 2x - 1 = -3:

Step 1 Undo the addition or subtraction first.

Step 2 Then undo the multiplication or division.

Some real-world situations start with a given amount and increase at a certain rate.



Real-World Link . . . Over 6.7 million teenagers bowl at least once a year. Source: census.gov Real-World EXAMPLE

BOWLING Suppose you spend \$6 to rent bowling shoes at The Bowling Alley. Each game costs \$3.50. How many games can you bowl if you have \$20 to spend?

Words	cost of shoes	plus	cost of one game	times	number of games	equals	\$20.
Variable		Let n	represent	he <mark>nun</mark>	nber of gan	nes.	
Equation	6	+	3.50	•	n	=	20
6 + 3.50 <i>n</i>	= 20		Write	the equ	uation.		
- 6	= -6		Subt	act 6 fro	om each sid	le.	
3.50 <i>n</i>	= 14						
3.50 <i>n</i> 3.50	$=\frac{14}{3.50}$		Divid	e each s	side by 3.50).	
п	=4		14 ÷	3.50 =	4		

Check 6 + 3.50n = 20 $6 + 3.50(4) \stackrel{?}{=} 20$ $6 + 14 \stackrel{?}{=} 20$ $20 = 20 \checkmark$

Write the original equation. Replace *n* with 4. Simplify.

The sentence is true.

Is this answer reasonable?

You can bowl 4 games.

CHECK Your Progress

j. FITNESS A fitness club is having a special offer where you pay \$22 to join plus a \$16 monthly fee. You have \$150 to spend. Write and solve an equation to find how many months you can use the fitness club.

C Your Understanding

Examples 1–4 (pp. 151–152)

Solve each equation. Check your solution.

1. $3x + 1 = 7$	2 . $4h - 6 = 22$
3. $-6r + 1 = -17$	4 . $-3y - 5 = 10$
5. $13 = 1 + 4s$	6. $-7 = 1 + 2n$

Example 5 (p. 153)
 7. MONEY Syreeta wants to buy some CDs, each costing \$14, and a DVD that cost \$23. She has \$65 to spend. Write and solve an equation to find how many CDs she can buy.



Exercises

HUMEWORK HUL			
For Exercises	See Examples		
8-11	1, 2		
12-15	3		
16–19	4		
20-21	5		

IOMEWORK HELP Solve each equation. Check your solution.

8. $3x + 1 = 10$	9. $5x + 4 = 19$	10. $2t + 7 = -1$
11. $6m + 1 = -23$	12. $-4w - 4 = 8$	13 . $-7y + 3 = -25$
14. $-8s + 1 = 33$	15. $-2x + 5 = -13$	16. $3 + 8n = -5$
17. $5 + 4d = 37$	18. $14 + 2p = 8$	19. $25 + 2y = 47$

For Exercises 20 and 21, write an equation. Then solve the equation.

- **20. WEATHER** The temperature is 20°F. It is expected to rise at a rate of 4° each hour for the next several hours. In how many hours will it be 32°?
- **21. MONEY** Raimundo has saved \$74 toward a new sound system that costs \$149. He plans on saving an additional \$15 each week. How many weeks will it take Raimundo to save enough money to buy the sound system?

Solve each equation. Check your solution.

22. $2r - 3.1 = 1.7$	23. $4t + 3.5 = 12.5$	24. $16b - 6.5 = 9.5$
25. $5w + 9.2 = 19.7$	26. $16 = 0.5r - 8$	27. $0.2n + 3 = 8.6$

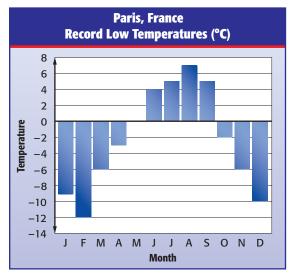
For Exercises 28 and 29, write an equation. Then solve the equation.

- **28. CELL PHONES** A cell phone company charges a monthly fee of \$39.99 for unlimited *off-peak* minutes on the nights and weekends but \$0.45 for each *peak* minute during the weekday. If Brad's monthly cell phone bill was \$62.49, for how many *peak* minutes did he get charged?
- **29. PLANTS** In ideal conditions, bamboo can grow 47.6 inches each day. At this rate, how many days will it take a bamboo shoot that is 8 inches tall to reach a height of 80 feet?

TEMPERATURE For Exercises 30 and 31, use the following information and the graph.

Temperature is usually measured on the Fahrenheit scale (°F) or the Celsius scale (°C). Use the formula F = 1.8C + 32 to convert from one scale to the other.

- The highest temperature ever recorded in Virginia Beach, Virginia, was 104°F. Find this temperature in degrees Celsius.
- The lowest temperature ever recorded in Virginia Beach was -3°F. Is this temperature greater or less than the lowest temperature ever recorded in Paris, France?

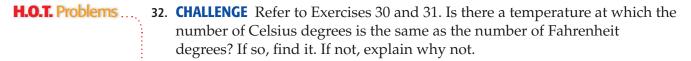


Source: www.usatoday.com/weather

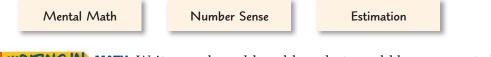
EXTRAPRACTICE

See pages 686, 717.

Math 🗐 🗐 🔟 🕑



- **33. CHALLENGE** Suppose your school is selling magazine subscriptions. Each subscription costs \$20. The company pays the school half of the total sales in dollars. The school must also pay a one-time fee of \$18. What is the fewest number of subscriptions that can be sold to earn a profit of \$200?
- **34. SELECT A TECHNIQUE** Bianca rented a car for a flat fee of \$19.99 plus \$0.26 per mile. Which of the following techniques might she use to determine the approximate number of miles she can drive for \$50. Justify your selection(s). Then use the technique(s) to solve the problem.



35. WRITING IN MATH Write a real-world problem that would be represented by the equation 2x + 5 = 15.

STANDARDS PRACTICE

- **36.** A taxi driver charges \$2.00 plus \$0.80 for each mile traveled. Which expression could be used to find the cost of a taxi ride of *m* miles?
 - **A** 2.80*m*
 - **B** 2m + 0.80
 - **C** 2 + 0.80m
 - **D** 2m + 0.80m

- **37**. The Rodriguez family went on a vacation. They started with \$1,875. If they spent \$140 each day, which expression represents how much money they had after *d* days?
 - **F** 1,735*d*
 - **G** 1,875 140*d*
 - **H** 140*d*
 - **J** 1,875 + 140*d*

Spiral Review

38. SCHEDULES Jaime needs to be at the bus stop by 7:10 A.M. If it takes her 7 minutes to walk to the bus stop and 40 minutes to get ready in the morning, what is the latest time that she can set her alarm in order to be at the bus stop 5 minutes earlier than she needs to be? Use the *work backward* strategy. (Lesson 3-4)

ALGEBRA Solve each equation. Check your solution.	(Lessons 3-2 and 3-3)
---	-----------------------

- **39.** 4f = 28 **40.** -3y = -15 **41.** p 14 = 27 **42.** -11 = n + 2
- **43. SCUBA DIVING** Find the vertical distance between two divers if one diver is 27 feet below sea level and the other diver is 13 feet below sea level. (Lesson 2-5)

GET READY for	the Next Lesson		
PREREQUISITE SKIL	L Multiply or divide.		
44. 2.5 × 20	45. 3.5 × 4	46 . 4,200 ÷ 2.1	47 . 104 ÷ 6.5

Measurement: Perimeter and Area

Main IDEA

Find the perimeters and areas of figures.

Standard 6AF3.1 Use variables in expressions describing geometric quantities (e.g., $P = 2w + 2\ell$, $A = \frac{1}{2}bh$,

 $C = \pi d$ —the formulas for the perimeter of a rectangle, the area of a triangle, and the circumference of a circle, respectively).

Standard 6AF3.2 Express in symbolic form simple relationships arising from geometry.

NEW Vocabulary

perimeter area

Concepts in Motion

Interactive Lab <u>ca.gr6math.com</u>

GET READY for the Lesson

MEASUREMENT Central Park in New York City contains a running track, walking paths, playgrounds, and even a carousel.

2.5 mi



- 1. If you walked around the outer edge of the entire park, how far would you walk? Describe how you found the distance.
- **2**. Explain how you can use both multiplication and addition to find the distance.

The distance around a geometric figure is called the **perimeter**. To find the perimeter of a rectangle, you can use addition or a formula.

KEY C	ONCEPT	Perimeter o	of a Rectangle
Words	The perimeter <i>P</i> of a rectangle is twice the sum of the length ℓ and width <i>w</i> .	Model	e
Symbols	$P = \ell + \ell + w + w$		
	$P = 2\ell + 2w \text{ or } 2(\ell + w)$		

EXAMPLE Find the Perimeter of a Rectangle

C	Find the perimete shown at the right	0	
	$P = 2\ell + 2w$ P = 2(15) + 2(4) P = 30 + 8 P = 38	Perimeter of a rectangle Replace ℓ with 15 and w with Multiply. Add.	15 cm 1 4.
	The perimeter is 38	8 centimeters.	
é	CHECK Your Prog	tess	.1

a. Find the perimeter of a rectangle whose length is 14.5 inches and width is 12.5 inches.

If you know the perimeter of a rectangle and the measure of one of the sides, you can solve an equation to find the remaining side.

Real-World EXAMPLE

2 GARDENS Elan is designing a rectangular garden. He wants the width to be 8 feet. He also wants the put a fence around the garden. If he has 40 feet of fencing, what is the greatest length the garden can be?

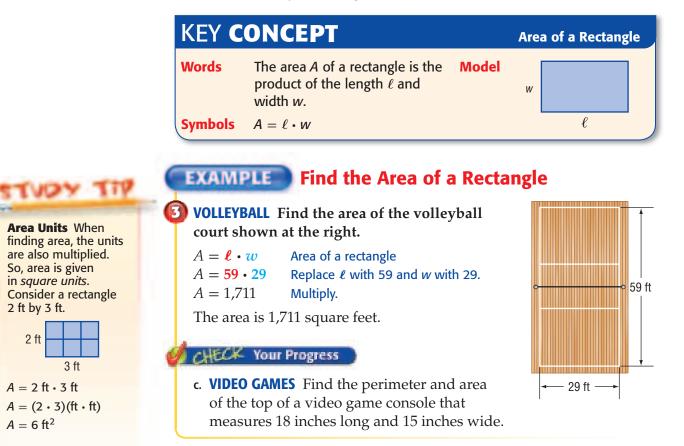
$\mathbf{P} = 2\ell + 2\mathbf{w}$	Perimeter of a rectangle
$40 = 2\ell + 2(8)$	Replace <i>P</i> with 40 and <i>w</i> with 8.
$40 = 2\ell + 16$	Multiply.
-16 = -16	Subtract 16 from each side.
$24 = 2\ell$	Simplify.
$12 = \ell$	Divide each side by 2.

The greatest length the garden can be is 12 feet wide.

CHECK Your Progress

b. FRAMES Angela bought a frame for a photo of her friends. The width of the frame is 8 inches. If the distance around the frame is 36 inches, what is the length of the frame?

The distance *around* a rectangle is its perimeter. The measure of the surface *enclosed* by a rectangle is its **area**.



EXAMPLE Use Area to Find a Missing Side

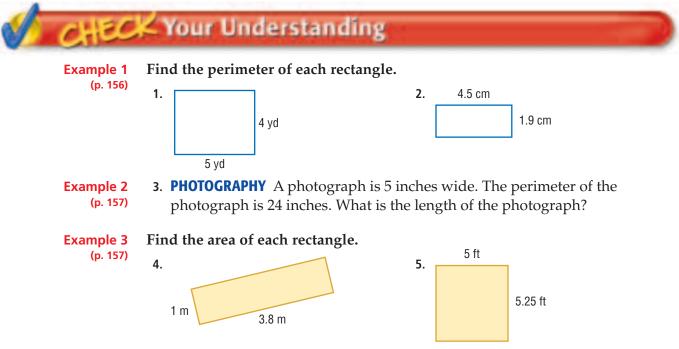
4) The area of a rectangle is 53.94 square feet. If the width is 8.7 feet, find the length.

	(METHOD 1) Substitute, the	solve.
	$A = \ell w$	Write the equation.
	$53.94 = \ell(8.7)$	Replace A with 53.94 and w with 8.7.
	$\frac{53.94}{8.7} = \frac{\ell(8.7)}{8.7}$	Divide each side by 8.7.
	$\ell = 6.2$	Simplify.
TVOY TIP	METHOD 2 Solve, then sub	stitute.
TVOY TIP	$A = \ell w$	
	$A = \ell w$ $\frac{A}{w} = \frac{\ell w}{w}$	stitute.
Reasonableness You know that	$A = \ell w$	stitute. Write the equation.
Check for Reasonableness You know that $53.94 \approx 54$ and that $8.7 \approx 9$. Since $54 \div 9 = 6$, the	$A = \ell w$ $\frac{A}{w} = \frac{\ell w}{w}$	stitute. Write the equation. Divide each side by <i>w</i> .

So, the length of the rectangle is 6.2 feet.

CHOOSE Your Method

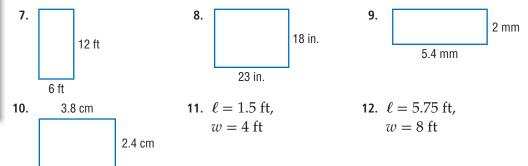
- d. What is the width of a rectangle that has an area of 135 square meters and a length of 9 meters?
- Personal Tutor at <u>ca.gr6math.com</u>



Exercises

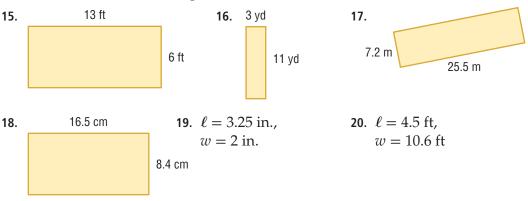
HOMEWORKHELP		
For Exercises	See Examples	
7–12	1	
13-14	2	
15–20	3	
21-22	4	

Find the perimeter of each rectangle.



- **13. SEWING** The fringe used to outline a placemat is 60 inches. If the width of the placemat is 12 inches, what is the measure of its length?
- 14. **GAMES** Orlando marks off a rectangular section of grass to use as a playing field. He knows that he needs to mark off 111 feet around the border of the playing field. If the field is 25.5 feet long, what is its width?

Find the area of each rectangle.



- **21. QUILTING** Daniela's grandmother is making a quilt that is 7 squares wide. If she needs 35 squares total, how many squares long is the length?
- **22. PAINTING** A rectangular mural is painted on a wall. If the mural is 12 feet wide and covers 86.4 square feet, what is the height of the mural?

Find the missing measure.

23.
$$P = 115.6$$
 ft, $w = 24.8$ ft

24. $A = 189.28 \text{ cm}^2$, w = 16.9 cm

ANALYZE TABLES For Exercises 25 and 26, use the table shown.

25. How much greater is the area of a Canadian football field than an American football field?

Football Field	Length (ft)	Width (ft)
American	300	160
Canadian	330	197

26. An *acre* equals 43,560 square feet. How many acres are there in a Canadian football field? Round to the nearest tenth of an acre and explain the method you used to solve the problem.

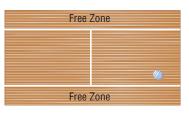


Real-World Link Regulation volleyball courts are 18 meters long by 9 meters wide, not including the free zone. Source: usavolleyball.org

EXTRAPRACTICE	32.
See pages 686, 717.	
Math 🗐 nine	
Self-Check Quiz at <u>ca.gr6math.com</u>	33.

For Exercises 27–30, determine whether the problem involves perimeter, area, or both. Then solve.

- **27. HIKING** Ramón walked along a rectangular hiking path. Initially, he walked 3 miles north before he turned east. If he walked a total of 14 miles, how many miles did he walk east before he turned south?
- **28. BORDERS** Kaitlyn's bedroom is shaped like a rectangle with rectangular walls. She is putting a wallpaper border along the top of the two longer walls and one of the shorter walls. If the length of the room is 13 feet and the width is 9.8 feet, how many feet of border does she need?
- **29. DECKS** Armando built a rectangular deck in his backyard. The deck takes up 168.75 square feet of space. If the deck's width is 12.8 feet, what is its approximate length?
- **30. FENCING** Jasmine plans to fence her rectangular backyard on three sides. Her backyard measures 48 feet in length. She will not fence one of the shorter sides. If the area of her backyard is 1,752 square feet, how many feet of fencing is required?
- ••31. **VOLLEYBALL** For safety, regulation courts have a "free zone" added to the width of each side of the court. If the free zone on each side is 3 meters wide, use the information to the left to find the area of the entire volleyball court including the free zone.



S

1 yd

1 yd

32. GEOMETRY Use the diagram at the right to write formulas for the perimeter *P* and area *A* of a square.



3 ft

3 ft

S

FIND THE DATA Refer to the California Data File on pages 16–19. Choose some data and write a real-world problem in which you would find the perimeter and area of a rectangle.

H.O.T. Problems

34. OPEN ENDED Draw and label three different rectangles that have an area of 24 square centimeters.

CHALLENGE For Exercises 35–38, find each equivalent measurement. Provide a diagram to justify your answers. The diagram for Exercise 35 is shown.

35. $1 \text{ yd}^2 = 1 \text{ ft}^2$ **36.** $4 \text{ yd}^2 = 1 \text{ ft}^2$
37. $1 \text{ ft}^2 = 1 \text{ in}^2$ **38.** $2 \text{ ft}^2 = 1 \text{ in}^2$

NUMBER SENSE For Exercises 39 and 40, describe the effect on the perimeter and area in each of the following situations.

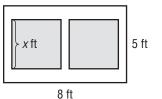
- **39**. The width of a rectangle is doubled.
- **40**. The length of a side of a square is doubled.

- **41. CHALLENGE** A rectangle has width *w*. Its length is one unit more than 3 times its width. Write an expression that represents the perimeter of the rectangle.
- **42. WRITING IN MATH** Decide whether the statement is *true* or *false*. Explain your reasoning and provide examples.

Of all rectangles with a perimeter of 24 square inches, the one with the greatest area is a square.

STANDARDS PRACTICE

43. Oakland Garden Center created a design plan for the Nelson family's rock garden. The shaded areas will hold flowers and the rest of the garden will be rock.

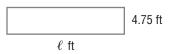


If each shaded area is a square, which expression represents the area of the garden that will be rock?

```
A (40 - 2x^2) ft<sup>2</sup> C (40 + x) ft<sup>2</sup>

B (40 - x) ft<sup>2</sup> D (40 + x^2) ft<sup>2</sup>
```

44. The rectangle below has width 4.75 feet and perimeter *P* feet.



Which of the following could be used to find the length of the rectangle?

F $P = 4.75 + \frac{\ell}{2}$ G $P = 4.75 - \ell$ H $P = 9.5 + 2\ell$ J $P = 9.5 - 2\ell$

Solve each equation	on. Check your solutio	on. (Lesson 3-5)		
45 . $5d + 12 = 2$	46. $13 - f = 7$	47. $10 = 2g + 3$	48. $6 = 3 - 3h$	
	juation to find how mu sson 3-3)	r returning a DVD 5 da 1ch the video store char	5	
	/			

GET READY for the Next Lesson

 PREREQUISITE SKILL
 Graph and label each point on a coordinate plane. (Lesson 2-3)

 54. (-4, 2)
 55. (3, -1)
 56. (-3, -4)
 57. (2, 0)

Measurement Lab Representing Relationships

Main IDEA

Graph data to demonstrate the relationship between the dimensions and the perimeter of a rectangle.

Standard 6AF3.2

Explore

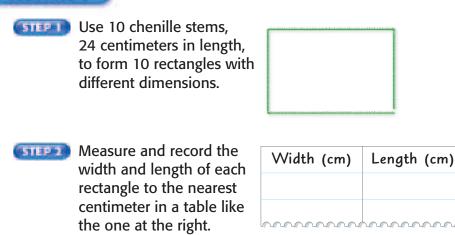
3 77/



Express in symbolic form simple relationships arising from geometry. Standard 6MR2.4 Use a

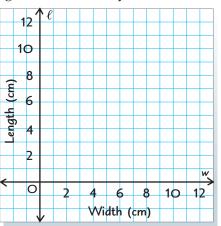
variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning. In this lab, you will investigate the relationships between the dimensions and the perimeter of a rectangle.

ACTIVITY



ANALYZE THE RESULTS

- 1. What rectangle measure does 24 centimeters represent?
- 2. Find the sum of the width and length for each of your rectangles. Write a sentence that describes the relationship between this sum and the measure of the length of the stem for each rectangle. Then write a rule that describes this relationship for a rectangle with a width w and length ℓ .
- **3**. In this activity, if a rectangle has a length of 4.5 centimeters, what is its width? Explain your reasoning. Write a rule that can be used to find w when ℓ is known for any rectangle in this Activity.
- 4. **GRAPH THE DATA** Graph the data in your table on a coordinate plane like the one at the right.
- Describe what the ordered pair (*w*, ℓ) represents. Describe how these points appear on the graph.
- 6. Use your graph to find the width. of a rectangle whose length is 7 centimeters. Explain your method.
- **7. MAKE A CONJECTURE** If the length of each chenille stem was



20 centimeters, how would this affect the data in your table? the rule you wrote in Exercise 3? the appearance of your graph?



Functions and Graphs

Main IDEA

Graph data to demonstrate relationships.



Standard 6AF2.3 Solve problems involving rates, average speed, distance, and time. Standard 6MR2.4 Use a variety of methods,

such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.

NEW Vocabulary

linear equation

REVIEW Vocabulary

function a relation in which each element of the input is paired with exactly one element of the output according to a specified rule (Lesson 1-10)

GET READY for the Lesson

MONEY The Westerville Marching Band is going on a year-end trip to an amusement park. Each band member must pay an admission price of \$15. In the table, this is represented by 15m.

- 1. Copy and complete the function table for the total cost of admission.
- 2. Graph the ordered pairs (number of members, total cost).

3. Describe how the points appear on the graph.

Total Cost of Admission Number of Total 15*m* **Members** Cost (\$) 1 15(1) 15 2 15(2) 30 3 15(3) 4 5 6

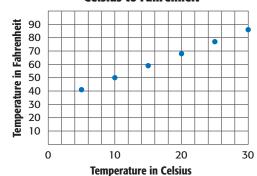
If you are given a function, ordered pairs in the form (input, output), or (x, y), provide useful information about that function. These ordered pairs can then be graphed on a coordinate plane and form part of the graph of the function. The graph of the function consists of the points in the coordinate plane that correspond to *all* the ordered pairs of the form (input, output).

Real-World EXAMPLE

TEMPERATURE The table shows temperatures in Celsius and the corresponding temperatures in Fahrenheit. Make a graph of the data to show the relationship between Celsius and Fahrenheit.

The ordered pairs (5, 41), (10, 50), (15, 59), (20, 68), (25, 77), and (30, 86) represent this function. Graph the ordered pairs.

Celsius	Fahrenheit	
5	41	
10	50	
15	59	
20	68	
25	77	
30	86	



Celsius to Fahrenheit

CHECK Your Progress

a. **MUSIC** The table shows the money remaining on a \$75 gift certificate after a certain number of CDs are bought. Make a graph to show how the number of CDs bought and the remaining balance are related.

\$75 Music Gift Certificate			
Number of CDs Balance (\$)			
1	63		
2	51		
3	39		
4 27			
5 15			

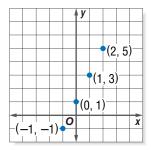
The solution of an equation with two variables consists of two numbers, one for each variable, that make the equation true. The solution is usually written as an ordered pair (x, y).

EXAMPLE Graph Solutions of Linear Equations

2 Graph y = 2x + 1.

Select any four values for the input *x*. We chose 2, 1, 0, and -1. Substitute these values for *x* to find the output *y*.

x	2 <i>x</i> + 1	y	(<i>x</i> , <i>y</i>)
2	2(2) + 1	5	(2, 5)
1	2(1) + 1	3	(1, 3)
0	2(0) + 1	1	(0, 1)
-1	2(-1) + 1	-1	(-1, -1)



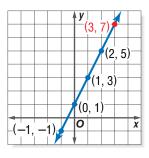
The four inputs correspond to the solutions (2, 5), (1, 3), (0, 1), and (-1, -1). By graphing these ordered pairs, you can create the graph of y = 2x + 1.

CHECK Your Progress Graph each equation. b. y = x - 3 c. y = -3x d. y = -3x + 2Personal Tutor at ca.gr6math.com

STUDY TIP

Graphing Equations Only two points are needed to graph the line. However, graph more points to check accuracy. Notice that all four points in the graph lie on the same straight line. Draw a line through the points to graph *all* solutions of the equation y = 2x + 1. Note that the point (3, 7) is also on this line.

y = 2x + 1	Write the equation.
7 ≟ 2 (3) + 1	Replace <i>x</i> with 3 and <i>y</i> with 7.
7 = 7 🗸	This sentence is true.



So, (3, 7) is also a solution of y = 2x + 1. An equation like y = 2x + 1 is called a **linear equation** because its graph is a straight line.



About one fourth of all skateboarding purchases are made by teenagers from 14 to 17 years old. **Source:** *Statistical Abstract* of the United States

Real-World EXAMPLE

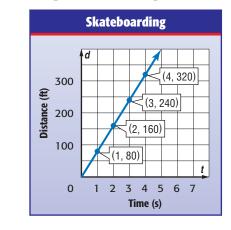
3 SKATEBOARDING The top speed reached by a standing skateboarder is 80 feet per second. The equation d = 80t describes the distance dthat a skateboarder can travel in time t. Represent the function by a graph.

Step 1 Select any four values for *t*. Select only positive numbers because *t* represents time. Make a function table.

t	80 <i>t</i>	d	(<i>t</i> , <i>d</i>)
1	80(1)	80	(1, 80)
2	80(2)	160	(2, 160)
3	80(3)	240	(3, 240)
4	80(4)	320	(4, 320)

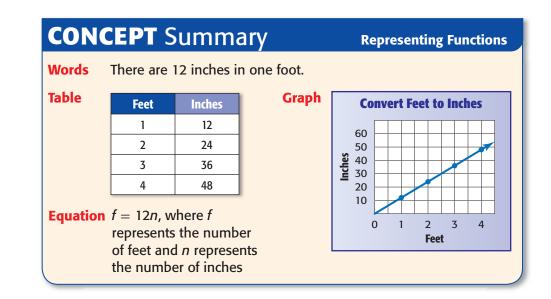


p 2 Graph the ordered pairs and draw a line through the points.



CHECK Your Progress

e. **JOBS** Sandi makes \$6 an hour baby-sitting. The equation m = 6h describes how much money *m* she earns baby-sitting for *h* hours. Represent this function by a graph.



Math Fromer/Getty Images

CHECK Your Understanding

Example 1	
(n 163)	

Graph the function represented by each table.

(p. 163)

1.

	Total Cost of Baseballs		
	Baseball	Total Cost (\$)	
	1	4	
	2	8	
3 12		12	
	4	16	

Convert Minutes to Seconds		
Minutes Seconds		
1	60	
2 120		
3 180		
4	240	

Graph each equation. Example 2

(p. 164)

3. y = x - 1

5. y = -2x + 3

Example 3 6. **MEASUREMENT** The perimeter of a square is 4 times greater than the length (p. 165) of one of its sides. The equation p = 4s describes the perimeter p of a square with sides *s* units long. Represent this function by a graph.

8.

4. y = -1x

2.

Exercises

HOMEWORKHELP		
For Exercises	See Examples	
7–8	1	
9–14	2	
15–16	3	

Graph the function represented by each table.

7.	Total Phone Bill			
	Time (min)	Total (¢)		
	1	8		
	2	16		
	3	24		
	4	32		

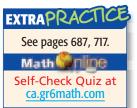
Calories in Fruit Cups		
Servings Total Calories		
1	70	
3	210	
5	350	
7	490	

Graph each equation.

9. $y = x + 1$	10. $y = x + 3$	11. $y = x$
12. $y = -2x$	13. $y = 2x + 3$	14. $y = 3x - 1$

For Exercises 15 and 16, represent each function by a graph.

- **15. CARS** A car averages 36 miles per gallon of gasoline. The function m = 36grepresents the miles *m* driven using *g* gallons of gasoline.
- **16. INTERNET** An Internet provider charges \$20 a month for service. The equation c = 20m describes the total charge *c* for *m* months of Internet access.



Graph each equation.

17. y = 0.25x**18.** y = x + 0.5**19.** y = 0.5x - 1

20. SHOPPING You buy a DVD for \$14 and CDs for \$9 each. The equation t = 14 + 9c represents the total amount t that you spend if you buy 1 DVD and *c* CDs. Represent this function by a graph.

H.O.T. Problems ..., 21. OPEN ENDED Draw the graph of a linear function. Name three ordered pairs in the function.

> **CHALLENGE** For Exercises 22 and 23, let *x* represent the first number and let *y* represent the second number. Draw a graph of each function.

- 22. The second number is three more than the first number.
- **23**. The second number is the product of -3 and the first number.
- 24. **WRITING IN MATH** Describe how you use a function table to create the graph of a function.

STANDARDS PRACTICE

25. The graph shows the relationship between the number of hours Jennifer spent jogging and the total number of miles she jogged. Which table best represents the data in the graph?

Distance

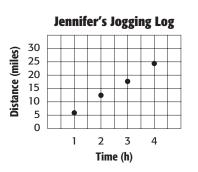
(mi)

4

3

2

1



C	Time (h)	Distance (mi)	D	Time (h)	Distance (mi)
	1	6		4	6
	2	12		3	6
	3	18		2	6
	4	24	1	1	6



Α

Time

(h)

6

12

18

24

26. **MEASUREMENT** The area and width of a rug are 323 square inches and 17 inches respectively. What is the perimeter of the rug? (Lesson 3-6)

Distance

(mi)

6

12

18

24

Solve each equation. Check your solution. (Lesson 3-5)

В

Time

(h)

2

3

4

5

28. 10x + 2 = 32 **29.** 48 - 8j = 16 **30.** 14 = 2 - 6d**27.** 4y + 19 = 7

31. Evaluate |5| + |-10|. (Lesson 2-1)

Cross-Curricular Project

Math and Geography

The Wide World of Soccer It is time to complete your project. Use the information and data you have gathered about countries where soccer is a favorite sport to prepare a Web page or poster. Be sure to include a graph with your project.

Math Cross-Curricular Project at ca.gr6math.com

Ý

Graphing Calculator Lab Graphing Relationships



Use technology to graph relationships involving conversions of measurement.

Extend

3 7 7



Standard 6AF2.1 Convert one unit of measurement

to another (e.g., from feet to miles, from centimeters to inches).

Standard 6MR2.4 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning. You can use a graphing calculator to graph relationships.

ACTIVITY

MEASUREMENT Use the table at the right to write a function that relates the number of yards *x* to the number of feet *y*. Then graph your function.

By examining the table, you can see that the number of feet is 3 times the number of yards. Write a function.

Yards (<i>x</i>)	Feet (<i>y</i>)
1	3
2	6
3	9
4	12

 $\frac{\text{The number of feet}}{y} = \frac{3 \text{ times}}{3} \frac{\text{the number of yards.}}{x}$

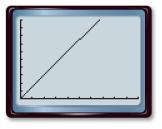
STEP 2) Press Y = and enter the function y = 3x into Y_1 .

(STEP 3)

STEP 4

Adjust your viewing window. Press WINDOW and change the values to reflect the range of values in the table. Finally, graph the function by pressing GRAPH.





ANALYZE THE RESULTS

- Test the function above using one of the values from the table and the CALC feature on your calculator. Press 2nd [CALC] 1 and then enter an *x*-value of 3. What *y*-value is displayed? What do each of these values represent and how are they represented on the graph?
- 2. Use your graph to convert 7 yards into feet. Explain your method.
- **3. MAKE A CONJECTURE** Write a function that could be used to convert feet into yards. What is an appropriate window for a graph of this function? Graph and test your function.
- 4. Use your function from Exercise 3 to convert 16 feet into yards.
- Write a function that could be used to convert 36 ounces to pounds. Indicate an appropriate window, then use a graph of the function to convert 36 ounces to pounds. (*Hint*: 1 pound = 16 ounces)

Study Guide and Review



Download Vocabulary Review from ca.gr6math.com

OLDA BLES

CHAPTER

Be sure the following Key Concepts are noted in your Foldable.



READY to Study

Key Concepts

Solving Equations (Lessons 3-2, 3-3, and 3-5)

GET

- If you add or subtract the same number from each side of an equation, the two sides remain equal.
- If you divide each side of an equation by the same nonzero number, the two sides remain equal.
- To solve a two-step equation like
 - 3x + 4 = 19 or 2x 1 = -5:
- **Step 1** Undo the addition or subtraction first.
- **Step 2** Then undo the multiplication or division.

Perimeter and Area Formulas (Lesson 3-6)

- The perimeter *P* of a rectangle is twice the sum of the length *ℓ* and width *w*.
- The area *A* of a rectangle is the product of the length ℓ and width *w*.

Linear Functions (Lesson 3-7)

• The graph of a linear function is a straight line. Ordered pairs in the form (*x*, *y*) can be used to represent a function and graphed on the coordinate plane as part of the graph of the function.

Key Vocabulary

formula (p. 144) linear equation (p. 164) two–step equation (p. 151) work backward strategy (p. 148)

Vocabulary Check

State whether each sentence is *true* or *false*. If *false*, replace the underlined word or number to make a true sentence.

- **1**. The expression $\frac{1}{3}y$ means <u>one-third of y</u>.
- 2. The words *more than* sometimes suggest the operation of <u>multiplication</u>.
- **3**. The formula d = rt gives the distance *d* traveled at a rate of *r* for *t* units of time.
- 4. The algebraic expression representing the words *six less than m* is 6 m.
- 5. Use the <u>work backward</u> strategy when you are given a final result and asked to find an earlier amount.
- **6.** The word *each* sometimes suggests the operation of <u>division</u>.
- 7. In solving the equation 4x + 3 = 15, first divide each side by 4.
- 8. The solution to the equation p + 4.4 = 11.6 is <u>7.2</u>.
- **9**. The process of solving a <u>two-step equation</u> uses the work backward strategy.
- **10**. The expression 5x means <u>5 more than x</u>.
- **11.** To find the distance around a rectangle, use the formula for its <u>area</u>.
- **12**. The word *per* sometimes suggests the operation of <u>subtraction</u>.



3-2

Lesson-by-Lesson Review

3-1	Writing Expressions and Equations (pp. 128–133)			
	Write each phrase as an algebraic expression.	Example 1 Write the phrase as an algebraic expression.		
	13 . the sum of a number and 5	four times the price		
	14. six inches less than her height15. twice as many apples	Let p represent the price. The algebraic expression is $4p$.		
	Write each sentence as an algebraic equation.	Example 2 Write the sentence as an algebraic equation.		
	 Ten years older than Theresa's age is 23. 	<i>Six less than the number of cookies is 24.</i> Let <i>c</i> represent the number of cookies.		
	17 . Four less than a number is 19.	The equation is $c - 6 = 24$.		
	18 . The quotient of 56 and a number is 14.			
	19. AMUSEMENT PARKS This year, admission to a popular amusement			
	park is \$8.75 more than the previous year's admission fee. Write an			

Solving Addition and Subtraction Equations (pp. 136–141)

expression describing the cost of

this year's admission.

Solve each equation. Check your solution.	Example 3 Solve $x + 6 = 4$. x + 6 = 4
20. $x + 5 = 8$ 21. $r + 8 = 2$ 22. $p + 9 = -4$ 23. $s - 8 = 15$	$\frac{-6 = -6}{x}$ Subtract 6 from each side. x = -2
 24. n - 1 = -3 25. w - 9 = 28 26. COOKIES Marjorie baked some chocolate chip cookies for her and her sister. Her sister ate 6 of these cookies. If there were 18 cookies left, write and solve an equation to find how many cookies <i>c</i> Marjorie baked. 	Example 4 Solve $y - 3 = -2$. y - 3 = -2 +3 = +3 Add 3 to each side. y = 1

3-3 So

Solving Multiplication Equations (pp. 142–146)

Solve each equation. Check your solution.

- **27.** 7c = 28 **28.** -8w = 72
- **29.** 10y = -90 **30.** -12r = -36
- **31. MONEY** Matt borrowed \$98 from his father. He plans to repay his father at \$14 per week. Write and solve an equation to find the number of weeks *w* required to pay back his father.

Example 5 Solve
$$-4b = 32$$
.

-4b = 32 $\frac{-4b}{-4} = \frac{32}{-4}$ b = -8

Divide each side by -4.

3-4 PSI: Work Backward (pp. 148–149)

3-5

Solve. Use the *work backward* strategy.

- **32. BASEBALL** Last baseball season, Nelson had four less than twice the number of hits Marcus had. Nelson had 48 hits. How many hits did Marcus have last season?
- **33. CREDIT CARDS** Alicia paid off \$119 of her credit card balance and made an additional \$62.75 in purchases. If she now owes \$90.45, what was her starting balance?

Example 6 A number is divided by 2. Then 4 is added to the quotient. After subtracting 3, the result is 18. What is the number?

Start with the final value and work backward with each resulting value until you arrive at the starting value.

18 + 3 = 21	Undo subtracting 3.
21 - 4 = 17	Undo adding 4.
$17 \cdot 2 = 34$	Undo dividing by 2.

The number is 34.

Solving Two-Step Equations (pp. 151–155)

Solve each equation. Check your solution.

34.	3y –	12 =	6	35.	6 <i>x</i> –	4 = 1	20
-----	------	------	---	-----	--------------	-------	----

36. 2x + 5 = 3 **37.** 5m + 6 = -4

38. 10c - 8 = 90 **39.** 3r - 20 = -5

40. ALGEBRA Ten more than five times a number is 25. Find the number.

Example 7 Solve
$$3p - 4 = 8$$
.
 $3p - 4 = 8$
 $4 = + 4$ Add 4 to each side.
 $3p = 12$
 $\frac{3p}{3} = \frac{12}{3}$ Divide each side by 3
 $p = 4$

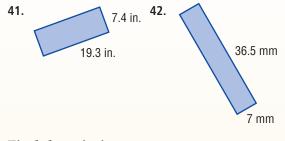


3-6

Study Guide and Review

Measurement: Perimeter and Area (p. 156–161)

Find the perimeter and area of each rectangle.



Find the missing measure.

- **43**. $P = 56 \text{ mi}, \ell = 21 \text{ mi}$
- **44.** $A = 10.26 \text{ ft}^2$, w = 2.7 ft
- **45**. $A = 272 \text{ yd}^2$, $\ell = 17 \text{ yd}$
- **46**. P = 14.2 cm, w = 2.6 cm
- **47. CARPET** In order to carpet her rectangular living room, Flora needs 192 square feet of carpet. If the length of her living room is 16 feet, find the width.

3-7

Functions and Graphs (p. 163–167)

Graph each equation.

48. $y = x + 5$	49. $y = x - 4$
50. $y = 2x$	51. $y = -1x$
52. $y = 3x + 2$	53. $y = -2x + 3$

MONEY MATTERS For Exercises 54–56, use the following infomation.

Angel earns \$6 per hour working at the Ice Cream Shop.

- **54**. Make a table that shows her total earnings for working 3, 5, 7, and 9 hours.
- **55**. Write an equation in which *x* represents the number of hours and *y* represents Angel's total earnings.
- **56**. Graph the equation.

Example 8 The perimeter of a rectangle is 38 meters. If the length is 7 meters, find the width.

$\mathbf{P} = 2\boldsymbol{\ell} + 2\boldsymbol{w}$	Perimeter formula	
38 = 2(7) + 2w	Replace <i>P</i> with 38 and ℓ with 7.	
38 = 14 + 2w	Simplify.	
24 = 2w	Subtract 14 from each side.	
$\frac{24}{2} = \frac{2w}{2}$	Divide each side by 2.	
12 = w	Simplify.	
The width is 12 meters.		

Example 9 The area of a rectangle is 285 square inches. If the width is 15 inches, find the length.

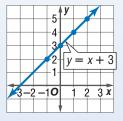
$A = \ell w$	Area formula
$285 = \ell(15)$	Replace A with 285 and w with 15.
$\frac{285}{15} = \frac{15\ell}{15}$	Divide each side by 15.
$19 = \ell$	Simplify.
The length is	19 inches.

Example 10 Graph y = x + 3.

Select four values
for <i>x</i> . Substitute
these values for <i>x</i>
to find values for <i>y</i> .

X	<i>x</i> + 3	y
-1	-1 + 3	2
0	0 + 3	3
1	1 + 3	4
2	2 + 3	5

Four solutions are (-1, 2), (0, 3), (1, 4), and (2, 5). The graph is shown below.



Practice Test

Write each phrase as an algebraic expression or equation.

1. \$5 less than Tomasita has

CHAPTER

- 2. 4 years older than Hana
- **3.** 56 inches is 9 inches shorter than Jacob's height.
- **4**. Twice the distance from the park to the post office is 5 miles.
- 5. **FLOWERS** The number of tulips in Paula's garden is 8 less than the number of marigolds. If there are 16 tulips, write and solve an equation to determine the number of marigolds *m*.
- 6. **STANDARDS PRACTICE** If you divide a number by 8 and subtract 11 from the result, the answer is 4. Which equation matches this relationship?

A $\frac{n-11}{8} = 4$	C $\frac{n}{8} = 11 - 4$
B $4 = \frac{n}{8} - 11$	D $4 = 11 - \frac{n}{8}$

ANALYZE TABLES For Exercises 7–9, use the table below. It shows how Jared's age and his sister Emily's are related.

Jared's age (yr)	1	2	3	4	5
Emily's age (yr)	7	8	9	10	11

- 7. Write an equation in which *x* represents Jared's age, and *y* represents Emily's age.
- 8. Graph the equation.
- **9**. Predict how old Emily will be when Jared is 10 years old.
- **10. TOURISM** The Statue of Liberty is 151 feet tall. It is 835 feet shorter than the Eiffel Tower. Write and solve an equation to find the height of the Eiffel Tower.

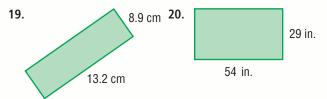
Solve each equation. Check your solution.

11. $x + 5 = -8$	12. $y - 11 = 15$
13. $9z = -81$	14. $-6k + 4 = -38$
15. $3z - 7 = 17$	16. $2g - 9 = -5$

- **17. PIZZA** Chris and Joe shared a pizza. Chris ate two more than twice as many pieces as Joe, who ate 3 pieces. If there were 3 pieces left, how many pieces were there initially? Use the *work backward* strategy.
- 18. STANDARDS PRACTICE A giant cake decorated as an American flag was 60 feet in length. If it took A square feet of icing to cover the top of the cake, which of the following would represent the cake's perimeter?

F
$$P = 120 + 2 \cdot \frac{A}{60}$$
 H $P = 60 + \frac{A}{60}$
G $P = 120 + 2A$ **J** $P = 60 + 2A$

Find the perimeter and area of each rectangle.



Graph each equation.

21. y = x + 1**22.** y = 2x**23.** y = 2x - 3

24. y = -x + 1

25. MOVIES A student ticket to the movies costs \$6. The equation c = 6t describes the total cost *c* for *t* tickets. Make a function table that shows the total cost for 1, 2, 3, and 4 tickets and then graph the equation.

CHAPTER

California Standards Practice Cumulative, Chapters 1–3



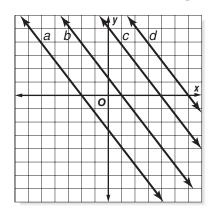
Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.

1 During a bike-a-thon, Shalonda cycled at a constant rate. The table shows the distance she covered in half-hour intervals.

Time (h)	Distance (mi)
$\frac{1}{2}$	6
1	12
11/2	18
2	24

Which of the following equations represents the distance d Shalonda covered after h hours?

- **A** d = 6 + h **B** d = 6h **C** d = 12 + h**D** d = 12h
- **2** Which line contains the ordered pair (-2, 4)?



- **F** line *a*
- **G** line *c*
- H line b
- J line d

3 The table gives the value of several terms and their positions in a sequence.

Position	3	4	5	6	7	n
Value of Term	13	17	21	25	29	

Which description shows the relationship between a term and n, its position in the sequence?

- A Add 4 to n.
- **B** Multiply *n* by 5 and add 1.
- **C** Multiply *n* by 3 and add 2.
- **D** Multiply *n* by 4 and add 1.
- 4 Mr. McDowell owes \$1,750 on his car loan and pays off \$185 each month towards the loan balance. Which expression represents how much money in dollars he still owes after *x* months?
 - **F** 1,750*x*
 - **G** 1,750*x* + 185
 - **H** 1,750*x* 185
 - **J** 1,750 185*x*
- 5 Which of the following problems can be solved by solving the equation x 9 = 15?
 - A Allison is nine years younger than her sister Pam. Allison is 15 years old. What is *x*, Pam's age?
 - **B** David's portion of the bill is \$9 more than Sam's portion of the bill. If Sam pays \$9, find *x*, the amount in dollars that David pays.
 - **C** The sum of two numbers is 15. If one of the numbers is 9, what is *x*, the other number?
 - **D** Pedro owns 15 CDs. If he gave 9 of them to a friend, what is *x*, the number of CDs he has left?

174 Chapter 3

California Standards Practice at <u>ca.gr6math.com</u>

More California Standards Practice For practice by standard, see pages CA1–CA39.

6 The table below shows values for *x* and corresponding values for *y*.

x	У
18	2
27	3
9	1
36	4

Which of the following represents the relationship between *x* and *y*?

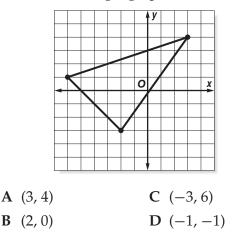
F
$$y = x + 16$$

G $y = 9x$
H $y = \frac{1}{9}x$
J $y = x + 9$

TEST-TAKING TIP

Question 7 Read the question carefully to check that you answered the question that was asked. In question 7, you are asked to pick which coordinates lie within the triangle, not to identify a vertex.

7 Which of the following coordinates lies within the triangle graphed below?



EVED A LIEL D

8 Which expression can be used to find the maximum number of 3-foot pieces of lumber than can be cut from a 12-foot length of lumber?

F	3 × 12	Η	3 + 12
G	12 ÷ 3	J	12 - 3

9 Tonya bought *p* pounds of sand. Each pound of sand costs \$0.40. Which equation gives the amount of money *a* in dollars Tonya spent?

A $p = 0.40a$	C $a = 0.40 + p$
B $a = 0.40p$	D $p = 0.40 + a$

Pre-AP

Record your answers on a sheet of paper. Show your work.

10 The distances traveled by a bicycle rider are given in the table.

Time (hours)	Distance (miles)
1	10
2	20
3	30
4	40
5	50

- a. Graph the ordered pairs to compare the time spent traveling and the distance traveled.
- **b.** Write an equation that relates the time *t* to the distance *d*.
- **c.** Use your equation to predict the distance traveled in 3.5 hours.

NEED EXIKA HELP?										
If You Missed Question	1	2	3	4	5	6	7	8	9	10
Go to Lesson	3-7	3-7	1-9	3-1	3-1	3-7	3-7	2-8	1-7	3-7
For Help with Standard	AF2.4	MR2.4	AF1.2	AF1.2	AF1.2	MR2.4	MR2.4	NS2.3	AF1.1	AF2.3

Unit 2 Number Sense: Fractions

Focus

Represent and use numbers in a variety of equivalent forms and apply addition, subtraction, multiplication, and division of fractions to accurately compute and solve problems.

CHAPTER 4 Fractions, Decimals, and Percents

BIG Idea) Compare and order positive and negative fractions, decimals, and mixed numbers. Solve problems involving fractions, ratios, proportions, and percentages.

CHAPTER 5 Applying Fractions

BIG Idea) Calculate and solve problems involving addition, subtraction, multiplication, and division.

Cross-Curricular Project

Math and Health

A Well-Balanced Diet You are what you eat! So are you ice cream or broccoli? You're on a mission to find out! Along the way, you collect and analyze data about what you eat over a period of five days. You'll also take on the role of a nutritionist, reasearching the Food Pyramid and creating a healthy meal plan. So bring a hearty appetite and your math tool kit. This adventure will tantalize your taste buds!

Math Math Log on to a.gr6math.com to begin.





 Standard 6NS2.0 Calculate and solve problems involving addition, subtraction, multiplication, and division.

Key Vocabulary

equivalent fractions (p. 192) percent (p. 202) ratio (p. 202) simplest form (p. 192)

Fractions, Decimals, and Percents



Insects Monarch butterflies have a wingspan of $3\frac{3}{8}$ inches to $4\frac{7}{8}$ inches. You can write these fractions as 3.375 and 4.875, respectively.



Fractions, Decimals, and Percents Make this Foldable to help you organize your notes. Begin with five sheets of $8\frac{1}{2}^n \times 11^n$ paper.

1 Stack five sheets of paper $\frac{3}{4}$ inch apart.



Crease and staple along the fold.



2 Roll up bottom edges so that all tabs are the same size.

Write the chapter

title on the front. Label each tab with a lesson number and title.







GET READY for Chapter 4

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 2

Math Online Take the Online Readiness Quiz at ca.gr6math.com.

Take the Quick Check below. Refer to the Quick Review for help.

OUIICKCheck

Option 1

State which dec	cimal is greater. (Lesson 3-9)
1 0 (0 (1	2 1 25 1 52

1. 0.0, 0.01	Z. 1.20, 1.02
3 . 0.33, 0.13	4 . 1.08, 10.8

5. LUNCH Kirsten spent \$4.21 on lunch while Almanzo spent \$4.12. Who spent the greater amount? (Lesson 3-9)

Use divisibility rules to determine whether each number is divisible by 2, 3, 5, 6, or 10. (Prior Grade)

6 . 125 7 . 78 8 . 3	37
---	----

9. **MUFFINS** Without calculating, determine whether 51 banana nut muffins can be evenly distributed among 3 persons. Explain. (Prior Grade)

Divide. (Prior Grade)

10 . 12 ÷ 6	11 . 18 ÷ 3
12. 2 ÷ 5	13 . 3 ÷ 4

Write each power as a product of the same factor. (Lesson 1-2)

14 . 2	3	15.	5^{5}
16 . 7	2	17.	9 ⁴

OUICKReview

Example 1			
State which decimal is greater, 7.4 or 7.04.			
7.4	Line up the decimal points		
7.04	and compare place value		

7.4	Line up the decimal points
7.04	and compare place value.
1	The 4 in the tenths place is greater than the 0 in the
7.4 is greater.	tenths place.

Example 2

Use divisibility rules to determine whether 84 is divisible by 2, 3, 5, 6, or 10.

- 2: Yes, the ones digit, 4, is divisible by 2.
- 3: Yes, the sum of the digits, 12, is divisible by 3.
- 5: No, the ones digit is neither 0 nor 5.
- 6. Yes, the number is divisible by both 2 and 3.
- 10: No, the ones digit is not 0.

Example 3

Find 1 ÷ 5.

0.2	Divide 1 by 5 until there
5)1.0	is a remainder of 0 or a
<u>-10</u>	repeating pattern.
0	

Example 4

<u>-10</u> 0

Write 4^3 as a product of the same factor. $4^3 = 4 \times 4 \times 4$

Math Lab Exploring Factors

ACTIVITY

Discover factors of whole numbers.

Explore



Main IDEA

Determine the least common multiple and the greatest common divisor of whole numbers; use them to solve problems with fractions (e.g., to find a common denominator to add two fractions or to find the reduced form for a fraction). **Standard 6MR1.1 Analyze problems by identifying relationships**, distinguishing relevant from irrelevant information, identifying missing

information, sequencing and prioritizing information, **and observing patterns.** Number each index card consecutively with the numbers 1 through 30.

Pass out the index cards in order, giving each student one index card. Have each student stand up and write the number 1 on the back of his or her card.



Begin with the student holding the "2" card. Have this student and every second student sit down and write the number 2 on the back of his or her card. The other students remain standing.

Next, start with the student holding the "3" card. Have this student and every third student stand up or sit down (depending on whether the student is already sitting or standing) and write the number 3 on the back of his or her card.

Continue this process for each of the remaining numbers up to 30. The thirtieth student ends the activity by standing or sitting, and writing the number 30 on the back of his or her card.

ANALYZE THE RESULTS

- 1. How many students are standing at the end of the activity? Which cards are they holding?
- 2. LOOK FOR A PATTERN Suppose there were 100 students holding index cards. Extend the pattern in Exercise 1 to predict the numbers that would be held by students standing at the end of the activity.
- **3.** Explain the relationship between the numbers on the front and the back of the cards.
- 4. Separate the cards into two groups: one group with exactly two numbers on the back of the card and one group with more than two numbers. Describe any special characteristics of each group.



Prime Factorization

Main IDEA

Find the prime factorization of a composite number.



Determine the least common multiple and the greatest common divisor of whole numbers; use them to solve problems with fractions (e.g., to find a common denominator to add two fractions or to find the reduced form for a fraction).

MINI Lab

Concepts in MOtion

BrainPOP® ca.gr6math.com

There is only one way that 2 can be expressed as the product of whole numbers. The figure shows that there is only one way that two squares can form a rectangle.

	2	2	
1			

- 1. Using your grid paper, draw as many different rectangles as possible containing 3, 4, 5, 6, 7, 8, 9, and 10 squares.
- 2. Which numbers of squares can be drawn in only one rectangle? In more than one rectangle?

The rectangles in the Mini Lab illustrate prime and composite numbers.

NEW Vocabulary

prime number composite number prime factorization factor tree

REVIEW Vocabulary

factor two or more numbers that are multiplied together to form a product; *Example*: 2 and 3 are factors of 6. (Lesson 1-2)

	prime number is a nole number greater
tha	an 1 that has exactly o factors, 1 and itself.
	composite number
is a	a whole number
	eater than 1 that has
	ore than two factors.

Whole Numbers	Factors
2	1, 2
3	1, 3
5	1, 5
7	1, 7
4	1, 2, 4
6	1, 2, 3, 6
8	1, 2, 4, 8
9	1, 3, 9
10	1, 2, 5, 10
0	many
1	1
	2 3 5 7 4 6 8 9 10

The numbers 0 and 1 are neither prime nor composite.

EXAMPLES Identify Numbers as Prime or Composite

Determine whether each number is *prime* or *composite*.

17 🚺

The number 17 has only two factors, 1 and 17, so it is prime.

2 12

The number 12 has six factors: 1, 2, 3, 4, 6, and 12. So, it is composite.

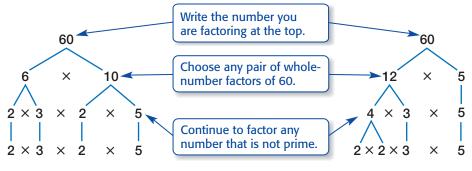
CHECK Your Progress

Determine whether each number is *prime* or *composite*.

a. 11 b. 15 c. 24

STUDY TIP

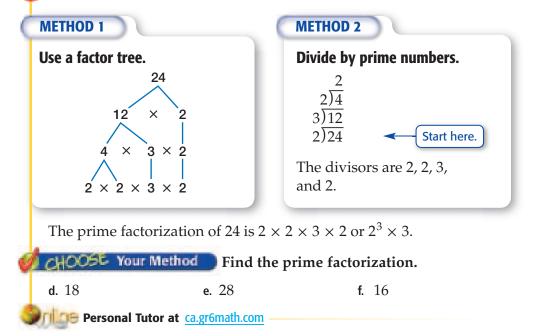
Commutative Property Multiplication is commutative, so the order of the factors does not matter. Both trees give the prime factorization of 60, but in different orders. Every composite number can be written as a product of prime numbers. This product is the **prime factorization** of the number. You can use a **factor tree** to find the prime factorization.



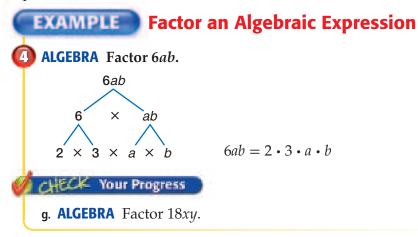
The prime factorization of 60 is $2 \times 2 \times 3 \times 5$, or $2^2 \times 3 \times 5$.

EXAMPLE Find the Prime Factorization

3 Find the prime factorization of 24.



Algebraic expressions like *6ab* can also be factored as the product of prime numbers and variables.



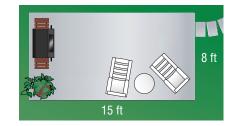
Examples 1, 2	Determine whe	ether each number i	s prime or comp	osite.	
(p. 181)	1. 7	2 . 50		3. 67	
	4. GARDENING Louisa has 72 flowers to plant in rows in a flower bed. How many different ways can she plant the flowers? Justify your answer.				
Example 3	Find the prime	factorization of eac	h number.		
(p. 182)	5. 34	6. 30		7. 12	
Example 4	ALGEBRA Factor	each expression.			
(p. 182)	8. 10 <i>ac</i>	9. $16x^2$		10. $11g^3$	
Exerci	ses				
Rest Constants					
WORKHELP		ether each number i			
See Ses Examples	 11. 22 15. 81 	12. 44 16. 31	13 . 13 17 . 97	14. 39 18. 43	
8 1, 2				18. 43	
8 3 4 4	-	factorization of eac			
+ +	19 . 96	20. 42	21 . 99	22. 64	
	23 . 210	24. 180	25 . 126	26. 375	
		obsters can live up to amount expressed a primes?			
	5	nounds can jump a d rite this distance as primes.		2 Cul	
	ALGEBRA Factor	each expression.			
	29. 15mn	30 . 20 <i>pq</i>		31. 34 <i>jkm</i>	
	32 . $49y^2$	33 . 52 <i>gh</i> ²		34. $48a^2b^2$	
	5		to make a true s	entence.	
	,	with prime factors	to make a true s		
	,	616	36. $2 \cdot 1 \cdot 5^2$ 38. $2^2 \cdot 1 \cdot 3^2$		

ALGEBRA For Exercises 40 and 41, determine whether the value of each expression is *prime* or *composite* if a = 1 and b = 5.

41. 7*b* - 4*a*

Math Control Extra Examples at <u>ca.gr6math.com</u> Zigmund Leszcynski/Animals Animals

EXTRAPRACION See pages 687, 718. Mathematical Self-Check Quiz at ca.gr6math.com MRS. Franks is building a patio that covers an area measuring 8 feet by 15 feet. She will use rectangular concrete tiles for the patio. 42. What is the area of the patio? 43. Find the prime factorization of the area.



- **44**. If she can only buy tiles with dimensions that are prime numbers, name the dimensions of the concrete tiles available for her patio.
- 45. How many tiles will she need to cover the patio?

H.O.T. Problems

- **46. RESEARCH** Use the Internet or another source to make a Sieve of Eratosthenes to determine the prime numbers up to 100.
- **47. CHALLENGE** This whole number is between 30 and 40. It has only two prime factors whose sum is 5. What is the number?
- **48**. **OPEN ENDED** Primes that differ by two are called *twin primes*. For example, 59 and 61 are twin primes. Give three examples of twin primes that are less than 50.
- **49. WRITING IN MATH** Suppose *n* represents a whole number. Is 2*n* prime or composite? Explain.

STANDARDS PRACTICE

50. What is the prime factorization of 126?
A 2² • 3 • 7 C 2 • 3 • 7²
B 2 • 3² • 7 D 2² • 3² • 7²

51. Which of the following numbers is *not* a prime number?

F	2	Η	16
G	11	J	31



52. ALGEBRA Graph y = 3x. (Lesson 3-7)

53. MEASUREMENT Find the perimeter and area of a rectangle with a length of 13 feet and width of 5 feet. (Lesson 3-6)

Add. (Lesson 2-4)

54. 6 + (-4)

55. -13 + 9 **56.** 25 + (-26) **57.** -5 + 5

GET READY for the Next Lesson

PREREQUISITE SKI	L State whether	each number is divisible by	
2, 3, 5, 6, 9, or 10.	(Page 668)		
58. 24	59. 70	60. 120	61 . 99

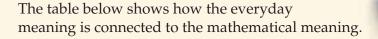
READING Word Problems

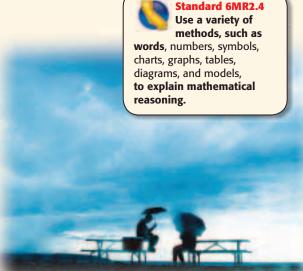
Everyday Meaning

The key to understanding word problems is to understand the meaning of the mathematical terms in the problem. Many words used in mathematics are also used in everyday language.

For example, you will use the terms *factor* and *multiple* in this chapter. Here are two sentences that show their everyday meanings.

- Weather was a *factor* in their decision to postpone the picnic.
- The star quarterback won *multiple* post-season awards.





Term	Everyday Meaning	Mathematical Meaning	Connection
factor	something that	2 and 3 are <i>factors</i> of 6.	A <i>factor</i> helps to make
from the Latin factor,	actively contributes to		a decision, and in
meaning doer	a decision or result		mathematics, factors
			"make up" a product.
multiple	consisting of more	The <i>multiples</i> of 2 are	<i>Multiple</i> means many,
from the Latin <i>multi-</i> ,	than one or shared by	0, 2, 4, 6,	and in mathematics, a
meaning many, and	many		number has infinitely
<i>plex,</i> meaning fold			many multiples.

PRACTICE

- 1. Make a list of other words that have the prefixes *fact-* or *multi-*. Determine what the words in each list have in common.
- 2. **WRITING IN MATH** Write your own rule for remembering the difference between *factor* and *multiple*.

RESEARCH Use a dictionary to find the everyday meanings of *least*, *greatest*, and *common*. Then use the definitions to determine how to find each number. Do not solve.

- 3. the greatest common factor of 10 and 15
- 4. the least common multiple of 2 and 3.



Greatest Common Factor

Main IDEA

Find the greatest common factor of two or more numbers.

Standard



the least common multiple and **the greatest** common divisor of whole **numbers:** use them to solve problems with fractions (e.g., to find a common denominator to add two fractions or to find the reduced form for a fraction).

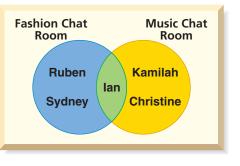
NEW Vocabulary

Venn diagram

GET READY for the Lesson

INTERNET Several friends spent time in two Internet chat rooms. The Venn diagram shows the chat rooms they visited.

- 1. Who visited the Fashion Chat Room? the Music Chat Room?
- 2. Who visited both chat rooms?



As shown above, Venn diagrams use overlapping circles to show how common elements among sets of numbers or objects are related. They can also show common factors. The greatest of the common factors of two or more numbers is the greatest common factor, or GCF.

greatest common factor (GCF)

EXAMPLE Find the Greatest Common Factor

Find the GCF of 18 and 48.

METHOD 1 List the factors of the numbers.

factors of 18: 1, 2, 3, 6, 9, 18

factors of 48: 1, 2, 3, 4, 6, 8, 12, 16, 24, 48

List the factors of 18 and 48.

The common factors of 18 and 48 are 1, 2, 3, and 6. So, the greatest common factor or GCF is 6.

METHOD 2 Use prime factorization.

Write the prime factorization. Circle the common prime factors.

 $18 = 2 \times 3 \times 3$ $48 = 2 \times 2 \times 2 \times 2 \times 3$

Write the prime factorizations of 18 and 48.

The greatest common factor or GCF is 2×3 or 6.

CHOOSE Your Method

Find the GCF of each pair of numbers.

a. 8, 10

b. 6, 12

c. 10, 17

READING in the Content Area

For strategies in reading this lesson, visit ca.gr6math.com.



READING Math

Greatest Common Factor The greatest common factor is also called the *greatest common divisor* because it is the greatest number that divides evenly into the given numbers.

EXAMPLE Find the GCF of Three Numbers

2) Find the GCF of 12, 24, and 60.

actors of 12: 1 , 2 , 3 , 4 , 6 , 12 actors of 24: 1 , 2 , 3 , 4 , 6 , 8, 12 , 24	List the factors of 12, 24, and 60.
factors of 60: 1 , 2 , 3 , 4 , 5, 6 , 10, 12 ,	15, 20, 30, 60
The common factors of 12, 24, and So, the greatest common factor or	
METHOD 2 Use prime factorization	
Write the prime factorization. Circ	cle the common prime factors.
$12 = 2 \times 2 \times 3$	
$12 = 2 \times 2 \times 3$ $24 = 2 \times 2 \times 2 \times 3$ $60 = 2 \times 2 \times 3 \times 5$ Write the	prime factorization of 12, 24, and 60
The common prime factors are 2, is $2 \times 2 \times 3$, or 12.	2, and 3. So, the GCF
CHOOSE Your Method Find th	e GCF of each set of numbers.
d. 30, 45, 75	e. 42, 70, 84

PARADES In a parade, 64 eighth graders are to march in front of 88 seventh graders. Both groups should have the same number of students in each row. Find the greatest number of students in each row.

The greatest number of students in each row is the GCF of the number of students in each group.

$$64 = 2 \times 2 \times 2 \times 2 \times 2 = 2^6$$

 $88 = 2 \times 2 \times 2 \times 11 = 2^3 \times 11$

The GCF of 64 and 88 is 2^3 , or 8.

So, there should be 8 students in each row.

CHECK Your Progress

f. **CARPENTRY** Mr. Glover wants to make shelves for his garage using an 18-foot board and a 36-foot board. He will cut the boards to make shelves of the same length and wants to use all of both boards. Find the longest possible length of each shelf.

Personal Tutor at <u>ca.gr6math.com</u>



Prime Numbers The GCF of a group of prime numbers is 1.

CHECK Your Understanding

Examples 1, 2	Find the GCF of each set of numbers.				
(pp. 186–187)	1 . 18, 30	2 . 45, 60			
	4. 6, 8, 12	5. 8, 20, 40			

7. **JOBS** A store manager wants to display the inventory of three styles of bicycle helmets in rows with the same number of each style in each row. Find the greatest number of helmets that can be placed in each row.

Bike Helmets		
Style	Inventory	
Sport	36	
Road	72	
Mountain	45	

3. 20, 50

10. 20, 45
 13. 45, 75

16. 18, 24, 3019. 36, 50, 130

6. 18, 42, 60

Exercises

Example 3

(p. 187)

HOMEWORKHELP

For Exercises	See Examples	
8-15	1	
16-19	2	
20-21	3	

Find the GCF of each set of numbers.

8 . 12, 78	9 . 40, 50
11. 32, 48	12. 24, 48
14 . 56, 96	15 . 40, 125
17. 36, 60, 84	18 . 35, 49, 84

- 20. BAKE SALE Esteban plans to sell the items shown at a bake sale. He arranges the items in groups. Each group has the same number of each item. Find the greatest number of items in each group.
- 21. **FOOD** The track-and-field coaches threw a party at the end of the season and bought a 12-inch, a 20-inch, and a 32-inch submarine sandwich. The sandwiches are cut into equalsized pieces. What is the length of the longest piece that can be cut?

32 in.

Granola Bars 32

Bagels 16

Muffins 56



← 12 in. →

Find the GCF of each set of numbers.

22. 25¢, \$1.50, 75¢, \$3.00

23. 6 feet, 15 feet, 21 feet, 9 feet

ALGEBRA Find the GCF of each set of expressions.

24. 24*a*, 6*a* **25.** 30*mn*, 40*mn*

26. 15*xy*, 55*y*

Find two numbers whose GCF is the given number.

27 . 9 28 . 12	29. 15	30 . 30
------------------------------	---------------	----------------



EXTRAPRACTICE

See pages 687, 718. Mathenine Self-Check Quiz at <u>ca.gr6math.com</u>

CLASS TRIPS For Exercises 31 and 32, use the following information and the table shown.

On Friday, Mr. Russo's class is going to the Dallas Museum of Natural History. The amount of money he collected from his students is shown. Each student paid the same amount.

Class Trip Money (\$)		
Monday	56	
Tuesday	28	
Wednesday	42	
Thursday	98	

- **31**. What is the greatest cost of the field trip per student?
- \star 32. How many students will be going on the class trip?

H.O.T. Problems CHALLENGE Determine whether each statement is *sometimes*, *always*, or *never* true.

- **33**. The GCF of two numbers is greater than both numbers.
- 34. If two numbers have no common prime factors, the GCF is 1.
- **35**. The GCF of two numbers is one of the numbers.
- **36. WRITING IN MATH** Using the words *factor* and *greatest common factor*, explain the relationship between the numbers 4, 12, and 24.

STANDARDS PRACTICE

- 37. Student Council earned \$26 selling bottled water, \$32 selling oranges, and \$28 selling energy bars. If all items cost the same, what is the greatest possible price per item?
 - A \$2
 - **B** \$4
 - **C** \$7
 - **D** \$8

- **38**. What is the greatest common divisor of 15, 30, and 45?
 - **F** 5
 - **G** 9
 - **H** 15
 - J 45

Spiral Review

39. What is the prime factorization of 75? (Lesson 4-1)

ALGEBRA Graph each equation. (Lesson 3-7)

42. y = 2x - 1

43. ALGEBRA Solve the equation -7y + 18 = 39. Check your solution. (Lesson 3-5)

GET READY for the Next Lesson

44. **PREREQUISITE SKILL** Serena received a gift card to download music from the Internet. She downloaded 3 songs on Monday, 5 songs on Tuesday, and one half of what was left on Wednesday. She has 6 songs left. How many songs were initially on the gift card? Use the *work backward* strategy. (Lesson 3-4)

Problem-Solving Investigation

MAIN IDEA: Solve problems by making an organized list.

Standard 6MR1.1 Analyze problems by identifying relationships, ..., and observing patterns. **Preparation for Standard 6DAP3.1** Represent all possible outcomes for compound events in an organized way (e.g., tables, grids, tree diagrams) and express the theoretical probability of each outcome.

P.S.I. TERM +

4-3

e-Mail: MAKE AN ORGANIZED LIST

YOUR MISSION: Solve the problem by making an organized list of all the possibilities.

THE PROBLEM: How many different ways can a woodwind trio be made?

Miranda: The first position needs to be either a bass clarinet or a bassoon. The other two positions should be filled by a clarinet, oboe, or flute.

EXPLORE	You know that either a bass clarinet or a bassoon must fill the first position. The other two positions are to be filled with two out of the three remaining instruments. You need to find all possible ways the trio can be made.							
PLAN	Make an org	ganized li	st.					
SOLVE		Trio 1	Trio 2	Trio 3	Trio 4	Trio 5	Trio 6	
	Position 1	bass clarinet	bass clarinet	bass clarinet	bassoon	bassoon	bassoon	
	Position 2	clarinet	oboe	flute	clarinet	oboe	flute	
	Position 3	oboe	flute	clarinet	oboe	flute	clarinet	
	There are si	x possibil	ities.					
CHECK	Draw a tree diagram to check the result.							

Analyze The Strategy

- 1. Explain why making an organized list was a useful strategy in solving this problem.
- 2. **WRITING IN MATH** Write a problem that can be solved by making an organized list. Then explain how to solve the problem using this strategy.

Mixed Problem Soluing



For Exercises 3–6, solve each problem by making an organized list.

- 3. **FOOD** Daniel is making a peanut butter and jelly sandwich. His choices are creamy or crunchy peanut butter, white or wheat bread, and grape, apple, or strawberry jelly. How many different types of sandwiches can Daniel make?
- 4. **GAMES** On the game board, you plan to move two spaces away from square A. You can move horizontally, vertically, or diagonally. How many different moves can you make from square A? List them.

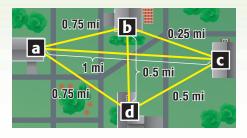
	A	B	С	
	D	Ε	F	
ſ	G	Н		

- 5. SCIENCE FAIR A photographer for the school newspaper is taking a picture of Mr. Teasley with the first, second, and third place winners of the science fair. If Mr. Teasley always stands on the far left, how many different ways can the students arrange themselves for the picture?
- **6. TELEPHONES** How many phone numbers are possible for one area code if the first three numbers are 268, in that order, and the last four numbers are 0, 9, 7, 1 in any order?

Use any strategy to solve Exercises 7–11. Some strategies are shown below.



7. ALGEBRA Consecutive odd numbers are numbers like 1, 3, 5, and 7. Find two consecutive odd numbers whose sum is 56 and whose product is 783. 8. **MEASUREMENT** Gabriel has to make deliveries to three neighbors. He lives at house *b* on the map. Find the shortest route to make the deliveries and return home.



- **9. COOKIES** Terez took a bag of cookies to play rehearsal. He gave one half of the cookies to the musicians and then gave five to the director of the play. Terez was left with 15 cookies. How many cookies did he take to rehearsal?
- **10. CLOTHES** Jeffrey owns 3 shirts, 2 pairs of pants, and 2 pairs of shoes. How many different outfits can he create?
- **SNOWFALL** A total of 17 inches of snow fell in a 72-hour period. In the last 24 hours, 6 inches fell, and in the previous 24 hours, 4 inches fell. How many inches fell in the first 24 hours?

Select the Operation

For Exercises 12 and 13, select the appropriate operation(s) to solve the problem. Justify your selection(s) and solve the problem.

- 12. EARTH SCIENCE Giant kelp seaweed is found in the Pacific Ocean. One plant grows 3 feet the first two days. If it continues to grow at the same rate, what would be the length of the seaweed at the end of 80 days?
- SCHOOL Members o Student Council are raising money to attend a conference.

s of	Transportation	\$1,200
are	Registration	\$288
ce.	Luncheon	\$360

The total costs of the conference are shown in the table. If 24 students attend the conference, how much does each student have to raise?



Simplifying Fractions

Main IDEA

Write fractions in simplest form.

[•] Standard NS2.4 Determine the least common multiple and the greatest common divisor of whole numbers; use them to solve problems with fractions (e.g., to find a common denominator to add two fractions or to find the reduced form for a fraction).

NEW Vocabulary

equivalent fractions simplest form



Checking Results To check if you simplified correctly, multiply the numerator and denominator of the answer by the GCF. The result should be the original fraction.

MINI Lab

On grid paper, draw the two figures shown. Shade 4 out of the 10 squares in one figure. Shade 2 out of the 5 rectangles in the other.

1. Write a fraction to describe each figure:

number of shaded parts total number of parts

2. Based on the figures, what can you conclude about the fractions?



Equivalent fractions have the same value. A fraction is in **simplest form** when the GCF of the numerator and denominator is 1.

EXAMPLES Write a Fraction in Simplest Form

Write $\frac{6}{24}$ in simplest form.

METHOD 1 Divide by common factors.

 $\frac{6}{24} = \frac{6 \div 2}{24 \div 2} = \frac{3}{12}$ 2 is a common factor of 6 and 24, so divide by 2.

 $\frac{3}{12} = \frac{3 \div 3}{12 \div 3} = \frac{1}{4}$ 3 is a common factor of 3 and 12, so divide by 3.

The fraction $\frac{1}{4}$ is in simplest form since 1 and 4 have no common factors greater than 1.

METHOD 2 Divide by the GCF.

First, find the GCF of the numerator and denominator.

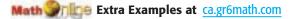
factors of 6: 1, 2, 3, 6 The GCF of 6 and 24 is 6. factors of 24: 1, 2, 3, 4, 6, 8, 12, 24

Then, divide the numerator and denominator by the GCF, 6.

 $\frac{6}{24} = \frac{6 \div 6}{24 \div 6} = \frac{1}{4}$ Divide the numerator and denominator by the GCF, 6.

So, $\frac{6}{24}$ written in simplest form is $\frac{1}{4}$.







More Than One

Way To write in

simplest form, you

can also divide by

15

common factors. $\frac{36}{45} = \frac{36 \div 3}{45 \div 3} = \frac{12}{15}$

 $\frac{12}{15} = \frac{12 \div 3}{15 \div 3} = \frac{4}{5}$

So, $\frac{36}{45} = \frac{4}{5}$.

Write ³⁶/₄₅ in simplest form.

First, find the GCF of the numerator and denominator.

factors of 36: 1, 2, 3, 4, 6, 9, 12, 18, 36 factors of 45: 1, 3, 5, 9, 15, 45

The GCF of 36 and 45 is 9.

c. $\frac{27}{36}$

Then, divide the numerator and denominator by the GCF, 9.

$\frac{36}{45} = \frac{36 \div 9}{45 \div 9} = \frac{4}{5}$	Divide the numerator and denominator by the GCF, 9.
So, $\frac{36}{45}$ written in simplest f	form is $\frac{4}{5}$.

CHOOSE Your Method

a. $\frac{7}{28}$

Write each fraction in simplest form.



Real-World Career.. How Does a Music

Composer Use Math? Music composers write notes that can vary in length. There are whole notes, half notes, quarter notes, eighth notes, and sixteenth notes.



For more information about a career as a music composer, visit: ca.gr6math.com.

Real-World EXAMPLE

MUSIC If the fraction of the frequencies of two notes can be simplified, the two notes are harmonious. Use the graphic to find the simplified fraction of the frequency of notes C and E.



Frequency Chart (Hertz)

frequency of note C 264 The slashes mean that frequency of note E part of the numerator and part of the denominator are both divided by the 3·5·11 same number. For example, $3 \div 3 = 1$.

The fraction of the frequency of notes C and E is $\frac{4}{5}$.

CHECK Your Progress

- d. **MUSIC** Use the graphic above to find the simplified fraction of the frequency of notes D and G. Notes E and F?
- e. **MUSIC** Use the graphic above to determine if the notes D and B are harmonious. Justify your answer.

Mige Personal Tutor at ca.gr6math.com

Your Understanding

Examples 1, 2 (pp. 192–193) Write each fraction in simplest form.

2. $\frac{4}{18}$

Example 3

(p. 193)

1. $\frac{3}{9}$

6.

10.

14.

5. ALLOWANCE Mary received \$15 for her weekly allowance. She spent \$10 at the movie theater with her friends. What fraction of the money, in simplest form, was spent at the theater?

3. $\frac{10}{25}$

Exercises

HOMEWORKHELP		
For Exercises	See Examples	
6–17	1,2	
18–19	3	

Write each fraction in simplest form.

<u>9</u> 12	7. $\frac{25}{35}$	8. $\frac{16}{32}$	9. $\frac{14}{20}$
$\frac{9}{12}$ $\frac{10}{20}$ $\frac{48}{64}$	11. $\frac{12}{21}$	12. $\frac{15}{25}$	13. $\frac{24}{28}$
$\frac{48}{64}$	15. $\frac{32}{32}$	16. $\frac{20}{80}$	17. $\frac{45}{54}$

- **18. PRESIDENTS** Of the 43 U.S. presidents, 15 were elected to serve two terms. What fraction of the U.S. presidents, in simplest form, was elected to serve two terms?
- **TV SHOWS** A television station has 28 new TV shows scheduled to air this week. What fraction of the television shows, in simplest form, are 30-minute programs?

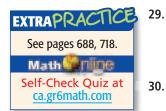
WYTB Programming	
30-minute	60-minute
20	8

4. $\frac{36}{40}$

Write each fraction in simplest form.

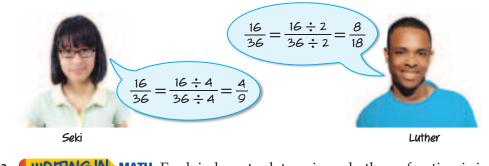
20.	$\frac{45}{100}$	21. $\frac{60}{150}$ 22.	$\frac{16}{120}$
-----	------------------	--	------------------

- **23.** $\frac{35}{175}$
- 24. TIME Fifteen minutes is what part of one hour?
- 25. **MEASUREMENT** Nine inches is what part of one foot?
- 26. CALENDAR Four days is what part of the month of April?
- **27. SLEEP** Marcel spends 8 hours each day sleeping. What fraction of a week, written in simplest form, does Marcel spend sleeping?
- **28. MONEY** Each week, Lorenzo receives a \$10 allowance. What fraction of his yearly allowance, in simplest form, does he receive each week?



- FIND THE DATA Refer to the California Data File on pages 16–19 of your book. Choose some data and write a real-world problem in which you would simplify fractions.
- **30. OPEN ENDED** Select a fraction that is *not* in simplest form. Then, simplify it.

- **H.O.T.** Problems 31. CHALLENGE Both the numerator and denominator of a fraction are even. Is the fraction in simplest form? Explain your reasoning.
 - **32. FIND THE ERROR** Seki and Luther both wrote $\frac{16}{36}$ in simplest form. Who is correct? Explain.



33. WRITING IN MATH Explain how to determine whether a fraction is in simplest form.

STANDARDS PRACTICE

34. It takes Benito 12 minutes to walk to school. What fraction represents the part of an hour it takes Benito to walk to school?

A
$$\frac{12}{1}$$
 C $\frac{5}{30}$
B $\frac{4}{15}$ **D** $\frac{1}{5}$

35. What fraction of a foot is 2 inches?

F	$\frac{1}{6}$
G	$\frac{1}{4}$
Н	$\frac{1}{3}$
J	$\frac{1}{2}$



36. SANDWICHES A deli offers sandwiches with ham, turkey, or roast beef with American, provolone, Swiss, or mozzarella cheese. How many different types of sandwiches can be made if you choose one meat and one cheese? Use the *make an organized list* strategy. (Lesson 4-3)

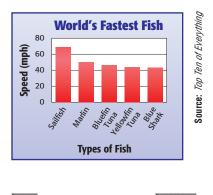
Find the GCF of each set of numbers. (Lesson 4-2)

37 . 27, 36	38.	16, 28
--------------------	-----	--------

39. 20, 50, 65

40. ANALYZE GRAPHS Refer to the graph. At these rates, about how much longer would it take a blue shark to swim 280 miles than it would a sailfish? Use the formula d = rt. Justify your answer. (Lesson 3-3)





43. 10)7.0

44. 8)3.000

Fractions and Decimals

Main IDEA

Write fractions as terminating or repeating decimals and write decimals as fractions.



Preparation for Standard 6NS1.1

Compare and order positive and negative fractions, decimals, and mixed numbers and place them on a number line.

NEW Vocabulary

terminating decimals repeating decimals bar notation

READY for the Lesson GEI

BUILDINGS The table shows the heights of the ten tallest buildings in Los Angeles.

- 1. What fraction of the buildings are between 600 and 900 feet tall?
- 2. Express this fraction using words and then as a decimal.
- **3**. What fraction of the buildings are between 710 and 730 feet tall? Express this fraction using words and then as a decimal.

Los Angeles' Tallest Buildings		
Building	Height (ft)	
U.S. Bank Tower	1,018	
Aon Tower	858	
Two California Plaza	750	
Gas Company Tower	749	
BP Plaza	735	
777 Tower	725	
Wells Fargo Tower	723	
United California Bank Plaza	717	
Paul Hastings Tower	699	
Bank of America Tower	699	
Source: laalmanac.com		

Our decimal system is based on powers of 10. So, if the denominator of a fraction is a power of 10, you can use place value to write the fraction as a decimal. For example, to write $\frac{7}{10}$ as a decimal, place a 7 in the tenths place.

Words	Fraction	Decimal
seven tenths	$\frac{7}{10}$	0.7

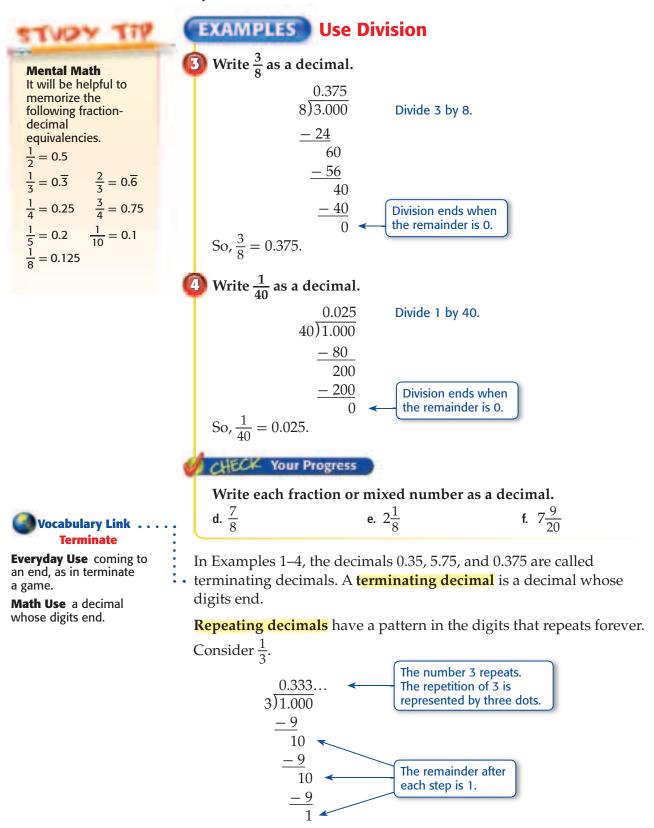
If the denominator of a fraction is a *factor* of 10, 100, 1,000, or any higher power of ten, you can use mental math and place value.

EXAMPLES Use Mental Math

Write each fraction or mixed number as a decimal.

2) $5\frac{3}{4}$ $\frac{7}{20}$ $5\frac{3}{4} = 5 + \frac{3}{4}$ Think of it as a sum. $\frac{7}{20} = \frac{35}{100}$ THINK = 5 + 0.75 You know that $\frac{3}{4} = 0.75$. = 5.75Add mentally. So, $5\frac{3}{4} = 5.75$. So, $\frac{7}{20} = 0.35$. CHECK Your Progress Write each fraction or mixed number as a decimal. **a.** $\frac{3}{10}$ **b.** $\frac{3}{25}$ c. $6\frac{1}{2}$

Any fraction can be written as a decimal by dividing its numerator by its denominator. Division ends when the remainder is zero.

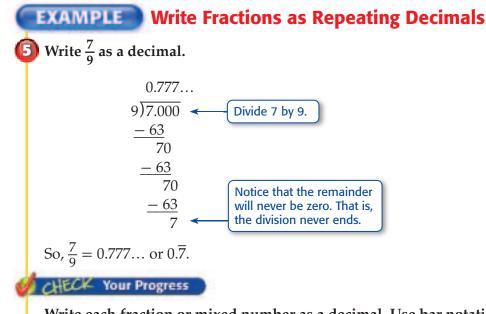


You can use **bar notation** to indicate that a number pattern repeats indefinitely. A bar is written only over the digits that repeat.

 $0.121212... = 0.\overline{12}$ $0.33333... = 0.\overline{3}$ $11.3858585... = 11.3\overline{85}$



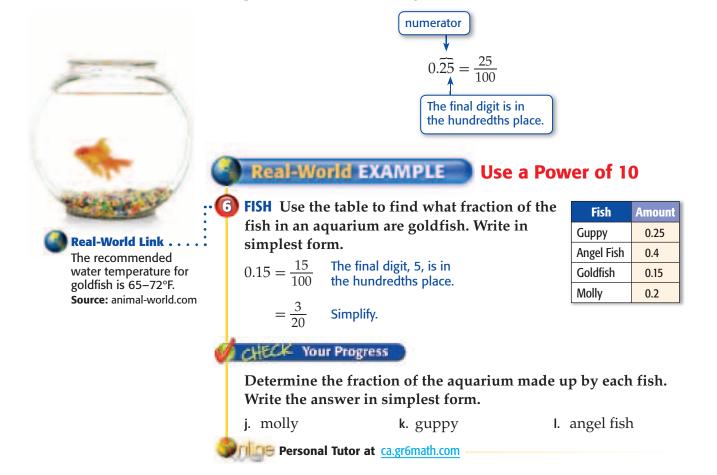
Math Time Extra Examples at ca.gr6math.com



Write each fraction or mixed number as a decimal. Use bar notation if the decimal is a repeating decimal.

g. $\frac{2}{3}$	h. $\frac{3}{11}$	i. $8\frac{1}{3}$
- 3	11	3

Every terminating decimal can be written as a fraction with a denominator of 10, 100, 1,000, or a higher power of ten. Place the digits that come after the decimal point in the numerator. Use the place value of the final digit as the denominator.



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Your Understanding

Examples 1–5 (pp. 196–198)

Write each fraction or mixed number as a decimal. Use bar notation if the decimal is a repeating decimal.

1. $\frac{2}{5}$	2. $\frac{9}{10}$	3. $7\frac{1}{2}$ 7. $\frac{5}{9}$	4. $4\frac{3}{20}$
5. $\frac{1}{8}$	2. $\frac{9}{10}$ 6. $3\frac{5}{8}$	7. $\frac{5}{9}$	4. $4\frac{3}{20}$ 8. $1\frac{5}{6}$

Example 6 (p. 198)

Write each deci	mal as a fraction or mixed r	number in simplest form.
9 . 0.22	10 . 0.1	11 . 4.6

12. HOCKEY During a hockey game, an ice resurfacer travels 0.75 mile during each ice resurfacing. What fraction represents this distance?

Exercises

HOMEWORK HELP			
For Exercises	See Examples		
13–16	1, 2		
17–22	3, 4		
23–28	5		
29–36	6		

Write each fraction or mixed number as a decimal. Use bar notation if the decimal is a repeating decimal.

13. $\frac{4}{5}$	14. $\frac{1}{2}$	15. $4\frac{4}{25}$	16. $7\frac{1}{20}$
17. $\frac{5}{16}$	18. $\frac{3}{16}$	19. $\frac{33}{50}$	20. $\frac{17}{40}$
21. $5\frac{7}{8}$	22. $9\frac{3}{8}$	23. $\frac{4}{9}$	24. $\frac{8}{9}$
25. $\frac{1}{6}$	26. $\frac{8}{11}$	27. $5\frac{1}{3}$	28. $2\frac{6}{11}$

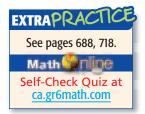
Write each decimal as a fraction or mixed number in simplest form.

29. 0.2	30 . 0.9	31 . 0.55
32. 0.34	33. 5.96	34. 2.66

- **35. INSECTS** The maximum length of a praying mantis is 30.5 centimeters. What mixed number represents this length?
- **36. GROCERIES** Suppose you buy the package of deli ham shown. What fraction of a pound did you buy?



37. FIND THE DATA Refer to the California Data File on page 16–19 of your book. Choose some data and write a real-world problem in which you would write a percent as a decimal.



Write each of the following as an integer over a whole number.

38. -13 **39.** $7\frac{1}{3}$ **40.** -0.028 **41.** -3.2

42. MUSIC Nicolás practiced playing the cello for 2 hours and 18 minutes. Write the time Nicolás spent practicing as a decimal.

43. SOFTBALL The batting average of a softball player is the number of hits divided by the number of at-bats. If Felisa had 50 hits in 175 at-bats and Harmony had 42 hits in 160 at-bats, who had the better batting average? Justify your answer

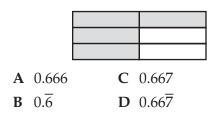
H.O.T. Problems

44. OPEN ENDED Write a fraction that is equivalent to a terminating decimal and one that is equivalent to a repeating decimal.

- **45. CHALLENGE** The value of pi (π) is 3.1415926.... The mathematician Archimedes believed that π was between $3\frac{1}{7}$ and $3\frac{10}{71}$. Was Archimedes correct? Explain your reasoning.
- **46. WRITING IN MATH** Fractions with denominators of 2, 4, 8, 16, and 32 produce terminating decimals. Fractions with denominators of 6, 12, 18, and 24 produce repeating decimals. What causes the difference? Explain.

STANDARDS PRACTICE

47. Which decimal represents the shaded region of the model?



48. Based on the information given in the table, what fraction represents $0.\overline{8}$?

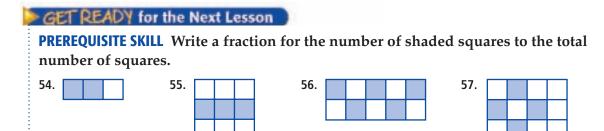
$\mathbf{F} = \frac{4}{5}$	Decimal	Fraction
G $\frac{80}{99}$	0.3	<u>3</u> 9
	0.4	<u>4</u> 9
H $\frac{5}{6}$	0.5	<u>5</u> 9
J $\frac{8}{9}$	0.6	<u>6</u> 9

52. $\frac{51}{68}$



Write each f	raction in simplest form.	(Lesson 4-4)		
49. $\frac{10}{24}$	50 . $\frac{39}{81}$	51.	$\frac{28}{98}$	

53. PIZZA How many different pizzas can Alfonso order if he can choose thick, thin, or deep dish crust and one topping from either pepperoni, sausage, or mushrooms? Use the *make an organized list* strategy. (Lesson 4-3)



CHAPTER

Mid-Chapter Quiz

Lessons 4-1 through 4-5

3. 2

Determine whether each number is *prime* or composite. (Lesson 4-1)

1. 24 **2**. 61

4. AGE Kevin just turned 13 years old. How old will he be the next time his age is a prime number? (Lesson 4-1)

Find the prime factorization of each

number. (Lesson 4-1)

5.	30	6	-	120
----	----	---	---	-----

Factor each expression. (Lesson 4-1)

7.	$14x^2y$	8.	50 <i>mn</i>
----	----------	----	--------------

Find the GCF of each set of numbers. (Lesson 4-2)

9. 16, 40 10. 65, 100

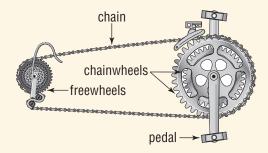
STANDARDS PRACTICE What is the 11. greatest number of crayons in each row of an 8-, a 64-, and a 96-crayon box if all rows have the same number? (Lesson 4-2)

- A 12
- **B** 8
- **C** 4
- **D** 2
- 12. **STANDARDS PRACTICE** Lynne cannot remember her password to check the messages on her cell phone. She knows that it is a three-digit number consisting of the numbers 1, 4, and 7, but she cannot remember the order. Which list shows all the different possibilities for her password? (Lesson 4-3)
 - **F** 147, 174, 417, 714, 741
 - G 147, 174, 417, 471, 714, 741
 - **H** 417, 471, 714, 741
 - J 147, 174, 74, 417, 17, 471, 714, 741

13. PIANO Evelina spends 35 minutes practicing the piano each afternoon after school. What part of one hour does she spend practicing? Write as a fraction in simplest form. (Lesson 4-4)

Write each fraction in simplest form. (Lesson 4-4)

- 14. $\frac{20}{36}$
- **15.** $\frac{45}{60}$
- **16.** $\frac{63}{108}$
- **17.** $\frac{60}{72}$
- **18. CYCLING** A *gear ratio* of a bike is the comparison of the number of teeth on a chainwheel to the number on a freewheel. The gear ratio for Alexis' 10-speed bike is $\frac{22}{30}$. Write this fraction in simplest form. (Lesson 4-4)



Write each fraction or mixed number as a decimal. Use bar notation if the decimal is a repeating decimal. (Lesson 4-5)

19. $\frac{7}{8}$ 20. $\frac{2}{9}$ 2	21. $3\frac{13}{20}$
--	-----------------------------

Write each decimal as a fraction in simplest form. (Lesson 4-5)

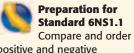
- **22.** 0.6 **23**. 0.48 24. 7.02
- **25. ANIMALS** The maximum height of an Asian elephant is 9.8 feet. What mixed number represents this height? (Lesson 4-5)



Fractions and Percents

Main IDEA

Write fractions as percents and percents as fractions.



Preparation for Standard 6NS1.1

positive and negative fractions, decimals, and mixed numbers and place them on a number line.

NEW Vocabulary

ratio percent

percent.

GET READY for the Lesson

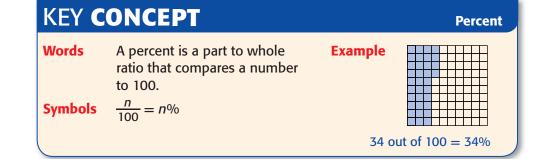
Some students were asked to choose methods that make learning subjects more interesting. The results are shown.

- **1**. For each method, shade a 10×10 grid that represents the number of students that chose the method.
- 2. What fraction of the students chose the Internet?

Method	Number of Students
Internet	17 out of 50
Teacher	29 out of 100
TV program	1 out of 4
Textbook	3 out of 25

Source: Opinion Research Corporation

A ratio is a comparison of two quantities by division. Ratios, like 34 out of 100 can also be written as 34:100 or $\frac{34}{100}$. When a ratio compares a number to 100, it can be written as a percent.



EXAMPLES Write Ratios as Percents

Write each ratio as a percent.

90

Annie answered 90 out of 100 questions correctly.

	$\frac{90}{100} = 90\%$ Annie answered 90% of the questions correctly.	90%
(On average, 50.5 out of 100	
	$\frac{50.5}{100} = 50.5\%$	
READING Math	On average, 50.5% of the stu	idents own a pet.
Percent <i>Percent</i> means per <i>hundred</i> or <i>hundred</i> ths.	CHECK Your Progress) Wr	ite each ratio as a percent.
The symbol % means	a. 45 out of 100 cars sold	b. \$3.30:\$100 spent on soft drinks



Percents You will learn another way to write fractions as percents that does not use equivalent fractions in Chapter 6.

Fractions and percents are ratios that can represent the same number. You can write a fraction as a percent by finding an equivalent fraction with a denominator of 100.

EXAMPLE Write a Fraction as a Percent

3 Write $\frac{3}{20}$ as a percent.

First, find an equivalent fraction with a denominator of 100. Then write the fraction as a percent.

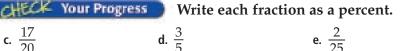
$$\frac{3}{20} = \frac{3 \times 5}{20 \times 5} = \frac{15}{100} \text{ or } 15\%$$

So, $\frac{3}{20} = 15\%$.

c. $\frac{17}{20}$

= $\frac{3}{20}$ 15 100

e. $\frac{2}{25}$



Real-World EXAMPLE

COINS The 50 State Quarters[®] Program allows the United States Mint to release a new quarter every ten weeks from 1999 through 2008 commemorating the 50 states. By the end of 2005, 35 state coins were released. What percent of the coins is this?

By the end of 2005, 35 out of 50 state coins were released.

 $\frac{35}{50} = \frac{70}{100}$ Write an equivalent fraction with a denominator of 100. $= 70\% \frac{70}{100} = 70\%$

So, 70% of the state coins were released by the end of 2005.

CHECK Your Progress

f. **COINS** What percent of the coins in the 50 State Quarters Program are being released after 2005?

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EXAMPLE Write a Percent as a Fraction

5) Write 48% as a fraction in simplest form.

 $48\% = \frac{48}{100}$ Definition of percent

 $=\frac{12}{25}$ Simplify.

CHECK Your Progress

Write each percent as a fraction in simplest form.

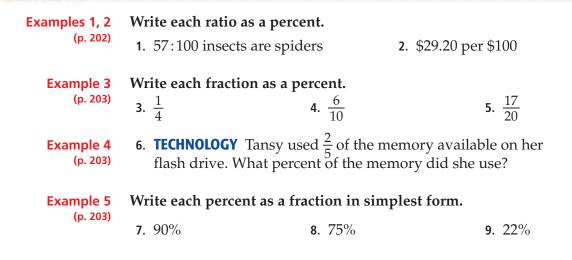
g. 40% **h**. 6% i. 24%



Real-World Link . .

Each state quarter has a diameter of 24.26 millimeters, a thickness of 1.75 millimeters, and weighs 5.670 grams. Source: usmint.gov

Heck Your Understanding



Exercises

HOMEWORKHELP					
For Exercises	See Examples				
10–15	1, 2				
16–23	3				
24–25	4				
26–33	5				

Write each ratio as a percent.

10.	87 out of 100 bool	ks read	11.	42 per 100 teena	ger	S
	12.2 out of 100 po		13 . 99.9:100 miles driven			en
14.	$11\frac{3}{4}$ out of 100 fee	t	15.	$66\frac{2}{3}$: 100 yards r	un	
Wr	ite each fraction a	s a percent.				
16.	$\frac{7}{10}$ 12	7. $\frac{16}{20}$	18.	$\frac{15}{25}$	19.	$\frac{13}{50}$
20.	$\frac{1}{5}$ 2	1. $\frac{3}{5}$	22.	$\frac{19}{20}$	23.	<u>10</u> 10

- 24. **PETS** Twenty out of every 25 households own one dog. What percent of households own one dog?
- **25. SPORTS** If 15 out of every 50 teens like to ski, what percent of teens like to ski?

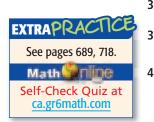
Write each percent as a fraction in simplest form.

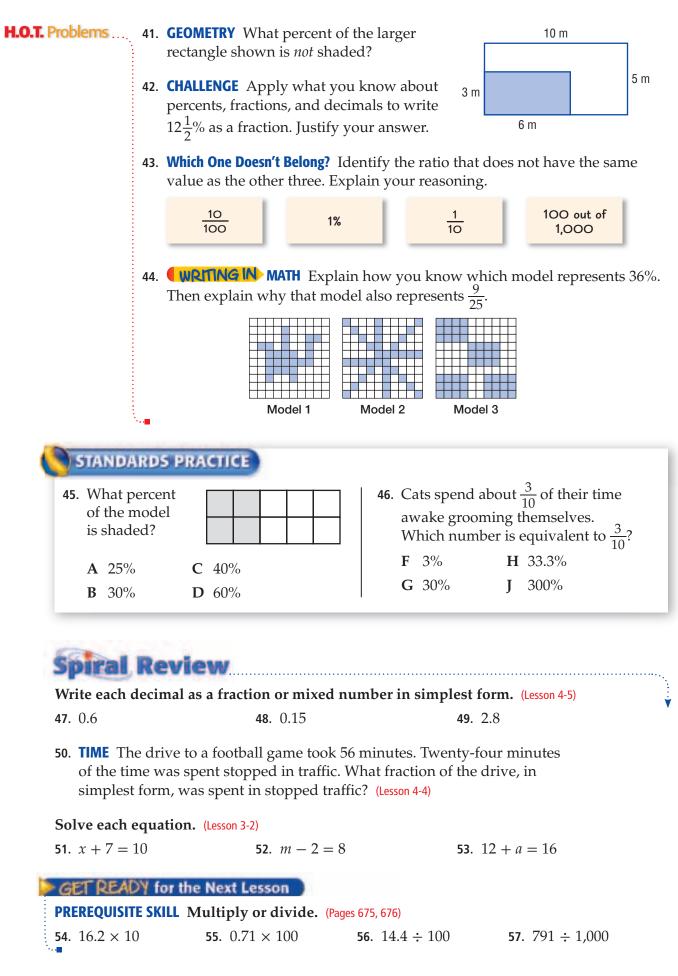
26.	45%	27. 30%	28. 62%	29. 88%
30.	68%	31. 13%	32. 2%	33. 300%

Replace each \bullet with >, <, or =.

34. $\frac{1}{4}$ •25%	35. $\frac{9}{20}$ ● 55%	36. 78% • $\frac{3}{5}$
37. $38\% \bullet \frac{19}{50}$	38. $12\% \bullet 1\frac{1}{5}$	39. $2\frac{2}{5} \bullet 24\%$

40. VOLUNTEERING A Girl Scouts event is expecting 40 out of 50 people to volunteer at a charity auction. So far 30 volunteers have arrived at the auction. What percent of the volunteers have not yet arrived?







Percents and Decimals

Main IDEA

Write percents as decimals and decimals as percents.



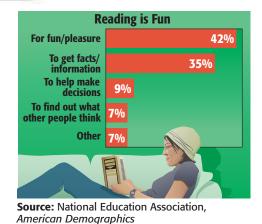
Preparation for Standard 6NS1.1

Compare and order positive and negative fractions, decimals, and mixed numbers and place them on a number line.

GET READY for the Lesson

READING The graphic shows the reasons that students in 6th through 12th grades read.

- 1. Write the percent of students who read for fun as a fraction.
- 2. Write the fraction as a decimal.
- **3**. Compare the decimal in Question 2 with its percent form. Identify any similarities or differences.



In Lesson 4-5, you learned that any fraction can be written as a decimal. You can use this fact to write percents as decimals.

EXAMPLE Write Percents as Decimals

Write 7% as a decimal.

METHOD 1	Write the percent as a fraction.
$7\% = \frac{7}{100}$	Write the percent as a fraction.

- Write the percent as a fraction.
- = 0.07Write the fraction as a decimal.

Division

When dividing by 100, the decimal

point moves two places left.

METHOD 2 Divide mentally.

The % symbol means to divide by 100. So, remove the % symbol and divide by 100.

b. 54%

- 7% = .07Remove the % symbol and divide by 100. Add placeholder zero.
- = 0.07Add leading zero.



Write each percent as a decimal.

a. 8%

c. 85.2%



Real-World EXAMPLE

Concepts in Motion Interactive Lab ca.gr6math.com

2 GEOGRAPHY Alaska is the largest state, making up about $16\frac{1}{10}$ % of the land area of the United States. Write this amount as a decimal.



 $\begin{array}{ll} 16\frac{1}{10}\% = 16.1\% & \mbox{ Write } \frac{1}{10} \mbox{ as } 0.1. \\ &= 16.1 & \mbox{ Remove the } \% \mbox{ symbol and divide by } 100. \\ &= 0.161 & \mbox{ Add leading zero.} \\ \mbox{ So, } 16\frac{1}{10}\% = 0.161. \end{array}$

CHECK Your Progress

- d. **GEOGRAPHY** About $6\frac{4}{5}\%$ of the total area of the United States is water. What decimal represents this amount?
- e. **GEOGRAPHY** The total area of Australia is about $38\frac{11}{20}\%$ of the total area of North America. Write the amount as a decimal.

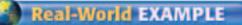
EXAMPLE Write Decimals as Percents

Write 0.4 as a percent.

$0.4 = \frac{4}{10} \text{ or } \frac{40}{100}$	Write the decimal as	a fraction.
= 40%	Write the fraction as a	a percent.
METHOD 2 M	ultiply mentally.	
Multiply by 10	0 and add the % symb	ol.
0.4 = 0.40 M	ultiply by 100. Add a place	eholder zero.
=40% Ac	dd the % symbol.	
So, 0.4 = 40%.		
CHOOSE Your	Method Write each	decimal as a percent.

STUDY TIP

Division When multiplying by 100, the decimal point moves two places right.



SCIENCE About 0.875 of an iceberg's mass is underwater. What percent of an iceberg's mass is underwater?

$$0.875 = 0.875$$
 Multiply by 100.

= 87.5% Add the % symbol.

So, 87.5% of an iceberg's mass is underwater.

CHECK Your Progress

i. **EXERCISE** Each day, Rico and his dog walk 0.625 mile. What percent of a mile do they walk?

CONCEPT Summary

Percent as a Decimal

To write a percent as a decimal, divide the percent by 100 and remove the percent symbol.

25% = .25 or 0.25

Decimal as a Percent

To write a decimal as a percent, multiply the percent by 100 and add the percent symbol.

0.58 = 0.58 = 58%

CHECK Your Understanding

Example 1	Write each perc	ent as a decimal.			
(p. 206)	1. 68%	2. 5%	3. 27.6°	%	
Example 2 (p. 207)		family spends about $33\frac{2}{5}$ al represents the amount	•	come on hous	sing
Example 3	Write each deci	mal as a percent.			
(p. 207)	5. 0.09	6. 0.3	7. 0.73	7. 0.73	
Example 4		The table shows	Player	Average	
(p. 208)	<u> </u>	WNBA players with	Anna DeForge	0.85	
	0	ree-throw averages	Kelly Miller	0.848	
	for the 2005 regular season. What percent of the time does Katie Smith make a free-throw?		Allison Feaster	0.846	
			Katie Smith	0.782	
	Kaue Jilliul		Vickie Johnson	0.774	

Source: wnba.com

Real-World Link Of the world's icebergs, 93% are found surrounding the Antarctic. Source: JPL Polar Oceanography Group

Exercises

HOMEWORKHELP					
For Exercises	See Examples				
9–20	1				
21–22	2				
23-34	3				
35–37	4				

Write each percent as a decimal.

9. 2	7% 1	10.	70%	11.	6%	12.	4%
13 . 1	8.5% 1	14.	56.4%	15.	2.2%	16.	3.8%
17. 2	$7\frac{7}{10}\%$ 1	18.	$15\frac{1}{2}\%$	19.	$30\frac{1}{4}\%$	20.	$46\frac{2}{5}\%$

- **21. BONES** An adult human body has $68\frac{3}{5}\%$ of the number of bones it had at birth. What decimal represents this amount?
- 22. VIDEO GAMES Brian reaches the sixth level of a video game $92\frac{3}{4}\%$ of the time he plays. What decimal represents this percent?

Write each decimal as a percent.

23. 0.7	24. 0.6	25. 5.8	26. 8.2
27 . 0.95	28. 0.08	29. 0.17	30 . 0.78
31 . 0.675	32. 0.145	33 . 0.012	34. 0.7025

LACROSSE For Exercises 35–37, use the table shown. What percent of the games played did each team win?

- 35. Pomona-Pitzer
- **36**. California Polytechnic
- **37**. Which team won 3 out of 12 games?

Davis Club	0.25
California Polytechnic	1.0

Western Women's Lacrosse League,

2006 Season

Portion of

Games Won

0.625

0.9

Replace each \bullet with >, <, or = to make a true sentence.

Source: uslacrossepacific.org

School Name

Chico State

Pomona-Pitzer

38 . 0.25% ● 0.125	39 . 0.76 ● 76.5%	40. 500% ● 50
41 . 99% • 0.985	42. 0.325 • 30%	43 . 56% ● 0.5625

44. SPORTS A tennis player won 0.805 of the matches she played. What percent of the matches did she lose?

ANALYZE TABLES For Exercises 45–48, use the table and the information given.

Five scales can be used to build a model train based on the life-size original. For example, a G-scale train is about 4% of the size of the original. So, the model of a train that measures 75 feet would measure 36 inches.

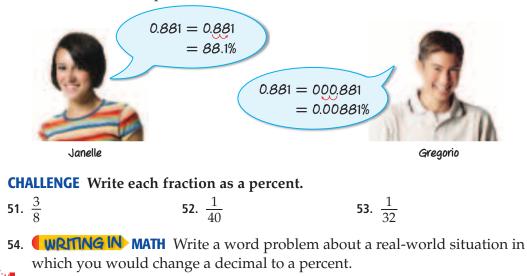
- **45**. Find the decimal equivalents for each scale.
- 46. Which scale is the smallest?
- **47**. Find the approximate length of an actual 75-foot train in the N scale.
- **48**. Which scale is used if a model of a 75-foot train is about 18.75 inches?

Scale	Percent Equivalent
G	4.4%
0	2.083%
HO	1.15%
N	0.625%
Z	0.45%

Source: internettrains.com



- **49. OPEN ENDED** Write any decimal between 0 and 1. Then write it as a fraction in simplest form and as a percent.
- **50. FIND THE ERROR** Janelle and Gregorio both wrote 0.881 as a percent. Who is correct? Explain.



STANDARDS PRACTICE

- 55. It is estimated that 13.9% of the population of Texas was born outside the United States. Which number is not equivalent to 13.9%?
- 56. Which of the following is ordered from least to greatest?
- 139 **C** 0.139 Α 1.000
- **B** $\frac{13.9}{100}$
- **D** 1.39

- **F** 0.42, $\frac{2}{5}$, 50%, $\frac{3}{4}$ **G** $\frac{2}{5}$, 0.42, 50%, $\frac{3}{4}$ **H** $\frac{3}{4}$, $\frac{2}{5}$, 0.42%, 50%
- J $\frac{3}{4}$, 0.42, $\frac{2}{5}$, 50%

Spiral Review

Write each ratio as a percent. (Lesson 4-6)

- **57**. 72 out of 100 animals 60. Write $9\frac{3}{8}$ as a decimal. (Lesson 4-5)
 - **58**. \$9.90:\$100 **59**. 3.1 out of 100 households
- 61. **BALLOONS** Write an integer that represents a hot-air balloon descending 83 feet. (Lesson 2-1)
- 62. MONEY Marina earned \$187.50 by working 30 hours. If she works 35 hours at this rate, how much will she earn? (Lesson 1-1)

GET READY for the Next Lesson

PREREQUISITE SKILL Write the prime factorization of each number. (Lesson 4-1) **65**. 76 **63**. 50 **64**. 32 **66.** 105



Least Common Multiple

Main IDEA

Find the least common multiple of two or more numbers.

Standard 6NS2.4 Determine the least common **multiple** and the greatest common divisor of whole numbers: use them to solve problems with fractions (e.g., to find a common denominator to add two fractions or to find the reduced form for a fraction).

NEW Vocabulary

multiple least common multiple (LCM)



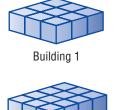
Everyday Use to find the product

Multiple Math Use the product of a number and any whole number

MINI Lab

- Model the first floors of Building 1 and Building 2, as shown.
 - 1. Add a second floor to each building. Record the total number of cubes used in a table like the one shown below.





Building 2

- 2. Add floors until each building has five floors.
- 3. Describe two buildings that have the same number of cubes.
- 4. If you keep adding floors, will the two buildings have the same number of cubes again? Explain.

A **multiple** is the product of a number and any whole number. The least common multiple, or LCM, of two or more numbers is the least of their common multiples, excluding zero.

EXAMPLES Find the LCM

Find the LCM of 6 and 10.

METHOD 1 List the nonzero multiples.

List the multiples of 6 until you come to a number that is also a multiple of 10.

multiples of 6: 6, 12, 18, 24, **30**, ...

multiples of 10: 10, 20, **30**, ...

Notice that 30 is also a multiple of 10. The LCM of 6 and 10 is 30.

METHOD 2 Use prime factorization.

 $6 = 2 \cdot 3$ The prime factors of 6 and 10 are 2, 3, and 5. $10 = 2 \cdot 5$

The LCM is the least product that contains the prime factors of each number. So, the LCM of 6 and 10 is $2 \cdot 3 \cdot 5$ or 30.

So, the LCM of 6 and 10 is 30.

Find the LCM of 45 and 75.

Use Method 2. Find the prime factorization of each number.

$$45 = 3 \cdot 3 \cdot 5 \text{ or } 3^2 \cdot 5$$

$$75 = 3 \cdot 5 \cdot 5 \text{ or } 3 \cdot 5^2$$
The prime factors of 45 and 75
are 3 and 5. Write the prime
factorization using exponents.

The LCM is the product of the prime factors 3 and 5, with each one raised to the *highest* power it occurs in *either* prime factorization. The LCM of 45 and 75 is $3^2 \cdot 5^2$, which is 225.

ø	CHOOSE	Your Method	Find the LCM of	each	set of numbers.
	a. 3, 12	b.	10, 12	C.	25, 30

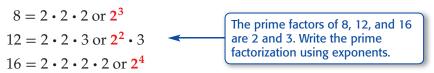


Real-World Link Each day, about 700,000 people in the U.S. celebrate their birthday. Source: hallmark.com

Real-World EXAMPLE

PARTY Ling needs to buy paper plates, napkins, and cups for a party. Plates come in packages of 12, napkins come in packages of 16, and cups come in packages of 8. If she wants to have the same number of plates, napkins, and cups, what is the least number of packages she will have to buy?

First find the LCM of 8, 12, and 16.



The LCM of 8, 12, and 16 is $2^4 \cdot 3$, which is 48.

To find the number of packages of each Ling needs to buy, divide 48 by the amount in each package.

cups: $48 \div 8$ or 6 packages plates: $48 \div 12$ or 4 packages napkins: $48 \div 16$ or 3 packages

So, Ling will need to buy 6 packages of cups, 4 packages of plates, and 3 packages of napkins.

CHECK Your Progress

d. **VEHICLES** Mr. Hernandez changes his car's oil every 3 months, rotates the tires every 6 months, and replaces the air filter once a year. If he completed all three tasks in April, what will be the next month he again completes all three tasks?

Personal Tutor at ca.gr6math.com

CHECK Your Understanding

Examples 1–3	Find the LCM of	each set of numbers.		
(pp. 211–212)	1 . 4, 14	2. 6,7	3 . 12, 15	
	4 . 21, 35	5 . 3, 5, 12	6 . 6, 14, 21	
Example 3	7. GOVERNMENT The number of years per term for a U.S. President, senator, and representative is shown. Suppose a senator was elected in the presidential election year 2004. In what		Elected Office	Term
(p. 212)			President	
			Senator	(
year will he or she campaign again during a presidential election year?		5	Representative	

Exercises

HOMEWO	RKHELP	Fi
For Exercises	See Examples	1
8–13, 20	1, 2	1
14–19, 21	3	14

Find the LCM for each set of numbers.

8 . 6, 8	9 . 8, 18	10 . 12, 16
11. 24, 36	12. 11, 12	13 . 45, 63
14 . 2, 3, 5	15. 6, 8, 9	16 . <i>8</i> , 12, 16
17 . 12, 15, 28	18 . 22, 33, 44	19 . 12, 16, 36

- **20. CHORES** Hernando walks his dog every two days. He gives his dog a bath once a week. Today, Hernando walked his dog and then gave her a bath. How many days will pass before he does both chores on the same day?
- 21. **TEXT MESSAGING** Three friends use text messaging to notify their parents of their whereabouts. If all three contact their parents at 3:00 P.M., at what time will all three contact their parents again at the same time?

Friend	Time Interval
Linda	every 30 min
Brandon	every 45 min
Edward	every 60 min

n (yr) 4 6 2

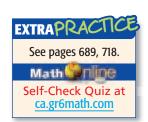
Find the LCM of each set.

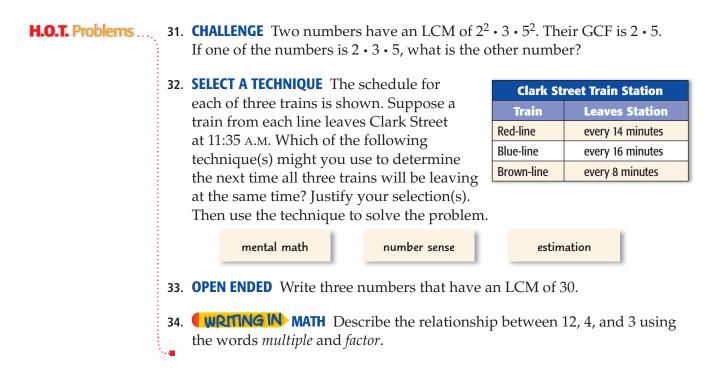
22.	\$3.00, \$14.00	23. 10¢, 25¢, 5¢	24 . 9 inches, 2 feet
-----	-----------------	-------------------------	------------------------------

Write two numbers whose LCM is the given number.

25. 35 26. 56 27. 70 28. 30

- **29. SNACKS** Alvin's mom needs to buy snacks for soccer practice. Juice boxes come in packages of 10. Oatmeal snack bars come in packages of 8. She wants to have the same number of juice boxes and snack bars, what is the least number of packages of each snack that she will have to buy?
- **30. REASONING** The LCM of two consecutive positive numbers is greater than 200 and is a multiple of 7. What are the least possible numbers?





STANDARDS PRACTICE

 35. Which rule describes the common multiples of 12 and 18, where <i>n</i> represents the counting numbers? A 12<i>n</i> B 18<i>n</i> C 36<i>n</i> D 216<i>n</i> 	 36. Which of the following is the least common multiple of 24 and 60? F 72 G 96 H 120 J 1,140
--	---

Spiral Review

Write each percent as	a decimal. (Lesson 4-7)		
37. 55%	38. 26.4%	39. $\frac{1}{4}\%$	40. 2%

- **41. DIAMONDS** Sixty-eight percent of engagement rings have a diamond that is round in shape. Write this percent as a fraction in simplest form. (Lesson 4-6)
- **42. ALGEBRA** Solve 3x = 18. (Lesson 3-3)
- **43. ALGEBRA** Rose swam 7 laps more than twice the number of laps her sister swam. Write an algebraic expression to represent this situation. (Lesson 3-1)

GET READY for the Next Lesson

 PREREQUISITE SKILL Replace each ● with <, > or = to make a true sentence. (Page 670)

 44. 6.85 ● 5.68
 45. 2.34 ● 2.43
 46. 6.9 ● 5.99



Comparing and Ordering Rational Numbers

Main IDEA

Compare and order fractions, decimals, and percents.

Standard 6NS1.1 Compare and order positive and negative fractions, decimals, and mixed numbers and place them on a number line. Standard NS2.4 **Determine the least** common multiple and the greatest common divisor of whole numbers; use them to solve problems with fractions (e.g., to find a common denominator to add two fractions or to find the reduced form for a fraction).

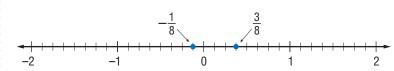
NEW Vocabulary

rational numbers common denominator least common denominator (LCD)

MINI Lab

In Chapter 2, you used a number line to compare integers. You can also use a number line to compare positive and negative fractions.

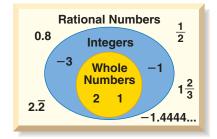
The number line shows that $-\frac{1}{8} < \frac{3}{8}$.



Graph each pair of numbers on a number line. Then determine which number is less.

1. $-\frac{7}{8}, -\frac{3}{8}$	2. $-\frac{5}{8}$, $-1\frac{1}{8}$	3. $-\frac{13}{8}, -\frac{3}{8}$
4. $-1\frac{7}{8}, -1\frac{5}{8}$	5. $-\frac{1}{2}, -\frac{3}{4}$	6. $1\frac{1}{4}, -1\frac{1}{4}$

The different types of numbers you have been using are all examples of rational numbers. A **rational number** is a number that can be expressed as a fraction. Fractions, terminating and repeating decimals, percents, and integers are all rational numbers. The points corresponding to rational numbers begin to "fill in" the number line.



EXAMPLE Compare Rational Numbers

() Replace the • with <, >, or = to make $-1\frac{5}{6} • -1\frac{1}{6}$ a true sentence.

Graph each rational number on a number line. Mark off equal size increments of $\frac{1}{6}$ between -2 and -1.

$$-2 -1\frac{5}{6} -1\frac{4}{6} -1\frac{3}{6} -1\frac{2}{6} -1\frac{1}{6} -1$$

The number line shows that $-1\frac{5}{6} < -1\frac{1}{6}$.

CHECK Your Progress

a. Replace the • with <, >, or = to make $-5\frac{5}{9}$ • $-5\frac{1}{9}$ a true sentence.

A **common denominator** is a common multiple of the denominators of two or more fractions. The least common denominator or LCD is the LCM of the denominators. You can use the LCD to compare fractions.

EXAMPLE Compare Rational Numbers

2 Replace the \bigcirc with <, >, or = to make $\frac{7}{12} \bigcirc \frac{8}{18}$ a true sentence. $12 = 2^2 \cdot 3$ and $18 = 2 \cdot 3^2$. So, the LCM is $2^2 \cdot 3^2$ or 36. The LCD of the denominators 12 and 18 is 36. $\frac{8}{18} = \frac{8 \times 2}{18 \times 2}$ $\frac{7}{12} = \frac{7 \times 3}{12 \times 3}$ $=\frac{16}{36}$ $=\frac{21}{26}$ Since $\frac{21}{36} > \frac{16}{36}$, then $\frac{7}{12} > \frac{8}{18}$. CHECK Your Progress Replace each ● with <, >, or = to make a true sentence. **b.** $\frac{5}{6} \bullet \frac{7}{9}$ **c.** $\frac{1}{5} \bullet \frac{7}{50}$ **d.** $-\frac{9}{16} \bullet -\frac{7}{10}$

You can also compare fractions by writing each fraction as a decimal and then comparing the decimals.

Real-World EXAMPLE

3 MOUNTAIN BIKING In Coach Ito's first period class, 19 out of 32 students own a mountain bike. In his seventh period class, 16 out of 28 students own a mountain bike. In which class do a greater fraction of students own a mountain bike?

Since the denominators are large, write $\frac{19}{32}$ and $\frac{16}{28}$ as decimals and then compare.

 $19 \div 32 \approx 0.5938$ $16 \div 28 \approx 0.5714$ Divide.

Since 0.5938 > 0.5714, then $\frac{19}{32} > \frac{16}{28}$.

So, a greater fraction of students in the first period class own a mountain bike.

CHECK Your Progress

e. BOWLING Twelve out of 32 students in second period class like to bowl. In fifth period class, 12 out of 29 students like to bowl. In which class do a greater fraction of the students like to bowl?

Real-World Link . . More than 8.2 million

people participate in off-road mountain

biking each year. Source: National Sporting

Goods Association



It is a good idea to memorize these fraction-decimal-percent equivalents because they are used frequently.

CONCEPT	Summary	Fractions-Decimals-Percents		
$\frac{1}{4} = 0.25 = 25\%$	$\frac{1}{5} = 0.2 = 20\%$	$\frac{1}{8} = 0.125 = 12.5\%$	$\frac{1}{10} = 0.1 = 10\%$	
$\frac{1}{2} = 0.5 = 50\%$	$\frac{2}{5} = 0.4 = 40\%$	$\frac{3}{8} = 0.375 = 37.5\%$	$\frac{3}{10} = 0.3 = 30\%$	
$\frac{3}{4} = 0.75 = 75\%$	$\frac{3}{5} = 0.6 = 60\%$	$\frac{1}{3} = 0.\overline{3} = 33.\overline{3}\%$	$\frac{7}{10} = 0.7 = 70\%$	
1 = 1.00 = 100%	$\frac{4}{5} = 0.8 = 80\%$	$\frac{2}{3} = 0.\overline{6} = 66.\overline{6}\%$	$\frac{9}{10} = 0.9 = 90\%$	

STANDARDS EXAMPLE

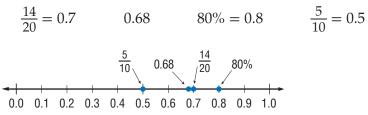
Emma's quiz scores for the grading period are $\frac{14}{20}$, 0.68, 80%, and $\frac{5}{10}$. Which list shows the scores from least to greatest?

A80%, $\frac{14}{20}$, 0.68, $\frac{5}{10}$ C80%, 0.68, $\frac{14}{20}$, $\frac{5}{10}$ B $\frac{5}{10}$, $\frac{14}{20}$, 0.68, 80%D $\frac{5}{10}$, 0.68, $\frac{14}{20}$, 80%

Read the Item

First write each number as a decimal. Then compare.

Solve the Item



Since $\frac{5}{10} < 0.68 < \frac{14}{20} < 80\%$, the answer is D.

CHECK Your Progress

- f. The amount of rain received on four consecutive days was 0.3-inch, $\frac{3}{5}$ -inch, 0.75-inch, and $\frac{2}{3}$ -inch. Which list shows the amounts from least to greatest?
- F $0.3-in, \frac{2}{3}-in., \frac{3}{5}-in., 0.75-in.$ H $0.75-in., \frac{2}{3}-in., \frac{3}{5}-in., 0.3-in.$ G $0.3-in, \frac{3}{5}-in., \frac{2}{3}-in., 0.75-in.$ J $\frac{3}{5}-in., \frac{2}{3}-in., 0.3-in., 0.75-in.$ Personal Tutor at ca.gr6math.com

Test-Taking Tip

Eliminate Possibilities

Eliminate the possibilities that you know are incorrect. Then consider the choices that remain. In Example 4, you can eliminate Choices A and C since 80% > 0.68.

CHECK Your Understanding

Examples 1–2 (pp. 215–216)	Replace each • with <, necessary.	>, or = to ma	ke a true sente	ence. Use	e a number line if
	1. $-\frac{4}{9} \bullet -\frac{7}{9}$ 2.	$-1\frac{3}{4} \bullet -1\frac{6}{8}$	3. $\frac{3}{8} \bullet \frac{6}{15}$	4	$2\frac{4}{5} \bullet 2\frac{7}{8}$
Example 3 (p. 216)	 SOCCER The table sh two soccer goalies. V Elliot or Shanna? Ex SCHOOL On her first questions correctly. 	Vho has the be plain. quiz in social s	tter average, studies, Majori		
Example 4 (p. 217)	 questions correctly. On her second quiz, she answered 27 out of 30 questions correctly. On which quiz did Majorie have the greater score? 5TANDARDS PRACTICE The lengths of four insects are 0.02-inch, ¹/₈-inch, 0.1-inch, and ²/₃-inch. Which list shows the lengths in inches from least to greatest? 				
	A 0.1, 0.02, $\frac{1}{8}$, $\frac{2}{3}$ B $\frac{1}{8}$, 0.02, 0.1, $\frac{2}{3}$		C 0.02, 0.1 D $\frac{2}{3}$, 0.02,	0 0	
Evenuel					

Exercises

HOMEWORK HELP		
For Exercises	See Examples	
8–19	1, 2	
20–25, 49	3	
26–31, 48	4	

Replace each ● with <, >, or = to make a true sentence. Use a number line if necessary.

- **20.** 40% 112 out of 25

per day? Explain.

- **22**. 0.82 5 out of 6
- 8. $-\frac{3}{5} \bullet -\frac{4}{5}$ 9. $-\frac{5}{7} \bullet -\frac{2}{7}$ 10. $-7\frac{5}{8} \bullet -7\frac{1}{8}$ 11. $-3\frac{2}{3} \bullet -3\frac{4}{6}$ **12.** $\frac{7}{10} \bullet \frac{2}{3}$ **13.** $\frac{4}{7} \bullet \frac{5}{8}$ **14.** $\frac{2}{3} \bullet \frac{10}{15}$ **15.** $-\frac{17}{24} \bullet -\frac{11}{12}$ **16.** $2\frac{3}{4} \bullet 2\frac{2}{3}$ **17.** $6\frac{2}{3} \bullet 6\frac{1}{2}$ **18.** $5\frac{5}{7} \bullet 5\frac{11}{14}$ **19.** $3\frac{11}{16} \bullet 3\frac{7}{8}$ **21**. 3 out of 5 • 59%
- 24. **WEATHER** The table shows about how much rain falls in Albuquerque and Denver. Which city has the greater fraction of inches of rain

City	Amount of Rain (in.)	Number of Days
Albuquerque, NM	9	60
Denver, CO	15	90

Source: weather.com

23. 9 out of 20 • 0.45

25. GAMES Rocio and Cecil played darts. Rocio hit the bull's-eye 5 out of 18 times. Cecil *missed* the bull's-eye 4 out of 15 times. Who hit the bull's-eye a greater fraction of the time?

Order each set of numbers from least to greatest.

26. 0.23, 19%, $\frac{1}{5}$	27 . $\frac{8}{10}$, 81%, 0.805	28. $-0.615, -\frac{5}{8}, -0.62$
29. $-1.4, -1\frac{1}{25}, -1.25$	30. 7.49, $7\frac{49}{50}$, 7.5	31. $3\frac{4}{7}, 3\frac{3}{5}, 3.47$

MEASUREMENT Replace each • with <, >, or = to make a true sentence.

32. $\frac{5}{8}$ yard $\bigcirc \frac{1}{16}$ yard**33.** 0.25 pound $\bigcirc \frac{2}{9}$ pound**34.** $2\frac{5}{6}$ hours $\bigcirc 2.8$ hours**35.** $1\frac{7}{12}$ gallons $\bigcirc 1\frac{5}{8}$ gallons

MEASUREMENT Order each of the following from least to greatest.

36. 4.4 miles, $4\frac{3}{8}$ miles, $4\frac{5}{12}$ miles**37.** 6.5 cups, $6\frac{1}{3}$ cups, 6 cups**38.** 1.2 laps, 2 laps, $\frac{1}{2}$ lap**39.** $\frac{1}{5}$ gram, 5 grams, 1.5 grams

ANIMALS For Exercises 40–42, use the table that shows the lengths of the smallest mammals.

Animal	Length (ft)
Eastern Chipmunk	$\frac{1}{3}$
Kitti's Hog-nosed Bat	0.83
European Mole	<u>5</u> 12
Masked Shrew	$\frac{1}{6}$
Spiny Pocket Mouse	0.25

Source: Scholastic Book of World Records

- 40. Which animal is the smallest mammal?
- **41**. Which animal is smaller than the European mole but larger than the spiny pocket mouse?
- 42. Order the animals from greatest to least size.

:-SOFTBALL For Exercises 43 and 44, use the following table which shows the at-bats, hits, and home run statistics for four players on the 2004 Olympics U.S. Women's softball team.

Player	At-Bats	Hits	Home Runs
Crystal Bustos	26	9	5
Kelly Krestschman	21	7	1
Stacey Nuveman	16	5	2
Natasha Watley	30	12	0

Source: olympics.org

- **43**. Write the ratio of hits to at-bats as a decimal to the nearest thousandth for each player. Who had the greatest batting average during the Olympic games?
 - **44**. Write the ratio of home runs to at-bats as a decimal for each player. Who had the greatest home run average during the Olympic games?



Real-World Link .

The Olympic gold medals are actually made out of 92.5% silver, with the gold medal covered in 6 grams of pure gold. **Source:** about.com

EXTRAPRACTICE

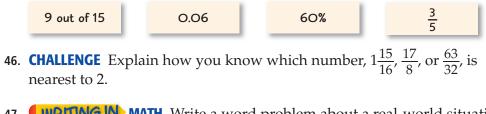
See pages 690, 718.

Math Conce Self-Check Quiz at

ca.gr6math.com



45. Which One Doesn't Belong? Identify the ratio that does not have the same value as the other three. Explain your reasoning.

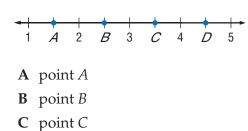


47. **WRITING IN MATH** Write a word problem about a real-world situation in which you would compare rational numbers. Then solve the problem.

STANDARDS PRACTICE

D point D

48. Which point shows the location of $\frac{7}{2}$ on the number line?



49. Which list of numbers is ordered from least to greatest?

F
$$\frac{1}{4}$$
, $4\frac{1}{4}$, 0.4, 0.04

G 0.04, 0.4,
$$4\frac{1}{4}, \frac{1}{4}$$

H 0.04,
$$\frac{1}{4}$$
, 0.4, $4\frac{1}{4}$
J 0.4, $\frac{1}{4}$, 0.04, $4\frac{1}{4}$

50. Which of the following fractions is closest to 0?

A
$$-\frac{3}{4}$$

B $-\frac{2}{3}$
C $\frac{7}{12}$

D
$$\frac{5}{8}$$

Spiral Review Find the LCM of each set of numbers. (Lesson 4-8) What's On Top? **51**. 14, 21 **52**. 3, 13 **53**. 12, 16 Onions 4% Other **FOOD** The graph shows the results of a survey for 7% favorite pizza toppings. Write the percent of people Vegetables who chose each topping as a decimal. (Lesson 4-7) 13% Pepperoni 43% 55. vegetables 54. onions 56. mushrooms Mushrooms 14% 57. Find the GCF of 18 and 72. (Lesson 4-2) Sausage 19%

Source: Market Facts for Bolla

ALGEBRA Solve each equation. (Lesson 3-5)

59. 2n - 5 = 19 **60.** -8 = -3d + 1**58.** 4x + 3 = 15

Study Guide and **Ŕeview**



Review from ca.gr6math.com

DLDARLES

CHAPTED

Be sure the following Key Concepts are noted in your Foldable.



READY to Study

Key Concept

Greatest Common Factor (Lesson 4-2)

GET

• The greatest common factor or GCF is the greatest of the common factors of two or more numbers.

Fractions, Decimals, and Percents

(Lessons 4-4 to 4-7)

- A fraction is in simplest form when the GCF of the numerator and denominator is 1.
- A terminating decimal is a decimal whose digits end. Repeating decimals have a pattern in the digits that repeats forever.
- A percent is a part to whole ratio that compares a number to 100.
- To write a percent as a decimal, divide the percent by 100 and remove the percent symbol.
- To write a decimal as a percent, multiply the percent by 100 and add the percent symbol.

Least Common Multiple (Lesson 4-8)

• The least common multiple or LCM of two or more numbers is the least of their common multiples.

Rational Numbers (Lesson 4-9)

• A rational number is one that can be expressed as a fraction.

Key Vocabulary

bar notation (p. 197) common denominator (p. 216) composite number (p. 181) equivalent fractions (p. 192) ratio (p. 202) factor tree (p. 182) greatest common factor (GCF) (p. 186) least common denominator (p. 216) least common multiple (LCM) (p. 211)

multiple (p. 211) percent (p. 202) prime factorization (p. 182) prime number (p. 181) rational number (p. 215) repeating decimal (p. 197) simplest form (p. 192) terminating decimal (p. 197)

Vocabulary Check

State whether each sentence is *true* or *false*. If *false*, replace the underlined word or number to make a true sentence.

- 1. A ratio is a comparison of two numbers by multiplication.
- 2. A <u>rational number</u> is a whole number greater than 1 that has exactly two factors, 1 and itself.
- **3**. 1.875 is an example of a <u>terminating</u> decimal.
- 4. A common denominator for the fractions $\frac{2}{3}$ and $\frac{1}{4}$ is <u>12</u>.
- 5. The greatest common factor of 3 and 5 is 15.
- 6. A ratio that compares a number to <u>100</u> is a percent.
- 7. The fractions $\frac{9}{21}$ and $\frac{3}{7}$ are <u>equivalent</u> fractions.



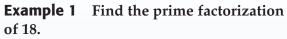
Lesson-by-Lesson Review

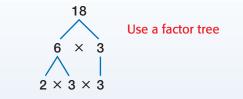
4-1

Prime Factorization (pp. 181–184)

Find the prime factorization of each number.

- **8.** 54 **9.** 128 **10.** 68 **11.** 95
- **12. ALGEBRA** Factor $36x^2yz^3$.
- **13. PLANTS** The palm tree *raffia* has leaves up to 65 feet long. Write this length as a product of primes.





The prime factorization of 18 is 2×3^2 .

4-2

Greatest Common Factor (p. 186–189)

Find the GCF of each set of numbers.

14.	18, 27	15 . 30, 72
16.	28, 70, 98	17 . 42, 63, 105

- **18. ALGEBRA** Find the GCF of 18w and $54w^2y$.
- **19. CLOTHING** Maria spent a total of \$24 on earrings, \$36 on shirts, and \$48 on shorts. If each item cost the same amount, what is the greatest possible price per item?

Example 2 Find the GCF of 24 and 56.

First, make a list of all the factors of 24 and 56.

factors of 24: **1**, **2**, 3, **4**, 6, **8**, 12, 24 factors of 56: **1**, **2**, **4**, 7, **8**, 14, 28, 56 common factors: **1**, **2**, **4**, **8** The GCF of 24 and 56 is 8.

4-3

PSI: Make an Organized List (pp. 190–191)

Solve by making an organized list.

- **20. SEATING** In how many ways can four friends sit in a row at the movies?
- 21. **TELEPHONES** A phone company offers 5 different types of long-distance plans and 3 different caller features (call waiting, caller ID, and call forward). How many different kinds of plans can be set up that include a long-distance service and a caller feature?

Example 3 In how many ways can the letters A, B, and C be arranged?

The possible outcomes are written below.

ABC ACB BAC BCA CAB CBA

There are 6 different ways to arrange the letters.

4-6

Simplifying Fractions (pp. 192–195)

Write each fraction in simplest form.

22 . $\frac{12}{15}$	23. $\frac{35}{60}$	24 . $\frac{11}{121}$
25 . $\frac{14}{63}$	26. $\frac{37}{45}$	27 . $\frac{55}{110}$

28. CATS The average household cat sleeps 18 hours a day. Write a fraction in simplest form comparing the number of hours a household cat sleeps to the number of hours in a day.

Example 4 Write $\frac{24}{32}$ in simplest form.

Find the GCF of the numerator and denominator.

 $\frac{24}{32} = \frac{24 \div 8}{32 \div 8} = \frac{3}{4}$ Divide the numerator and denominator by the GCF.

4-5 Fractions and Decimals (pp. 196–200)

Write each fraction or mixed number as a decimal. Use bar notation if the decimal is a repeating decimal. 3 7 5

29.	$\frac{3}{4}$	30. $\frac{7}{8}$	31 . $\frac{3}{9}$
32.	$4\frac{1}{3}$	33. $6\frac{2}{5}$	34. $1\frac{6}{7}$

Write each decimal as a fraction in simplest form.

35.	0.7	36. 0.44	a 37.	0.05
38.	0.18	39. 0.54	4 0 .	0.08

41. RUNNING Jeremy ran a mile in 5 minutes and 8 seconds. Write this time in minutes as a decimal.

Example 5	Write $\frac{3}{8}$ as a decimal.		
	0.375 8)3.000	So, $\frac{3}{8} = 0.375$.	
	<u>- 24</u>		
	60 <u>- 56</u>		
	40 - 40		
	0		
Example 6		as a fraction.	

Write 0.64 as a fraction.
Write as a fraction with a
denominator of 100.
Simplify.

Fractions and Percents (pp. 202–205)

Write each fraction as a percent.

42. $\frac{32}{100}$ **43.** $\frac{11}{25}$ **44.** $\frac{47}{50}$ **45.** $\frac{8}{20}$

Write each percent as a fraction in simplest form.

46. 68% **47.** 95% **48.** 42% **49.** 16%

50. FOOD A survey showed that 58% of school children like peanut butter and jelly sandwiches. Write this percent as a fraction in simplest form.

	Write $\frac{27}{50}$ as a percent.
$\frac{27}{50} = \frac{54}{100}$	Write an equivalent fraction with a denominator of 100.
= 54%	Definition of percent
Example 8	Write 96% as a fraction.
Example 8 $96\% = \frac{96}{100}$	Write 96% as a fraction. Definition of percent
•	



Study Guide and Review



4-8

4-9

Percents and Decimals (pp. 206–210)

Write each percent as a decimal.

- **51.** 48% **52.** 7%
- **53.** 12.5% **54.** $75\frac{1}{4}\%$

Write each decimal as a percent.

- **55.** 0.61 **56.** 0.055 **57.** 0.19 **58.** 0.999
- **59. WEATHER** Twenty-three percent of the days last month were rainy. Write this percent as a decimal.

Example 9Write 35% as a decimal. $35\% = \frac{35}{100}$ Write the percent as a fraction.= 0.35Write the fraction as a decimal.Example 10Write 0.625 as a percent.0.625 = 0.625Multiply by 100.= 62.5%Add the % symbol.

Least Common Multiple (pp. 211–214)

Find the LCM of each set of numbers.

60 . 9, 15	61 . 4, 8
62. 16, 24	63 . 3, 8, 12
64 . 4, 9, 12	65 . 15, 24, 30

66. BREAKFAST At a bakery, muffins come in dozens and individual serving containers of orange juice come in packs of 8. If Avery needs to have the same amount of muffins as orange juice containers, what is the least possible number of sets of each he needs to buy?

Example 11 Find the LCM of 8 and 36.

Write each prime factorization.

 $8 = 2 \times 2 \times 2 = 2^{3}$ $36 = 2 \times 2 \times 3 \times 3 = 2^{2} \times 3^{2}$

LCM: $2^3 \times 3^2 = 72$

The LCM of 8 and 36 is 72.

Comparing and Ordering Rational Numbers (pp. 215–220)

Replace each • with <, >, or = to make a true sentence. 67 $\frac{3}{2}$ 68 -0.45 $-\frac{9}{2}$

67.
$$\frac{3}{8} \bullet \frac{2}{3}$$

68. $-0.45 \bullet -\frac{9}{20}$
69. $\frac{8}{9} \bullet 85\%$
70. $-3\frac{3}{4} \bullet -3\frac{5}{8}$

71. **SCHOOL** Michael received a $\frac{26}{30}$ on his English quiz and received 81% on his Biology test. In which class did he receive the higher score?

Example 12 Replace • with <,>, or = to make $\frac{3}{5}$ • $\frac{5}{8}$ a true sentence. Find equivalent fractions. The LCD is 40. $\frac{3}{5} = \frac{3 \times 8}{5 \times 8} = \frac{24}{40}$ $\frac{5}{8} = \frac{5 \times 5}{8 \times 5} = \frac{25}{40}$ Since $\frac{24}{40} < \frac{25}{40}$, then $\frac{3}{5} < \frac{5}{8}$.

Practice Test

- 1. Find the prime factorization of 72.
- 2. Find the GCF of 24 and 40.

CHAPTER

3. SCHEDULES Farijah registered for French, Pre-Algebra, Life Science, English, and Social Studies. French is only offered first period, Pre-Algebra is only offered fifth period, and she must have lunch fourth period. How many different schedules can she create out of a six period day? Use the make an organized list strategy.

Write each fraction in simplest form.

5. $\frac{64}{72}$ 4. $\frac{24}{60}$

Write each fraction, mixed number, or percent as a decimal. Use bar notation if the decimal is a repeating decimal.

6.
$$\frac{7}{9}$$
 7. $4\frac{5}{8}$ **8.** 91%

9. **PRESIDENTS** Calvin Coolidge was the thirtieth president of the United States. He slept an average of 10 hours a day, the most of any United States president. What percent of time each day did President Coolidge sleep?

Write each decimal or percent as a fraction in simplest form.

11. 0.006 12. 42% 10. 0.84

- **STANDARDS PRACTICE** Which of the 13. following is equivalent to the expression 4.7×10^3 ?
 - A 4.700
 - **B** 47
 - **C** 470
 - **D** 4,700

Write each fraction or decimal as a percent. 14. $\frac{15}{25}$ 35

- **17. PAINTING** Adrian has already painted 46 square feet of a wall measuring 10 feet by 10 feet. What percent of the wall has he painted?
- **STANDARDS PRACTICE** What percent of 18. the figure below is unshaded?

F 15%

G 30%

- **H** 40%
- **J** 60%

Find the LCM of each set of numbers.

19. 18, 42 20. 4, 5, 12

21. INSECTS One type of cicada emerges from hibernation every 17 years. Another type of cicada emerges every 13 years. If both come out of hibernation in the same year, after how many years will this happen again?

Replace each \bullet with <, >, or = to make a true sentence.

22.
$$-\frac{3}{5} \bullet -\frac{5}{9}$$
 23. $4\frac{7}{12} \bullet 4\frac{6}{8}$ **24.** $\frac{13}{20} \bullet 65\%$

25. BASKETBALL To make it past the first round of tryouts for the basketball team, Paul must make at least 35% of his free-throw attempts. During the first round of tryouts he makes 17 out of 40 attempts. Did Paul make it to the next round of tryouts? Explain your reasoning.

CHAPTER

California Standards Practice Cumulative, Chapters 1-4



Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.

1 A large school system estimates that 0.706 of its students will take the bus to school throughout the school year. Which number is greater than 0.706?

A
$$\frac{706}{1,000}$$

B
$$-1\frac{6}{7}$$

C
$$\frac{76}{100}$$

- 2 Debra is working on three different art projects. She has completed $\frac{1}{4}$, $\frac{3}{8}$, and $\frac{1}{2}$ of these projects, respectively. Which list shows the percent of work completed on these projects from least to greatest?
 - **F** 37.5%, 50%, 25%
 - **G** 50%, 37.5%, 25%
 - H 25%, 37.5%, 50%
 - J 25%, 50%, 87.5%
- 3 Which of the following is the prime factored form of the lowest common denominator of $\frac{1}{6}$ and $\frac{3}{8}$?
 - A $2^2 \times 3 \times 5$
 - **B** $2^3 \times 5$
 - C 2×6
 - **D** $2^3 \times 3$

TEST-TAKING TIP

Question 3 Eliminate any answer choices that you know are incorrect. Since 8 does not have a factor of 3, you can eliminate answer choice A.

4 Solve the equation x + 7 = -3. What is the value of *x*?

F 4 **H** -4

G 3 J -10

- 5 At a wedding reception, the number of seats *s* is equal to the 8 times the number of tables *t*. Which equation matches this situation?
 - **A** s = 8 + t **B** $t = 8 \cdot s$ **C** $s = 8 \cdot t$ **D** t = 8 - t
 - \mathbf{D} i = 0 i
- **6** Which problem situation matches the equation below?

$$x + 12 = 35$$

- **F** The difference between two numbers is 35. One of the numbers is 12. What is *x*, the other number?
- **G** Laura is 12 years younger than her brother. If Laura is 35 years old, find her brother's age *x*.
- **H** The sum of a number, *x*, and 12 is 35. What is the value of *x*?
- J Karen had \$35. If she received \$12, what is *x*, the total amount she now has?
- 7 Which of the following is true when evaluating the expression $3 \cdot 4^2 12 \div 6$?
 - A Multiply 3 by 4 first since multiplication comes before subtraction.
 - **B** Evaluate 4^2 first since it is a power.
 - **C** Divide 12 by 6 first since division comes before multiplication.
 - **D** Multiply 3 by 4 first since all operations occur in order from left to right.



California Standards Practice at ca.gr6math.com

More California Standards Practice For practice by standard, see pages CA1–CA39.

8 Which sequence follows the rule 2n + 5, where *n* represents the position of a term in the sequence?

F 3, 5, 7, 9, 11,	H 7, 9, 11, 13, 15,
G 6, 8, 10, 12, 14,	J 8, 12, 16, 20, 24,

- 9 Nicholas used the Distributive Property to evaluate the expression 5(12 + 7) mentally. Which of the following is a correct use of the Distributive Property to evaluate this expression?
 - A 5(12 + 7) = 5(12) + 5(7) = 60 + 35 or 95
 - **B** 5(12 + 7) = 5(12) + 7 = 60 + 7 or 67
 - C 5(12+7) = 12 + 5(7) = 12 + 35 or 47
 - **D** 5(12+7) = 5 + 60 + 5 + 7 = 65 + 12 or 77
- **10** Which of the following relationships is represented by the data in the table?

X	У
1	5,280
2	10,560
3	15,840
4	21,120
5	26,400

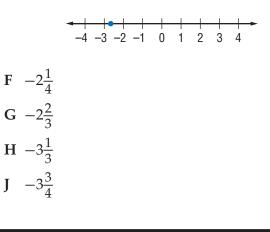
- **F** Conversion of miles to feet
- G Conversion of inches to yards
- H Conversion of feet to miles
- J Conversion of yards to inches

11 If g = 4, m = 3, and n = 6, then $\frac{mn + 2}{g} + 1$ is equivalent to which of the following?

A	6	C 3
B	5	D 2

NEED EXTRA HELD?

12 Which number is best represented by the point graphed on the number line below?



Pre-AP

Record your answers on a sheet of paper. Show your work.

13 The table shows the number of students who volunteered at the food bank.

Classroom	Number of Students Volunteering	Total Number of Students
А	7	24
В	3	8
С	6	18

- a. Model the fraction of the number of students volunteering to the total number of students for each classroom on grid paper.
- **b.** Which classroom had the greatest number of students volunteering?
- c. Which classroom had the greatest fraction of students volunteering?
- d. Write each ratio as a fraction in simplest form, as a decimal, and as a percent.

If You Missed Question	1	2	3	4	5	6	7	8	9	10	11	12	13
Go to Lesson	4-9	4-9	4-2	3-2	3-1	3-1	1-4	1-9	1-8	2-6	1-4	4-9	4-9
For Help with Standard	NS1.1	NS1.1	NS2.4	AF1.1	AF1.2	AF1.2	AF1.3	AF1.2	AF1.3	MR1.1	AF1.3	NS1.1	NS1.1





 Standard 6NS2.0
 Calculate and solve problems involving addition, subtraction, multiplication, and division.

Key Vocabulary

compatible numbers (p. 232) like fractions (p. 236) reciprocal (p. 258) unlike fractions (p. 237)

Applying Fractions



Baking The measurements found on measuring cups and spoons are written as fractions. You will use fractions to find how much of each ingredient is needed when you make part of a whole recipe.

FOLDABLES Study Organizer

Applying Fractions Make this Foldable to help you organize your notes. Begin with a plain sheet of 11" by 17" paper, four index cards, and glue.

Fold the paper in half widthwise.

3 Glue the edge on each

side to form two pockets.



Open and fold along the length about $2\frac{1}{2}$ " from the bottom.



Label the pockets Fractions and Mixed Numbers, respectively. Place two index cards in each pocket.





Chapter 5 Applying Fractions

228

Eclinse Studios

GET READY for Chapter 5

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 2

Math Online Take the Online Readiness Quiz at ca.gr6math.com

Take the Quick Check below. Refer to the Quick Review for help.

Option 1

QUICKCheck	QUICKReview
Find the LCD of each pair of fractions. (Lesson 4-8) 1. $\frac{5}{7}$, $\frac{3}{5}$ 2. $\frac{1}{2}$, $\frac{4}{9}$ 3. $\frac{8}{15}$, $\frac{1}{6}$ 4. $\frac{3}{4}$, $\frac{7}{10}$	Example 1 Find the LCD of $\frac{5}{6}$ and $\frac{3}{10}$. The LCD is the LCM of the denominators, 6 and 10, or 30.
 Multiply or divide. (Prior Grade) 5. 1.8 × 12 6. 99 ÷ 12 7. 83 ÷ 100 8. 4.6 × 0.3 9. MEASUREMENT How many 1.6-meter sections of rope can be cut from a length of rope 6.4 meters? (Prior Grade) 10. COINS Manuel owes each of 8 friends \$0.35. How much does he owe in all? (Prior Grade) 	Example 2 Find 7.8 \div 0.25. 31.2 $0.25)7.800$ -7.5 30 -25 50 -50 0
Complete to show equivalent mixed numbers. (Prior Grade) 11. $3\frac{1}{5} = 2\frac{1}{5}$ 12. $9\frac{2}{3} = 1\frac{5}{3}$ 13. $6\frac{1}{4} = 5\frac{1}{4}$ 14. $8\frac{6}{7} = 7\frac{1}{7}$ 15. RECIPES A recipe calls for $4\frac{2}{3}$ cups of flour. This is equivalent to 3 cups of flour plus an additional	Example 3 Complete $4\frac{2}{9} = 1\frac{11}{9}$ to show equivalent mixed numbers. $4\frac{2}{9} = 3 + 1\frac{2}{9}$ $= 3 + \frac{9}{9} + \frac{2}{9}$ $= 3 + \frac{11}{9}$ $= 3\frac{11}{9}$

15. RECIPES A recipe calls for $4\frac{2}{3}$ cups of flour. This is equivalent to 3 cups of flour plus an additional how many cups of flour? (Prior Grade)

Estimating with Fractions

horizontal

vertical support

support

Main IDEA

Estimate sums, differences, products, and quotients of fractions and mixed numbers.



Standard 6NS2.1 Solve problems involving addition, subtraction, multiplication, and division of positive fractions and explain why a particular operation was used for a given situation.

NEW Vocabulary

compatible numbers

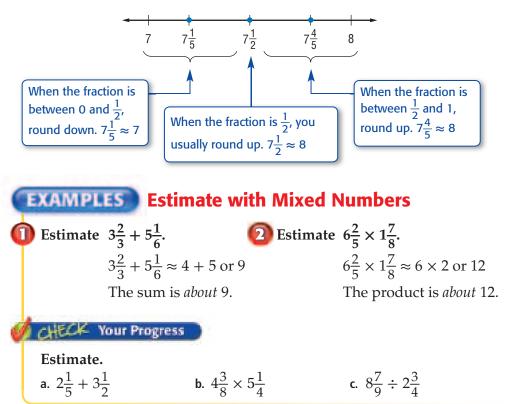
READY for the Lesson

KITES For a kite to have balance while flying, the left and right sides of the horizontal support must each be $\frac{2}{3}$ as long as the bottom of the vertical support. Also, the top must be $\frac{1}{3}$ as long as the bottom portion.

1. Suppose the bottom portion of the vertical support is $2\frac{3}{4}$ feet. Round this length to the nearest foot.

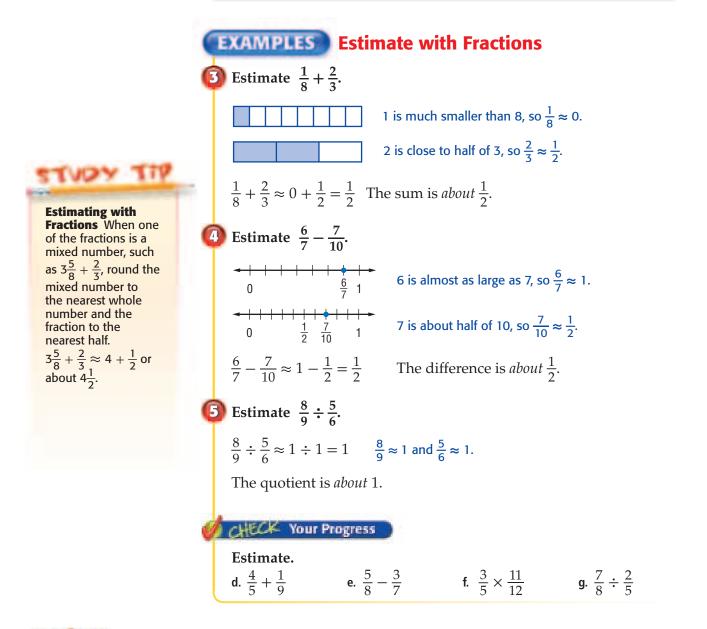
- 2. About how long should the upper portion of the vertical support be?
- 3. About how long should the left and right sides of the horizontal support be?

To estimate the sum, difference, product, or quotient of mixed numbers, round the mixed numbers to the nearest whole number.

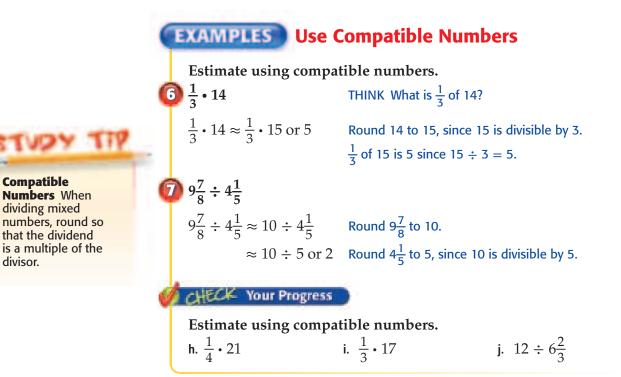


To estimate the sum, difference, product, or quotient of fractions, round each fraction to $0, \frac{1}{2}$, or 1, whichever is closest. Number lines and fraction models, like the ones shown below, can help you decide how to round.

Fractions Close to 0	Fractions Close to $\frac{1}{2}$	Fractions Close to 1
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c c} \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet \\ 0 & & \frac{9}{10} \\ \end{array}$
1 7	<u>4</u> 9	<u>5</u> 6
The numerator is much smaller than the denominator.	The numerator is about half of the denominator.	The numerator is almost as large as the denominator.



Compatible numbers, or numbers that are easy to compute mentally, can also be used to estimate.



Real-World EXAMPLE

MONSTER TRUCKS The height of the wheels on the monster truck at the left is about $\frac{2}{3}$ of the total height of the truck. Estimate the height of the wheels.

Words	Wheel height is $\frac{2}{3}$ of the truck height. Let <i>x</i> represent the wheel height.				
Variable					
Equation	X	=	$\frac{2}{3}$	•	$15\frac{1}{2}$

 $x \approx \frac{2}{3} \cdot 15$ Round $15\frac{1}{2}$ to 15, since 15 is divisible by 3. $x \approx 10$ $\frac{1}{3}$ of 15 is 5, so $\frac{2}{3}$ of 15 is 2 • 5 or 10.

The wheels are about 10 feet high.

CHECK Your Progress

k. MEASUREMENT The area of a rectangle is $19\frac{3}{4}$ square feet. The width of the rectangle is $5\frac{1}{4}$ feet. What is the approximate length of the rectangle?

Dersonal Tutor at ca.gr6math.com

Real-World Link The monster truck shown is $15\frac{1}{2}$ feet tall

and weighs 28,000

monstertrucks-uk.com

pounds. Source:

Michael Newman/PhotoEdit

Your Understanding



-5	Estimate.		
31)	1. $8\frac{3}{2} + 3$		

1. $8\frac{3}{8} + 1\frac{4}{5}$	2. $2\frac{5}{6} - 1\frac{1}{8}$	3. $5\frac{5}{7} \cdot 2\frac{7}{8}$	4. $9\frac{2}{7} \div 2\frac{2}{3}$
5. $\frac{1}{6} + \frac{2}{5}$	6. $\frac{6}{7} - \frac{1}{5}$	7. $\frac{5}{8} \cdot \frac{8}{9}$	8. $\frac{4}{5} \div \frac{6}{7}$

Examples 6, 7 (p. 232)

- Estimate using compatible numbers. 9. $\frac{1}{4} \cdot 15$ 10. $21\frac{5}{6} \div 9\frac{3}{4}$
- Example 8 (p. 232)
 11. MEASUREMENT About how many bookcase shelves like this one shown at the right can a carpenter cut from a board that is 1 foot wide and 12 feet long?

 $3\frac{1}{2}$ ft

15. $4\frac{2}{5} - 1\frac{1}{2}$

19. $8\frac{1}{2} \div 2\frac{5}{8}$

23. $\frac{3}{4} - \frac{3}{5}$

27. $\frac{1}{10} \div \frac{5}{6}$

The Floor

to (Salt

Sweet and Simple Bread

I a define dry grast

t. Annala and

FT GROW MATER

1 ft

Exercises

HOMEWORK HELP				
For Exercises	See Examples			
12–19	1, 2			
20–29	3–5			
30–35	6–8			

12. $3\frac{3}{4} + 4\frac{5}{6}$	13. $1\frac{1}{8} + 5\frac{11}{12}$	14. $5\frac{1}{3} - 3\frac{1}{6}$
16. $2\frac{2}{3} \cdot 6\frac{1}{3}$	17. $1\frac{4}{5} \cdot 3\frac{1}{4}$	18. $6\frac{1}{8} \div 1\frac{2}{3}$
20. $\frac{3}{4} + \frac{3}{8}$	21. $\frac{5}{8} + \frac{3}{7}$	22. $\frac{5}{9} - \frac{1}{6}$
24. $\frac{1}{8} \cdot \frac{3}{4}$	25. $\frac{4}{9} \cdot \frac{11}{12}$	26. $\frac{4}{5} \div \frac{7}{8}$

- **28. BAKING** Amado wants to make the recipe at the right, but he has only $1\frac{1}{3}$ cups of flour. About how much more flour does he need?
- **29. MEASUREMENT** Isabella is sewing a trim that is $1\frac{1}{8}$ inches wide on the bottom of a skirt that is $15\frac{7}{8}$ inches long. Approximately how long will the skirt be?

Estimate using compatible numbers.

30. $\frac{1}{4} \cdot 39$ **31.** $\frac{1}{6} \cdot 37$ **32.** $23\frac{2}{9} \div 3$ **33.** $25\frac{3}{10} \div 5\frac{2}{3}$

- 34. **MONEY** Arleta has \$22. She uses $\frac{1}{3}$ of her money to buy a pair of earrings. About how much money did she spend on the earrings?
- **35. SNACKS** A cereal company has 24 pounds of granola to package in bags that contain $1\frac{3}{4}$ pounds of granola. About how many bags will they have?

- **FIND THE DATA** Refer to the California Data File on pages 16–19. 36. Choose some data and write a real-world problem in which you would estimate with fractions.
- **37. SPORTS** Paquito and Jeff are on a basketball team. The table shows the approximate fraction of the team's points that each of them scored in a game. If the team scored a total of 72 points, about how many did Paquito and Jeff score together?



- **38. RESEARCH** Research the statistics of any basketball team. How can you use fractions to analyze the statistics?
- **39. COOKING** Kathryn baked the sheet of brownies shown. She wants to cut it into brownies that are about 2 inches square. How many brownies will there be?

•• ANALYZE TABLES For Exercises 40–43, use the following information and the table shown.

The adult human skeleton is made up of 206 bones. The table shows the approximate fraction of the bones that each body part(s) makes up.

- 40. About how many bones are in the feet?
- 41. About how many bones are in both hands and feet?
- 42. About how many bones are in one hand?
- **43**. The length of your thighbone is equal to $\frac{1}{4}$ of your height.

About how many inches long is your thighbone?

- 44. CHALLENGE If a number being divided is rounded up and the divisor is rounded down, what is the effect on the new quotient?
- 45. OPEN ENDED Select two fractions whose estimated difference and product is $\frac{1}{2}$. Justify your selection.
- 46. NUMBER SENSE Determine which of the following has a sum that is greater than 1. Write *yes* or *no* and explain.

a.	$\frac{1}{2} + \frac{4}{7}$	C.	$\frac{2}{5} + \frac{1}{6}$
b.	$\frac{3}{4} + \frac{5}{8}$	d.	$\frac{2}{3} + \frac{4}{7}$

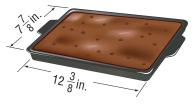


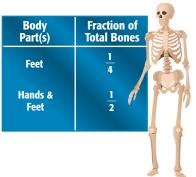
Real-World Link . The femur or thigh bone is the longest in length, largest in volume, and strongest bone of the human body. Source: orthopedics.about.com

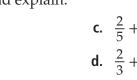
EXTRAPRACTICE
See pages 690, 719.
Math 🎱 🛯 📴 C
Self-Check Quiz at ca.gr6math.com

H.O.T. Problems ...

234 Chapter 5 Applying Fractions







47. SELECT A TECHNIQUE To make the crust for a peach cobbler, Dion needs $3\frac{1}{4}$ cups of flour, $1\frac{2}{3}$ cups of sugar, and $1\frac{2}{3}$ cups of hot water. He needs to mix all of these in a large bowl. The largest bowl he can find holds 6 cups. Which of the following techniques might Dion use to determine whether he can use this bowl to mix the ingredients? Justify your selection(s). Then use the technique(s) to solve the problem.



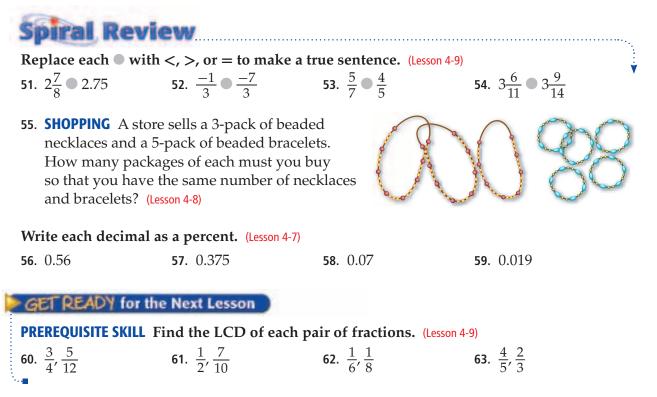
48. WRITING IN MATH Describe when estimation is a better method for solving a problem rather than using a pencil and paper, a calculator, or a computer. Then give a real-world example.

STANDARDS PRACTICE

- **49**. A chef has $15\frac{2}{3}$ cups of penne pasta and $22\frac{1}{4}$ cups of rigatoni pasta. About how much pasta is there altogether?
 - A 7 cups
 - **B** 35 cups
 - **C** 38 cups
 - D 42 cups

- **50**. On a full tank of gasoline, a certain car can travel 360 miles. The needle on its gasoline gauge is shown. Without refueling, which is the best estimate of how far the car can travel?
 - F 150 miles
 - **G** 180 miles
 - H 240 miles
 - J 329 miles





Adding and Subtracting Fractions

Main IDEA

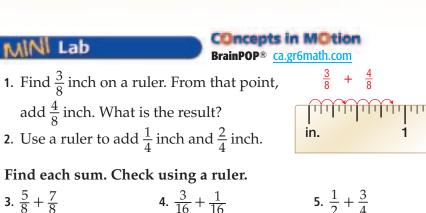
Add and subtract fractions.

Standard 6NS2.1 Solve problems involving addition, subtraction, multiplication, and division of positive fractions and explain why a particular operation was used for a given situation. Standard 6NS2.4 Determine the least

common multiple and the greatest common divisor of whole numbers; use them to solve problems with fractions (e.g., to find a common denominator to add two fractions or to find the reduced form for a fraction).

NEW Vocabulary

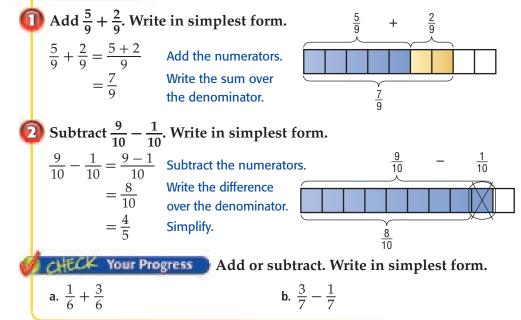
like fractions unlike fractions



Fractions that have the same denominators are called **like fractions**.

KEY C	ONCEPT	Add and Subtract Like Fractions
Words To add or subtract like frac numerators and write the		•
Examples	Numbers	Algebra
	$\frac{1}{5} + \frac{3}{5} = \frac{1+3}{5}$ or $\frac{4}{5}$	$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$, where $c \neq 0$
	$\frac{11}{12} - \frac{4}{12} = \frac{11 - 4}{12}$ or $\frac{7}{12}$	$\frac{a}{c} - \frac{b}{c} = \frac{a-b}{c}$, where $c \neq 0$





READING in the Content Area

For strategies in reading this lesson, visit ca.gr6math.com.

REVIEW Vocabulary

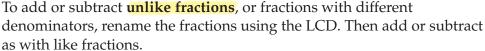
LCD the least common multiple of the denominators of two or more fractions;

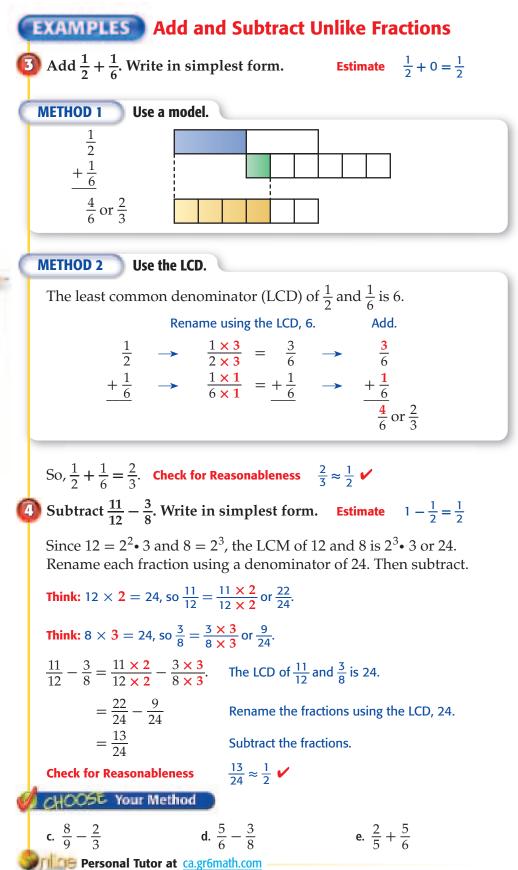
Example: the LCD of $\frac{1}{4}$ and $\frac{2}{3}$ is 12. (Lesson 4-9)

Renaming Fractions To rename a fraction,

multiply both the

numerator and the denominator of the original fraction by the same number. By doing so, the renamed fraction has the same value as the original fraction.





Real-World EXAMPLES

WEATHER The average precipitation for November and December in Grand Junction, Colorado, is $\frac{7}{10}$ inch and $\frac{3}{5}$ inch, respectively.

On average, how much more precipitation fell in November than in December?

The phrase *how much more* suggests subtraction, so find $\frac{7}{10} - \frac{3}{5}$.

 $\frac{7}{10} - \frac{3}{5} = \frac{7}{10} - \frac{3 \times 2}{5 \times 2}$ The LCD of $\frac{7}{10}$ and $\frac{3}{5}$ is 10. $= \frac{7}{10} - \frac{6}{10}$ Rename the fractions using the LCD. $= \frac{1}{10}$ Subtract the numerators.

On average, $\frac{1}{10}$ inch more precipitation fell in November.

6 Find the average precipitation for both months combined.

The phrase *combined* suggests addition, so find $\frac{7}{10} + \frac{3}{5}$.

 $\frac{7}{10} + \frac{3}{5} = \frac{7}{10} + \frac{6}{10}$ Rename. = $\frac{13}{10}$ Add. = $1\frac{3}{10}$ Write $\frac{13}{10}$ as a mixed number.

The average precipitation for both months combined was $1\frac{3}{10}$ inches.

CHECK Your Progress

f. **WEATHER** Using the information at the left, find the difference of the average precipitation for Santa Barbara for May and September.

CHECK Your Understanding

5

Real-World Link .

precipitation for May and September for Santa Barbara,

California, is $\frac{1}{5}$ and $\frac{2}{5}$

inches, respectively. Source: National Climatic

The average

Data Center

Examples 1–4 (pp. 236–237)	Add or subtract. 1. $\frac{4}{9} + \frac{2}{9}$ 5. $\frac{1}{6} + \frac{3}{8}$	Write in simplest 4 2. $\frac{5}{6} + \frac{4}{9}$ 6. $\frac{2}{3} + \frac{5}{6}$	3. $\frac{3}{8} - \frac{1}{8}$	4. $\frac{4}{5} - \frac{2}{5}$ 8. $\frac{3}{4} - \frac{1}{3}$
Examples 5, 6 (p. 238)				ich problem. Explain
	9. MEASUREMENT Cassandra cuts $\frac{5}{16}$ inch off the top of a photo and $\frac{3}{8}$ inc the bottom. How much smaller is the total height of the photo now?			the photo now?
	10. CHORES A buc bucket was on	thet was $\frac{7}{8}$ full with $\frac{1}{4}$ full. What particular	h soapy water. After rt of the water was r	r washing the car, the used?

Tim Hursley/SuperStock

Exercises

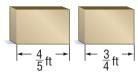
HOMEWORKHELP		
For Exercises	See Examples	
11-14	1, 2	
15-22	3, 4	
23–26	5, 6	

Add or subtract. Write in simplest form.

11. $\frac{3}{7} + \frac{1}{7}$	12. $\frac{5}{8} + \frac{7}{8}$	13. $\frac{5}{6} - \frac{1}{6}$	14. $\frac{7}{10} - \frac{3}{10}$
15. $\frac{1}{15} + \frac{3}{5}$	16. $\frac{7}{12} + \frac{7}{10}$	17. $\frac{5}{8} + \frac{11}{12}$	18. $\frac{7}{9} + \frac{5}{6}$
19. $\frac{7}{9} - \frac{1}{3}$	20. $\frac{4}{5} - \frac{1}{6}$	21. $\frac{4}{9} - \frac{2}{15}$	22. $\frac{3}{10} - \frac{1}{4}$

For Exercises 23–26, choose an operation to solve each problem. Explain your reasoning. Then solve the problem.

23. MEASUREMENT Ebony is building a shelf to hold the two boxes shown. What is the smallest width she should make the shelf?



- 24. **PRESIDENTS** As of 2005, $\frac{5}{14}$ of the U.S. presidents were born in either Virginia or Ohio, and $\frac{1}{6}$ were born in either New York or Massachusetts. What fraction of presidents were born in these four states?
- **25. MEASUREMENT** Makayla bought $\frac{1}{4}$ pound of ham and $\frac{5}{8}$ pound of turkey. How much more turkey did she buy?
- 26. **ANIMALS** The three-toed sloth can travel $\frac{3}{20}$ miles per hour while a giant tortoise can travel $\frac{17}{100}$ miles per hour. How much faster, in miles per hour, is the giant tortoise?

Simplify.

27. $\frac{1}{7} + \frac{1}{2} + \frac{5}{28}$	28. $\frac{1}{4} + \frac{5}{6} + \frac{7}{12}$	29. $\frac{1}{6} + \left(\frac{2}{3} - \frac{1}{4}\right)$	30. $\frac{5}{6} - \left(\frac{1}{2} + \frac{1}{3}\right)$
31. $1 + \frac{1}{4}$		33. $2 + \frac{2}{3}$	

- **35. SPORTS** After 1 hour, Jon had finished $\frac{5}{6}$ of a long-distance race, and Cheng had finished $\frac{7}{9}$ of it. At that time, who had finished a greater fraction of the race, and by how much?
- **36. ANALYZE TABLES** Lolita and Salvador each receives an equal allowance. The table shows the fraction of their allowance they each deposit into savings and the fraction they spend at the mall. Determine who has the greater amount of money left and by how much. Explain your reasoning.

Where Money	Fraction of Allowance		
Goes	Lolita	Salvador	
savings account	$\frac{1}{2}$	$\frac{1}{3}$	
spent at mall	$\frac{1}{4}$	<u>3</u> 5	
left over			

40. *a* + *b*

ALGEBRA Evaluate each expression if $a = \frac{3}{4}$ and $b = \frac{5}{6}$. 37. $\frac{1}{2} + a$ 38. $b - \frac{7}{10}$ 39. b - a

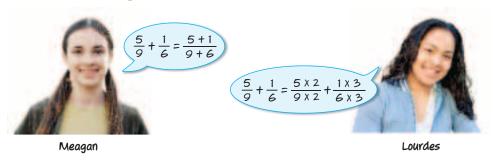


Real-World Link Thomas Jefferson, the third President of the United States, was born in Virginia. He served in office from 1801 to 1809. Source: whitehouse.gov

- **41. BOOK REPORTS** Four students were scheduled to give book reports in a 1 hour class period. After the first report, $\frac{2}{3}$ hour remained. If the next two students' reports took $\frac{1}{6}$ hour and $\frac{1}{4}$ hour, respectively, what fraction of the hour remained after the final students' report? Justify your answer.
- **42. MEASUREMENT** Mrs. Escalante was riding a bicycle on a bike path. After riding $\frac{2}{3}$ of a mile, she discovered that she still needed to travel $\frac{3}{4}$ of a mile to reach the end of the path. How long is the bike path?
- **43. CELL PHONES** Out of 160 cell phone owners, $\frac{3}{8}$ use their phone for text messaging, $\frac{1}{4}$ prefer playing games, and the remaining owners prefer taking pictures. What fraction of owners prefers using their cell phone for text messaging or taking pictures?
- 44. **MEASUREMENT** LaTasha and Eric are jogging on a track. LaTasha jogs $\frac{1}{4}$ of a mile and then stops. Eric jogs $\frac{5}{8}$ of a mile, stops and then turns around and jogs $\frac{1}{2}$ of a mile. Who is farther ahead on the track? How much farther? Explain.
- **45. CHALLENGE** Fractions, such as $\frac{1}{2}$ or $\frac{1}{3}$, whose numerators are 1, are called *unit fractions*. Describe a method you can use to add two unit fractions mentally. Explain your reasoning and use your method to find $\frac{1}{99} + \frac{1}{100}$.
 - **46. OPEN ENDED** Provide a counterexample to the following statement.

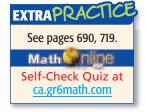
The sum of three fractions with odd numerators is never $\frac{1}{2}$.

47. FIND THE ERROR Meagan and Lourdes are finding $\frac{5}{9} + \frac{1}{6}$. Who is correct? Explain.



48. WRITING IN MATH To make a cake, Felicia needs 1 cup of flour but she only has a $\frac{2}{3}$ -measuring cup and a $\frac{3}{4}$ -measuring cup. Which method will bring her closest to having the amount of flour she needs? Explain.

a. Fill the ²/₃ measuring cup twice.
b. Fill the ²/₃ measuring cup once.
c. Fill the ³/₄ measuring cup twice.
d. Fill the ³/₄ measuring cup once.
e. Fill the ²/₃ and ³/₄ measuring cups each once.



H.O.T. Problems ...

STANDARDS PRACTICE

49. The table gives the number of hours Orlando spent at football practice for one week.

Day	Time (hours)
Monday	$1\frac{1}{2}$
Tuesday	2
Wednesday	$2\frac{1}{3}$
Thursday	$1\frac{5}{6}$
Friday	$2\frac{1}{2}$
Saturday	$1\frac{3}{4}$

How many more hours did he practice over the last three days than he did over the first three days?

A $\frac{1}{4}$ h **B** $\frac{1}{2}$ h $C \frac{2}{3}h$ $\mathbf{D} \frac{3}{4}\mathbf{h}$ **50**. Which of the following is the prime factored form of the lowest common denominator of $\frac{7}{12} + \frac{11}{18}$?

	F	2 × 3
	G	2×3^2
	Н	$2^2 \times 3^2$
	J	$2^3 \times 3$
51.	Fiı	$d \frac{5}{6} - \frac{1}{8}.$
	A	$\frac{4}{7}$
	В	<u>3</u> 8
	C	<u>7</u> 12
	D	<u>17</u> 24



57. Write 0.248 as a percent. (Lesson 4-7)

GET READY for the Next Lesson

PREREQUISITE SKILL Complete.

59. *a* − *b*

Estimate (Lesson 5-1)

52. $\frac{6}{7} - \frac{5}{12}$

58. *a* + *b*

- **53.** $4\frac{1}{9} + 3\frac{3}{4}$ **54.** $16\frac{2}{3} \div 8\frac{1}{5}$
- **55.** $5\frac{4}{5} \cdot 3\frac{1}{3}$
- **56. PETS** The table shows where pet owners get their pets. **Fraction of** Source Where do most pet owners get their pets? (Lesson 4-9) **Pet Owners** 3 **Animal Shelter** 20 21 Friend/Family 50 **ALGEBRA** Find each sum if a = -3 and b = 2. (Lessons 2-4 and 2-5) Pet Store 0.07 **60**. *b* − *a* Find as a stray 0.14

61. $5\frac{2}{3} = 5 +$ **62.** $1 = \frac{1}{9}$ **63.** $1 = \frac{1}{5}$

$$= 4 + \frac{3}{8}$$

64

Source: Yankelovich Partners

Adding and Subtracting Mixed Numbers

Main IDEA

Add and subtract mixed numbers.

Standard 6NS2.1 Solve problems involving addition, subtraction, multiplication, and division of positive fractions and explain why a particular operation was used for a given situation. Standard 6NS2.4 **Determine the least** common multiple and the greatest common divisor of whole numbers; use them to solve problems with fractions (e.g., to find a common denominator to add two fractions or to find the reduced form for

a fraction).

GET READY for the Lesson

ASTRONOMY Astronomers use *astronomical units* (AU) to represent large distances in space. One AU is the average distance from Earth to the Sun. Mercury is about $\frac{2}{5}$ AU from the Sun.

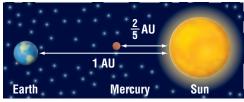


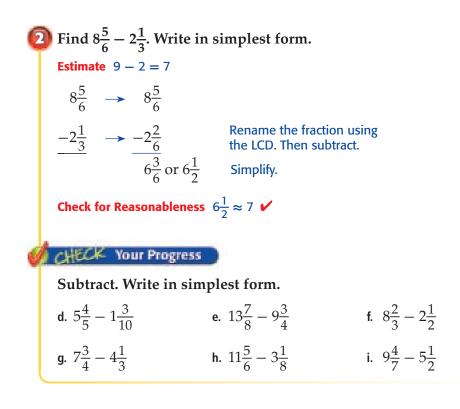
Diagram is not drawn to scale

- 1. Jupiter is $5\frac{2}{5}$ AU from the Sun and Saturn's distance is $9\frac{1}{2}$ AU. Write an expression to find how much closer to the Sun Jupiter is than Saturn.
- 2. Find the difference of the fractional parts of the mixed numbers.
- 3. Find the difference of the whole numbers.
- 4. **MAKE A CONJECTURE** Explain how to find $9\frac{1}{2} 5\frac{2}{5}$. Then use your conjecture to find the difference.

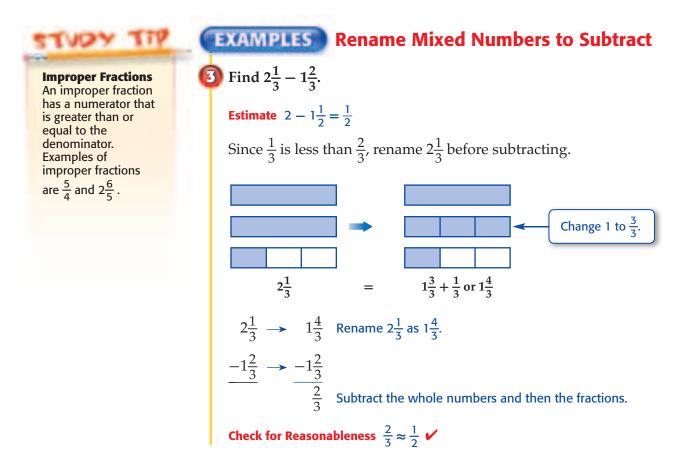
To add or subtract mixed numbers, first add or subtract the fractions. If necessary, rename them using the LCD. Then add or subtract the whole numbers and simplify if necessary.

EXAMPLES Add and Subtract Mixed Numbers

Find $7\frac{4}{9} + 10\frac{2}{9}$. Write in simplest form. Estimate 7 + 10 = 17 $7\frac{4}{9}$ Add the whole numbers and fractions separately. $\frac{+10\frac{2}{9}}{17\frac{6}{9}}$ or $17\frac{2}{3}$ Simplify. Check for Reasonableness $17\frac{2}{3} \approx 17$ \checkmark Check for Reasonableness $17\frac{2}{3} \approx 17$ \checkmark Add. Write in simplest form. a. $6\frac{1}{8} + 2\frac{5}{8}$ b. $5\frac{1}{5} + 2\frac{3}{10}$ c. $1\frac{5}{9} + 4\frac{1}{6}$



Sometimes when you subtract mixed numbers, the fraction in the first mixed number is less than the fraction in the second mixed number. In this case, rename the first fraction as an improper fraction in order to subtract.

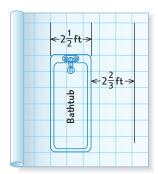


4 Find 8 – $3\frac{3}{4}$. **Estimate** 8 - 4 = 4Using the denominator of the second fraction, $8 = 8\frac{0}{4}$. Since $\frac{0}{4}$ is less than $\frac{3}{4}$, rename 8 before subtracting. $8 \rightarrow 7\frac{4}{4} \qquad \text{Rename 8 as 7 + } \frac{4}{4} \text{ or 7}\frac{4}{4}.$ $\frac{-3\frac{3}{4}}{4\frac{1}{4}} \rightarrow \frac{-3\frac{3}{4}}{4\frac{1}{4}} \qquad \text{Subtract.}$ $\text{Check for Reasonableness } 4\frac{1}{4} \approx 4 \checkmark$ CHECK Your Progress Subtract. Write in simplest form. k. $5\frac{3}{8} - 4\frac{11}{12}$ l. $7 - 1\frac{1}{2}$ j. $11\frac{2}{5} - 2\frac{3}{5}$

Real-World EXAMPLE

5 MEASUREMENT There should be $2\frac{2}{3}$ feet of clearance space in front of a bathtub. What is the sum of the width of a $2\frac{1}{2}$ -foot wide bathtub and the clearance space?

 $2\frac{1}{2} + 2\frac{2}{3} = 2\frac{3}{6} + 2\frac{4}{6}$ Rename the fractions. $= 4 + \frac{7}{6}$ Add the whole numbers and add the fractions. $= 4 + 1\frac{1}{6}$ Rename $\frac{7}{6}$ as $1\frac{1}{6}$. $=5\frac{1}{6}$ Simplify.



The total width is $5\frac{1}{6}$ feet.

CHECK Your Progress

m. **MEASUREMENT** Jermaine walked $1\frac{5}{8}$ miles on Saturday and $2\frac{1}{2}$ miles on Sunday. How many more miles did he walk on Sunday? Personal Tutor at ca.gr6math.com



Examples 1–4 (pp. 242–244)	Add or subtract 1. $1\frac{5}{7} + 8\frac{1}{7}$ 5. $3\frac{1}{4} - 1\frac{3}{4}$	Write in simplest 2. $8\frac{1}{2} + 3\frac{4}{5}$ 6. $5\frac{2}{3} - 2\frac{3}{5}$	form. 3. $7\frac{5}{6} - 3\frac{1}{6}$ 7. $11 - 6\frac{3}{8}$	4. $9\frac{4}{5} - 2\frac{3}{4}$ 8. $16 - 5\frac{5}{6}$
Example 5 (p. 244)	9. AQUARIUMS $10\frac{1}{2}$ gallons of	A fish tank that can of water. How much	hold $18\frac{2}{3}$ gallons of more water is need	water contains led to fill the tank?



Real-World Career ... How Does a Plumber Use Math? Plumbers add and

subtract mixed numbers when calculating the dimensions for installing house fixtures such as shower stalls and sinks.

Math 💓 📶 🛛 🖯

For more information, go to ca.gr6math.com.

244 Chapter 5 Applying Fractions

Aaron Haunt

Exercises

HOMEWORKHELP			
For Exercises	See Examples		
10-17	1, 2		
18–23	3		
24–25	4		
26–29	5		

Add or subtract. Write in simplest form.

1	10. $2\frac{1}{9} + 7\frac{4}{9}$	11. $3\frac{2}{7} + 4\frac{3}{7}$	12. $10\frac{4}{5} - 2\frac{1}{5}$	13. $8\frac{6}{7} - 6\frac{5}{7}$
	14. $9\frac{4}{5} - 2\frac{3}{10}$	15. $11\frac{3}{4} - 4\frac{1}{3}$	16. $8\frac{5}{12} + 11\frac{1}{4}$	17. $8\frac{3}{8} + 10\frac{1}{3}$
	18. $9\frac{1}{5} - 2\frac{3}{5}$	19. $6\frac{1}{4} - 2\frac{3}{4}$	20. $6\frac{3}{5} - 1\frac{2}{3}$	21. $4\frac{3}{10} - 1\frac{3}{4}$
	22. $14\frac{1}{6} - 7\frac{1}{3}$	23. $12\frac{1}{2} - 6\frac{5}{8}$	24. $8 - 3\frac{2}{3}$	25. $13 - 5\frac{5}{6}$

For Exercises 26–29, choose an operation to solve each problem. Explain your reasoning. Then solve the problem.

26. HIKING If Sara and Maggie hiked both of the trails listed in the table, how far did they hike altogether?

Trail	Length (mi)
Woodland Park	$3\frac{2}{3}$
Mill Creek Way	$2\frac{5}{6}$

- **27. MONUMENTS** The diagram shows the heights of the San Jacinto Monument near Houston, Texas, and the Washington Monument. How tall is the San Jacinto Monument?
- **28. GARDENS** The length of Kasey's garden is $4\frac{5}{8}$ feet. Find the width of Kasey's garden if it is $2\frac{7}{8}$ feet shorter than the length.
- **29. HAIRSTYLES** Before Alameda got her haircut, the length of her hair was $9\frac{3}{4}$ inches. After

	-6
*	
14 ft 6 _7 in.	<u> </u>



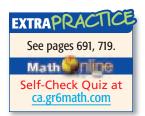
her haircut, the length was $6\frac{1}{2}$ inches. How many inches did she have cut?

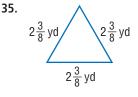
Add or subtract. Write in simplest form.

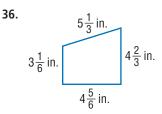
30.
$$10 - 3\frac{5}{11}$$
 31. $24 - 8\frac{3}{4}$ **32.** $6\frac{1}{6} + 1\frac{2}{3} + 5\frac{5}{9}$ **33.** $3\frac{1}{4} + 2\frac{5}{6} - 4\frac{1}{3}$

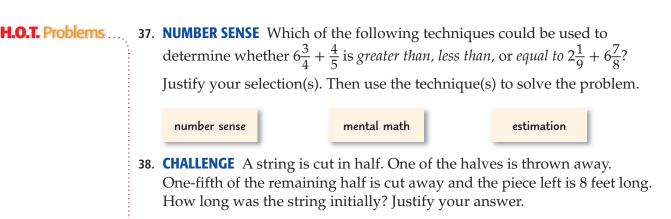
34. TIME Karen wakes up at 6:00 A.M. It takes her $1\frac{1}{4}$ hours to shower, get dressed, and comb her hair. It takes her $\frac{1}{2}$ hour to eat breakfast, brush her teeth, and make her bed. At what time will she be ready for school?

MEASUREMENT Find the perimeter of each figure.





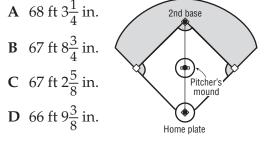




39. WRITING IN MATH The fence of a rectangular garden is constructed from 12 feet of fencing wire. Suppose that one side of the garden is $2\frac{5}{12}$ feet long. Explain how to find the length of the other side.

STANDARDS PRACTICE

40. The distance from home plate to the pitcher's mound is 60 feet 6 inches and from home plate to second base is 127 feet $3\frac{3}{8}$ inches. Find the distance from the pitcher's mound to second base.



- **41.** A recipe for party mix calls for $4\frac{3}{4}$ cups of cereal. The amount of peanuts needed is $1\frac{2}{3}$ cups less than the amount of cereal needed. How many cups of peanuts and cereal are needed?
 - **F** $3\frac{1}{12}$ cups **G** $6\frac{1}{2}$ cups

H
$$7\frac{5}{6}$$
 cups

J $8\frac{1}{2}$ cups

Spiral Review

42. SCHOOL Kai did $\frac{1}{5}$ of her homework in class and $\frac{1}{3}$ more of it on the bus. What fraction of homework does she still need to do? (Lesson 5-2)

Estimate. (Lesson 5-1)

- **43.** $\frac{8}{9} \div \frac{9}{10}$ **44.** $3\frac{1}{2} + 6\frac{2}{3}$ **45.** $8\frac{4}{5} \times 7\frac{1}{9}$ **46.** $4\frac{2}{9} 1\frac{1}{4}$
- **47. MEASUREMENT** To carpet a living room whose length is 17 feet, 255 square feet of carpet is needed. Find the width of the living room. (Lesson 3-6)

GET READY for the Next Lesson

48. PREREQUISITE SKILL Andre needs to be at the train station by 5:30 P.M. It takes him $\frac{1}{3}$ hour to pack and $1\frac{1}{4}$ hours to get to the station. Find the latest time he should begin packing. Use the *work backward* strategy. (Lesson 3-4)

Mid-Chapter Quiz

Lessons 5-1 through 5-3

1. **SAVINGS** Tonisha saves $\frac{1}{3}$ of the money she earns baby-sitting. If she earns \$25 one evening, estimate the amount she saves. (Lesson 5-1)

Estimate. (Lesson 5-1)

CHAPTED

2. $5\frac{1}{9} + 1\frac{7}{8}$	3. $13\frac{1}{2} \div 7\frac{2}{9}$
4. $\frac{11}{20} - \frac{5}{8}$	5. $4\frac{2}{3} \times 1\frac{3}{4}$
6. $7\frac{3}{4} \div 1\frac{4}{5}$	7. $\frac{8}{9} + 2\frac{13}{15}$

- 8. STANDARDS PRACTICE The school cafeteria makes 8 batches of cookies each day. Each batch uses $2\frac{1}{2}$ cups of flour and $1\frac{2}{3}$ cups of sugar. Which is the best estimate of the total amount of flour and sugar used each day for cookies? (Lesson 5-1)
 - A less than 30 cups
 - **B** between 30 cups and 45 cups
 - C between 45 cups and 55 cups
 - D more than 55 cups

Add or subtract. Write in simplest form.

(Lesson 5-2)

9.	$\frac{11}{15} - \frac{1}{15}$	10.	$\frac{4}{7}$ –	$\frac{3}{14}$
11.	$\frac{1}{2} + \frac{2}{9}$	12.	$\frac{5}{8} +$	$\frac{3}{4}$

13. SCIENCE $\frac{39}{50}$ of Earth's atmosphere is made up of nitrogen while only $\frac{21}{100}$ is made up of oxygen. What fraction of Earth's atmosphere is either nitrogen or oxygen? (Lesson 5-2)

Add or subtract. Write in simplest form.

(Lesson 5-3)	
14. $8\frac{3}{4} - 2\frac{5}{12}$	15. $5\frac{1}{6} - 1\frac{1}{3}$
16. $2\frac{5}{9} + 1\frac{2}{3}$	17. $2\frac{3}{5} + 6\frac{13}{15}$

 STANDARDS PRACTICE The table shows the weight of a newborn infant for the first year. (Lesson 5-3)

Month	Weight (lb)
0	$7\frac{1}{4}$
3	$12\frac{1}{2}$
6	16 <u>5</u>
9	19 <u>4</u>
12	$23\frac{3}{20}$

During which three month period was the infant's weight gain the greatest?

- F0-3 monthsH6-9 months
- **G** 3–6 months **J** 9–12 months
- **19. MEASUREMENT** How much does a $12\frac{3}{4}$ pound package weigh after a $3\frac{5}{8}$ -pound
 book is taken out of it? (Lesson 5-3)
- 20. **STANDARDS PRACTICE** The table gives the average annual snowfall for several U.S. cities. (Lesson 5-3)

City	Average Snowfall (in.)	
Anchorage, AK	$70\frac{4}{5}$	
Mount Washington, NH	259 <u>9</u> 10	
Buffalo, NY	$93\frac{3}{5}$	
Birmingham, AL	$1\frac{1}{2}$	

Source: factmonster.com

Α

B

On average, how many more inches of snow does Mount Washington, New Hampshire, receive than Anchorage, Alaska?

$$330\frac{7}{10}$$
 in.C $166\frac{3}{10}$ in. $189\frac{1}{10}$ in.D $92\frac{1}{10}$ in.

5-4. Problem-Solving Investigation

MAIN IDEA: Solve problems by eliminating possibilities.

Standard 6MR1.1 Analyze problems by identifying relationships, ..., and observing patterns. Standard 6NS2.1 Solve problems involving addition, subtraction, multiplication, and division of positive fractions and explain why a particular operation was used for a given situation.

P.S.I. TERM +

e-Mail: ELIMINATE POSSIBILITIES

YOUR MISSION: Eliminate possibilities to solve the problem.

THE PROBLEM: What is the most that Madison can record on the rest of a tape?



MADISON: I recorded $3\frac{1}{4}$ hours of a miniseries on a videotape that can record 6 hours total. What is the most that I can record on the rest of the tape-2, $2\frac{1}{2}$, or 3 hours?

EXPLORE	You know the combined hours of programming must be less than or equal to 6 hours.
PLAN	Eliminate answers that are not reasonable.
SOLVE	You couldn't record 3 more hours on the tape because $3\frac{1}{4} + 3 = 6\frac{1}{4}$.
	So, eliminate that choice. Now check the choice of $2\frac{1}{2}$ hours.
	$3\frac{1}{4} + 2\frac{1}{2} = 5\frac{3}{4}$
	Since this is less than 6 hours, this choice is correct. You could record $2\frac{1}{2}$ more hours on the tape.
CHECK	Recording 2 more hours would give $3\frac{1}{4} + 2$ or $5\frac{1}{4}$ hours. This is less than the
	6-hour maximum, but not the most that you could record.

Analyze The Strategy

- 1. Describe different ways that you can eliminate possibilities when solving problems.
- **2**. Explain how the strategy of eliminating possibilities is useful for taking multiple choice tests.
- 3. **WRITING IN MATH** Write a problem that could be solved by eliminating possibilities.

Mixed Problem Soluing



Eliminate possibilities to solve Exercises 4–6.

- 4. MEASUREMENT Guillermo has a 3-gallon cooler with $1\frac{3}{4}$ gallons of juice in it. If he wants the cooler full for his soccer game, how much juice should he add?
 - A 4 gallons
- C $1\frac{1}{4}$ gallons
 - **B** $3\frac{1}{4}$ gallons **D** $\frac{1}{4}$ gallon
- 5. **ELEPHANTS** An elephant in a zoo eats 58 cabbages in a week. About how many cabbages does an elephant eat in one year?

F	7	Η	1,500
G	700	J	3,000

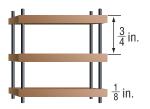
6. TRAVEL Mr. Rollins drove 780 miles on a 5-day trip. He rented a car for \$23 per day plus \$0.15 per mile after 500 free miles. About how much did the rental car cost?

Α	\$100	C	\$160
В	\$130	D	\$180

Use any strategy to solve Exercises 7–11. Some strategies are shown below.



7. **MEASUREMENT** The diagram shows a shelf that holds CDs. Each shelf is $\frac{1}{8}$ inch thick, and the distance between shelves is as shown. How much space is available on each layer of the shelf for a CD?



- 8. **ELEVATORS** An elevator can hold a maximum weight of 3,500 pounds. If the average adult weighs 170 pounds, about how many adults can the elevator hold?
- 9. GEOMETRY Draw the next two figures in the pattern.



- 10. **SLEEP** A nine month old infant needs about 14 hours of sleep each day while a teenager needs about 10 hours of sleep each day. How much more sleep does a nine month old need than a teenager? Write as a fraction of a day.
- **11. WEATHER** In some areas of the rain forest, 325 inches of rain may fall in a year. Is $\frac{1}{3}$ inch, 1 inch, 5 inches, or 33 inches the best estimate for the average rainfall per day in such an area?

Select the Operation

For Exercises 12–14, select the appropriate operation(s) to solve the problem. Justify your selection(s) and solve the problem.

- **12. SUPPLIES** Vanessa has \$55 to buy school supplies. She bought a backpack for \$23.50, a combination lock for \$6.25, and 4 binders that are \$3.99 each. If mechanical pencils are \$2.50 per pack, how many packs can she buy?
- **13. PIZZA** Sebastian ate $\frac{2}{5}$ of a pizza while his sister ate $\frac{1}{3}$ of the same pizza. The remainder was stored in the refrigerator. What fraction of the pizza was stored in the refrigerator?
- 14. **COOKING** A recipe calls for $2\frac{2}{3}$ cups of flour and $1\frac{1}{4}$ cups of sugar. How many more cups of flour are called for than sugar?

Math Lab **Multiplying Fractions**

Main IDEA

Use area models to multiply fractions and mixed numbers.

Explore



Standard 6MR3.3 Develop

generalizations of the results obtained and the strategies used and apply them in new problem situations.

Standard 6NS2.2

Explain the meaning of multiplication and division of positive fractions and perform the calculations (e.g., $\frac{5}{8} \div \frac{15}{16} = \frac{5}{8} \times \frac{16}{15} = \frac{2}{3}$). Just as the product of 3×4 is the number of square units in a rectangle whose area is 3 units by 4 units, the product of two fractions can be shown using area models.



COncepts in MOtion Animation ca.gr6math.com

 $\prod Find \frac{3}{4} \times \frac{2}{3} using a geoboard.$

The first factor is 3 *fourths* and the second factor is 2 *thirds*.

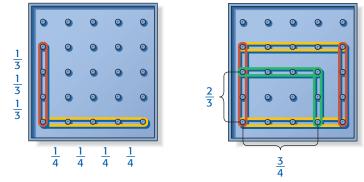


STEP 1 Use one geoband to show fourths and another to show thirds on the geoboard.

STEP 2

Use geobands to form a rectangle. Place one geoband on the peg to show 3 fourths and another on the peg to show 2 thirds.

TIP3 Connect the geobands to show a small rectangle.



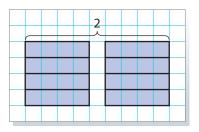
The area of the small rectangle is 6 square units. The area of the large rectangle is 12 square units. So, $\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$ or $\frac{1}{2}$.

Ø	CHECK Your	Progress Find e	each product usi	ng a geoboard.
	a. $\frac{1}{4} \times \frac{1}{3}$	b. $\frac{1}{2} \times \frac{1}{2}$	c. $\frac{3}{4} \times \frac{1}{2}$	d. $\frac{2}{3} \times \frac{1}{4}$

ACTIVITY

2) Find 2 $\times \frac{1}{4}$ using an area model.

(STEP 1) To represent 2 or $\frac{2}{1}$, draw 2 large rectangles, side by side. Divide each rectangle horizontally into fourths. Color both large rectangles blue.



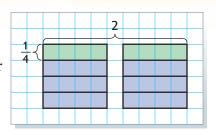


Shading

Yellow and blue make green. So, the green sections have been shaded twice and represent the product.

Color 1 fourth of each large rectangle yellow.

The fraction that compares the number of green sections, 2, to the number of sections in one rectangle, 4, is $\frac{2}{4}$ or $\frac{1}{2}$. So, 2 × $\frac{1}{4} = \frac{1}{2}$.



é	CHECK Your P	rogress Find	each product	t using a r	nodel.	
	e. $3 \times \frac{2}{3}$	f. $2 \times \frac{2}{5}$	g. $4 \times \frac{1}{2}$		$3 \times \frac{3}{4}$	
	ACTIVITY Find $1\frac{2}{3} \times \frac{1}{2}$ us	sing a model				
	(STEPT) Draw divide thirds into I	2 rectangles ed vertically int and horizonta nalves. Color 1- res blue.	ally			
	Then	$\frac{1}{2}$ of the squa count the sma		$\frac{1}{2}$	$1\frac{2}{3}$	
	Since the green rectangle, the t	otal area shade	d green is $\frac{3}{6}$ +	$-\frac{2}{6}$ or $\frac{5}{6}$. So	$1, 1\frac{2}{3} \times \frac{1}{2}$	
U	CHECK Your P	rogress Find	each product	t using a n	nodel.	
	i. $1\frac{1}{4} \times \frac{1}{5}$	j. $2\frac{1}{2}$ >	$\times \frac{3}{4}$	k. $1\frac{2}{3}$ >	$\langle \frac{1}{3}$	

ANALYZE THE RESULTS

- 1. Analyze Exercises a–k. What is the relationship between the numerators of the factors and of the product? Between the denominators of the factors and of the product?
- **2. MAKE A CONJECTURE** Write a rule you can use to multiply two fractions.

Multiplying Fractions and Mixed Numbers

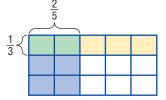
Main IDEA

Multiply fractions and mixed numbers.

Standard 6NS2.1 Solve problems involving addition, subtraction, multiplication, and division of positive fractions and explain why a particular operation was used for a given situation. Standard 6NS2.2 Explain the meaning of multiplication and division of positive fractions and perform the calculations $(e.g., \frac{5}{8} \div \frac{15}{16} = \frac{5}{8} \times \frac{16}{15} = \frac{2}{3}).$

GET READY for the Lesson

FORESTS About $\frac{1}{3}$ of the land in the United States is forests. About $\frac{2}{5}$ of U.S. forests are publicly owned.



Multiply Fractions

- 1. What part of the rectangle represents $\frac{1}{3}$?
- 2. What part of the rectangle represents $\frac{2}{5}$ of $\frac{1}{3}$?
- 3. Explain why the fraction of U.S. land that is publicly owned
 - forests can be found by multiplying $\frac{2}{5}$ by $\frac{1}{3}$.

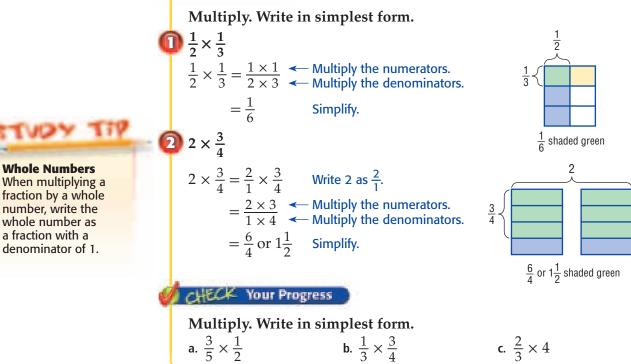
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E)

		• •	
Vords	To multiply fractions, multi denominators.	s, multiply the numerators and multiply the	
xamples	Numbers	Algebra	
	$\frac{1}{3} \times \frac{2}{5} = \frac{1 \times 2}{3 \times 5}$ or $\frac{2}{15}$	$\frac{a}{b} \cdot \frac{c}{d} = \frac{a \cdot c}{b \cdot d}$ or $\frac{ac}{bd'}$ where $b, d \neq 0$	

EXAMPLES Multiply Fractions



If the numerator and denominator of either fraction have common factors, you can simplify before multiplying.

REVIEW Vocabulary

GCF the greatest of the common factors of two or more numbers; Example: the GCF of 8 and 12 is 4. (Lesson 4-2)

EXAMPLE Simplify Before Multiplying

 $\boxed{3}$ Find $\frac{2}{7} \times \frac{3}{8}$. Write in simplest form.

 $\frac{2}{7} \times \frac{3}{8} = \frac{2}{7} \times \frac{3}{8}$ Divide 2 and 8 by their GCF, 2.

 $\times \frac{3}{5}$

 $=\frac{1\times3}{7\times4}$ or $\frac{3}{28}$ Multiply.

CHECK Your Progress

Multiply. Write in simplest form.

d. $\frac{1}{3} \times \frac{3}{7}$	e. $\frac{4}{9} \times \frac{1}{8}$	f. $\frac{5}{6}$
3^{7}	c . 9 ^ 8	. 6

EXAMPLE Multiply Mixed Numbers

If ind $\frac{1}{2} \times 4\frac{2}{5}$. Write in simplest form. Estimate $\frac{1}{2} \times 4 = 2$

METHOD 1 Rename the mixed number. $\frac{1}{2} \times 4\frac{2}{5} = \frac{1}{2} \times \frac{\frac{11}{22}}{5}$ Rename $4\frac{2}{5}$ as an improper fraction, $\frac{22}{5}$. Divide 2 and 22 by their GCF, 2. $=\frac{1\times11}{1\times5}$ Multiply. $=\frac{11}{5}$ or $2\frac{1}{5}$ Simplify.

METHOD 2 Use mental math.

The mixed number $4\frac{2}{5}$ is equal to $4 + \frac{2}{5}$. So, $\frac{1}{2} \times 4\frac{2}{5} = \frac{1}{2}\left(4 + \frac{2}{5}\right)$. Use the Distributive Property to multiply, then add mentally.

$$\frac{1}{2}\left(4+\frac{2}{5}\right) = 2 + \frac{1}{5}$$
THINK Half of 4 is 2 and half of 2 fifths is 1 fifth.

$$= 2\frac{1}{5}$$
Rewrite sum as mixed number.

So, $\frac{1}{2} \times 4\frac{2}{5} = 2\frac{1}{5}$. Check for Reasonableness $2\frac{1}{5} \approx 2$ V

CHOOSE Your Method

Multiply. Write in simplest form g. $\frac{1}{4}$

×
$$8\frac{4}{9}$$
 h. $5\frac{1}{3} \times 3$ i. $1\frac{7}{8} \times 2\frac{2}{5}$

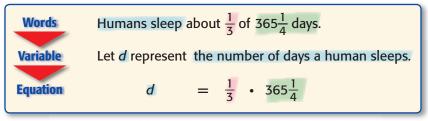
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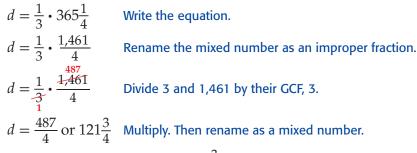
Simplifying

If you forget to simplify before multiplying, you can always simplify the final answer. However, it is usually easier to simplify before multiplying.

Real-World EXAMPLES

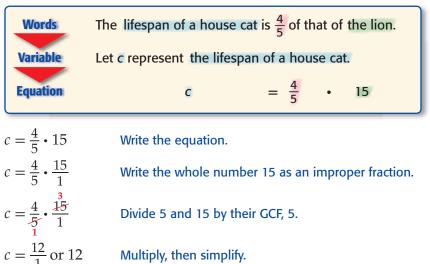
5 SLEEP Humans sleep about $\frac{1}{3}$ of each day. If each year is equal to $365\frac{1}{4}$ days, determine the number of days in a year the average human sleeps.





The average human sleeps $121\frac{3}{4}$ days each year.

ANIMALS The house cat has an average lifespan that is $\frac{4}{5}$ of a lion's. If a lion's lifespan is 15 years, find the average lifespan of a house cat.

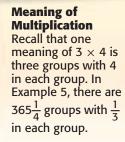


The average lifespan of a house cat is 12 years.

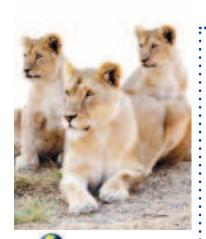
CHECK Your Progress

j. **COOKING** Sofia wishes to make $\frac{1}{2}$ of a recipe. If the original recipe calls for $3\frac{3}{4}$ cups of flour, how many cups should she use?

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DY TH



Real-World Link The average group of lions, called a pride, consists of about 15 lions with about $\frac{2}{3}$ of the pride being female. **Source:** African Wildlife Foundation

Your Understanding

Examp	les 1–4
(pp. 2	252–253)

Multiply. Write in simplest form	l .
2 1 1	2

-253)	1. $\frac{2}{3} \times \frac{1}{3}$	2. $2 \times \frac{2}{5}$	3. $\frac{1}{6} \times 4$
	4. $\frac{1}{4} \times \frac{8}{9}$	5. $2\frac{1}{4} \times \frac{2}{3}$	6. $1\frac{5}{6} \times 3\frac{3}{5}$
5,6	7. FOOD An average	ge slice of American chees	e is about $\frac{1}{8}$ inch thic

Examples (p. 254)

ck. What is the height of a package containing 20 slices?

Exercises

HOMEWORKHELP		
For Exercises	See Examples	
8–11	1, 2	
12-19	3, 4	
20–23	5, 6	

Multip	oly. Writ	e in simple	st form.	
3	1	2	2	

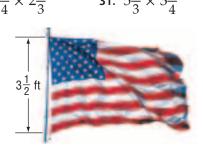
8. $\frac{3}{4} \times \frac{1}{8}$	9. $\frac{2}{5} \times \frac{2}{3}$	10. $9 \times \frac{1}{2}$	11 . $\frac{4}{5} \times 6$
12. $\frac{1}{5} \times \frac{5}{6}$	13. $\frac{4}{9} \times \frac{1}{4}$	14. $\frac{2}{3} \times \frac{1}{4}$	15. $\frac{1}{12} \times \frac{3}{5}$
16. $\frac{4}{7} \times \frac{7}{8}$	17. $\frac{2}{5} \times \frac{15}{16}$	18. $\frac{3}{8} \times \frac{10}{27}$	19. $\frac{9}{10} \times \frac{5}{6}$

- **20. DVDs** Each DVD storage case is about $\frac{1}{5}$ -inch thick. What will be the height of 12 cases sold together in plastic wrapping?
- 21. **PIZZA** Mark left $\frac{3}{8}$ of a pizza in the refrigerator. On Friday, he ate $\frac{1}{2}$ of what was left of the pizza. What fraction of the entire pizza did he eat on Friday?
- 22. **MEASUREMENT** The width of a vegetable garden is $\frac{1}{3}$ times its length. If the length of the garden is $7\frac{3}{4}$ feet, what is the width?
- 23. **RECIPES** A recipe to make one batch of blueberry muffins calls for $4\frac{2}{3}$ cups of flour. How many cups of flour are needed to make 3 batches of blueberry muffins?

Multiply. Write in simplest form. 24. $4\frac{2}{3} \times \frac{4}{7}$ 25. $\frac{5}{8} \times 2\frac{1}{2}$ 26. $14 \times 1\frac{1}{7}$ 27. $3\frac{3}{4} \times 8$

28. $9 \times 4\frac{2}{3}$ **29.** $4 \times 7\frac{5}{6}$ **30.** $3\frac{1}{4} \times 2\frac{2}{3}$ **31.** $5\frac{1}{3} \times 3\frac{3}{4}$

32. **MEASUREMENT** The length of an official United States flag must be $1\frac{9}{10}$ times its width. What is the length of the flag shown at the right?

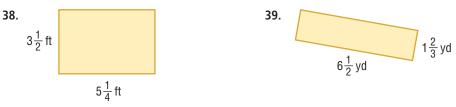


33. BICYCLING Philip rode his bicycle at $9\frac{2}{5}$ miles per hour. If he rode for $\frac{3}{4}$ of an hour, how many miles did he cover? **Evaluate each verbal expression.**

- **35**. four-sevenths of two-thirds
- 34. one-half of five-eighths36. nine-tenths of one-fourth
- 37. one-third of eleven-sixteenths

47. 2bc

MEASUREMENT Find the perimeter and area of each rectangle.



•40. **POOLS** The swimming pool at a community center is $90\frac{2}{5}$ feet long and $55\frac{1}{2}$ feet wide. If Natalie swims the perimeter of the pool four times, what is the total number of feet she will swim? Explain how you solved the problem.

MEASUREMENT For Exercises 41–44, use measurement conversions.

41. Find $\frac{1}{2}$ of $\frac{1}{4}$ of a gallon.	42. What is $\frac{1}{60}$ of $\frac{1}{24}$ of a day?
43. Find $\frac{1}{100}$ of $\frac{1}{1,000}$ of a kilometer.	44. What is $\frac{1}{12}$ of $\frac{1}{3}$ of a yard?

ALGEBRA Evaluate each expression if a = 4, $b = 2\frac{1}{2}$, and $c = 5\frac{3}{4}$.

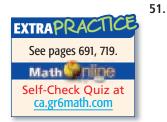
46. $b \times c - a$

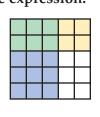
45. $a \times b + c$

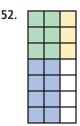
- **48. TELEVISION** One evening, $\frac{2}{3}$ of the students in Rick's class watched television, and $\frac{3}{8}$ of those students watched a reality show, of which $\frac{1}{4}$ taped the show. What fraction of the students in Rick's class watched and taped a reality TV show?
- **49. FOOD** Nicolás wants to make one and a half recipes of the pasta salad recipe shown at the right. How much of each ingredient will Nicolás need? Explain how you solved the problem.
- 50. **FIND THE DATA** Refer to the California Data File on pages 16–19. Choose some data and write a real-world problem in which you would multiply fractions.

Pasta Salad Recipe		
Ingredient	Amount	
broccoli	1 <u>1</u> c	
cooked pasta	3 3 4 c	
salad dressing	$\frac{2}{3}$ c	
cheese	$1\frac{1}{3}c$	

Write a multiplication expression to represent each model. Then evaluate the expression.









Real-World Link

There are an estimated 5 million in-ground swimming pools in the U.S. **Source:** *Pool & Spa Service Industry News*

- **H.O.T. Problems** 53. **CHALLENGE** Two fractions that are *not* improper are multiplied. Is the product *sometimes, always,* or *never* less than 1? Explain your reasoning.
 - 54. **OPEN ENDED** Draw and label a rectangle that has a perimeter of 1 and an area of less than $\frac{1}{16}$.

55. WRITING IN MATH Explain why
$$3\frac{2}{5} \times 4\frac{5}{12} \neq (3 \times 4) + \left(\frac{2}{5} \times \frac{5}{12}\right)$$

STANDARDS PRACTICE

56. Of the dolls in Marjorie's doll collection, $\frac{1}{5}$ have red hair. Of these, $\frac{3}{4}$ have green eyes. What fraction of Marjorie's doll collection has both red hair and green eyes? A $\frac{2}{9}$ C $\frac{4}{9}$

B
$$\frac{3}{20}$$
 D $\frac{19}{20}$

57. Which description gives the relationship between a term and *n*, its position in the sequence?

Position	1	2	3	4	5	n
Value of Term	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	

- **F** Subtract 4 from *n*.
- **G** Add $\frac{1}{4}$ to *n*.
- **H** Multiply n by $\frac{1}{4}$.
- J Divide *n* by $\frac{1}{4}$.

Spiral Review

- **58. MEASUREMENT** Find which room dimensions would give an area of $125\frac{3}{8}$ square feet. Use the *eliminate possibilities* strategy. (Lesson 5-4)
 - A
 $11\frac{1}{2}$ feet by $10\frac{3}{8}$ feet
 C
 $13\frac{5}{8}$ feet by 9 feet

 B
 $10\frac{7}{8}$ feet by $12\frac{1}{4}$ feet
 D
 $14\frac{3}{4}$ feet by $8\frac{1}{2}$ feet
- **59. MEASUREMENT** How much longer is a $2\frac{1}{2}$ -inch long piece of string than a $\frac{2}{5}$ -inch long piece of string? (Lesson 5-3)

Replace each • with <, >, or = to make a true sentence. (Lesson 4-9) 60. $\frac{5}{12} \bullet \frac{2}{5}$ 61. $\frac{3}{16} \bullet \frac{1}{8}$ 62. $3\frac{7}{6} \bullet 3\frac{6}{5}$

63. PHONES A long-distance telephone company charges a flat monthly fee of \$4.95 and \$0.06 per minute on all long-distance calls. Write and solve an equation to find the number of monthly minutes spent talking long-distance if the bill total was \$22.95. (Lesson 3-5)

GET READY for the Next Lesson

PREREQUISITE SKILL Solve each equation mentally. (Lesson 1-7)64. x + 2 = 865. 9 + m = 1266. 7 - w = 2



Algebra: Solving Equations

Main IDEA

Solve equations with rational number solutions.

Standard 6AF1.1 Write and solve one-step linear equations in one variable.

NEW Vocabulary

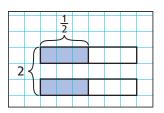
multiplicative inverse reciprocal

Multiplicative Inverse

Math Use reversal of order of the numerator and denominator of a fraction

MINI Lab

- 1. The model shows $\frac{1}{2} \cdot 2$. What is the product?
- 2. Use grid paper to model $\frac{1}{3} \cdot 3$. What is the product?
- 3. Copy and complete the table below.



$\frac{1}{2} \times 2 =$	$\frac{2}{3} \times \frac{3}{2} =$	$\frac{5}{6} \times \blacksquare = 1$	$\frac{11}{12} \times \frac{12}{11} =$
$\frac{1}{3} \times 3 =$	$\frac{3}{5} \times \frac{5}{3} =$	$\frac{9}{20} \times \blacksquare = 1$	$\times \frac{17}{8} = 1$

4. What is true about the numerators and denominators in the fractions in Exercise 3?

•• Two numbers with a product of 1 are called **multiplicative inverses**, or **reciprocals**.

KEY C	ONCEPT	Inverse Property of Multiplication
Words The product of a number and its multiplicative inverse is 1.		
Examples	Numbers	Algebra
	$\frac{3}{4} \times \frac{4}{3} = 1$	$\frac{a}{b} \cdot \frac{b}{a} = 1$, for $a, b \neq 0$

EXAMPLES Find Multiplicative Inverses

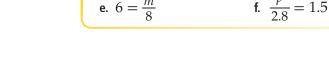
Image: 1Find the multiplicative inverse of $\frac{2}{5}$. $\frac{2}{5} \cdot \frac{5}{2} = 1$ Multiply $\frac{2}{5}$ by $\frac{5}{2}$ to get the product 1.The multiplicative inverse of $\frac{2}{5}$ is $\frac{5}{2}$, or $2\frac{1}{2}$.Image: 2Find the multiplicative inverse of $2\frac{1}{3}$. $2\frac{1}{3} = \frac{7}{3}$ Rename the mixed number as an improper fraction. $\frac{7}{3} \cdot \frac{3}{7} = 1$ Multiply $\frac{7}{3}$ by $\frac{3}{7}$ to get the product 1.The multiplicative inverse of $2\frac{1}{3}$ is $\frac{3}{7}$.Image: 2Find the multiplicative inverse of $2\frac{1}{3}$ is $\frac{3}{7}$.Image: 3Find the multiplicative inverse of each number.a. $\frac{5}{6}$ b. $1\frac{1}{2}$ c. 8d. $\frac{4}{3}$

In Chapter 3, you learned to solve equations using the Addition, Subtraction, and Division Properties of Equality. You can also solve equations by multiplying each side by the same number. This is called the Multiplication Property of Equality.

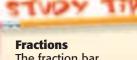
KEY C	ONCEPT	Multiplication	Property of Equality
Words	If you multiply each sic number, the two sides		the same nonzero
Examples	Numbers	Algo	ebra
	5 = 5	$\frac{x}{2} = -3$	$\frac{2}{3}x = 4$
	5 • 2 = 5 • 2	$\frac{x}{2}(2) = -3(2)$	$\frac{3}{2} \cdot \frac{2}{3}x = \frac{3}{2} \cdot 4$
	10 = 10	x = -6	x = 6

EXAMPLES Solve a Division Equation

¢	Solve	$7 = \frac{n}{4}$. Check	k youi	solution.	
		$7 = \frac{n}{4}$	Write	the equation.	
	7	$\bullet 4 = \frac{n}{4} \bullet 4$	Multip	oly each side of the equat	ion by 4.
		28 = n	Simpl		
	Check	$7 = \frac{n}{4}$	Write	the original equation.	
		$7 \stackrel{?}{=} \frac{28}{4}$	Repla	ce <i>n</i> with 28.	
		7 = 7 🗸	Is this	sentence true?	
C	Solve	$\frac{d}{3.5} = 4.2.$			
		$\frac{d}{3.5} = 4.2$		Write the equation.	
	$\frac{d}{3.5}$	• 3.5 = 4.2 • 3	3.5	Multiply each side by 3.	5.
		d = 14.7		Simplify.	
	The so	olution is 14.7	7.		
	Check	$\frac{d}{3.5} = 4.2$		Write the original equati	on.
		$\frac{14.7}{3.5} \stackrel{?}{=} 4.2$		Replace <i>d</i> with 14.7.	
		4.2 = 4.2 V	•	Is this sentence true?	
6	CHEC	Your Progr	ess		
	Solve	each equation		eck your solution.	
	e . 6 =	$\frac{m}{8}$	f.	$\frac{p}{2.8} = 1.5$	g. $\frac{k}{4.7}$ =



g.
$$\frac{k}{4.7} = 2.3$$



The fraction bar indicates division. So, $\frac{x}{2}$ means x divided by 2.

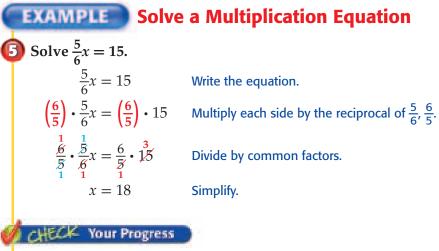
Math The Extra Examples at ca.gr6math.com

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STUDY TIP

Fractions as Coefficients The expression $\frac{5}{6}x$ can be read as $\frac{5}{6}$ of x, $\frac{5}{6}$ multiplied by x, 5x divided by 6, or $\frac{x}{6}$ multiplied by 5.



Solve each equation. Check your solution.

h.
$$\frac{1}{2}x = 8$$

i.
$$\frac{3}{4}x = 9$$

j. $\frac{7}{8}x = 21$

STANDARDS EXAMPLE

6 Valerie needs $\frac{2}{3}$ yard of fabric to make each hat for the school play. How many hats can she make with 6 yards of fabric?

A 12	C 8
B 9	D 4

Read the Item

Each hat needs $\frac{2}{3}$ yard of fabric. Given the number of hats, you would multiply by $\frac{2}{3}$ to find the number of yards of fabric needed.

Solve the Item

Write and solve a multiplication equation.

$$\frac{2}{3}n = 6$$
 Write the equation.

$$\frac{3}{2} \cdot \frac{2}{3}n = \left(\frac{3}{2}\right) \cdot 6$$
 Multiply each side by $\frac{3}{2}$, the reciprocal of $\frac{2}{3}$
 $n = 9$ Simplify.

So, the answer is B.

CHECK Your Progress

k. Wilson has 9 pounds of trail mix. How many $\frac{3}{4}$ -pound bags of trail mix can he make?

F 3	H 9
G 6	J 12

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Test-Taking Tip

Verify Your Answer It is a good idea to verify your answer by checking the other answer choices. By doing so, you can greatly reduce your chances of making an error. CHECK Your Understanding

Examples 1, 2 (p. 258)	Find the multiplicat 1. $\frac{8}{5}$	tive inverse of eac 2. $\frac{2}{9}$	h number. 3. $5\frac{4}{5}$	4. 9
Examples 3–5 (p. 259–260)	Solve each equation 5. $\frac{k}{16} = 2$ 8. $0.5 = \frac{h}{3.6}$	6. $4 = \frac{y}{3}$ 9. $\frac{3}{8}a = 12$	ition.	7. $\frac{b}{8.2} = 2.5$ 10. $6 = \frac{4}{7}x$
Example 5 (p. 260)	24 apples, the nu		fruit in the ref	r are apples and there are frigerator is given by the n the refrigerator?
Example 6 (p. 260)	$\frac{3}{4}$ of his pay deposit slip show	PRACTICE Dillon of whether we have much he de nount of his paych C \$60	ık. The eposited.	Great Savings Bank Dillon Gates Name Amount Deposited: \$45

Exercises

HOMEWORKHELP		
For Exercises	See Examples	
13–20	1, 2	
21–26 33–34	3, 4	
27–32	5	
51-52	6	

Find the multiplicative inverse of each number.

D \$75

	13. $\frac{5}{6}$	14. $\frac{11}{2}$	15. $\frac{1}{6}$	16. $\frac{1}{10}$
,	17. 3	18. 14	19. $5\frac{1}{8}$	20. $6\frac{2}{3}$

Solve each equation. Check your solution.

B \$33.75

21. $\frac{x}{12} = 3$	22. $28 = \frac{d}{4}$	23 . $\frac{b}{2.4} = 6$
24. $5 = \frac{w}{4.9}$	25. $0.8 = \frac{h}{3.6}$	26. $\frac{m}{4.6} = 2.8$
27. $\frac{2}{5}t = 12$	28. $24 = \frac{3}{4}a$	29. $\frac{7}{8}k = \frac{5}{6}$
30. $\frac{2}{3} = \frac{8}{3}b$	31. $\frac{1}{2}g = 3\frac{1}{3}$	32. $\frac{3}{5}c = 6\frac{1}{4}$

- **33. DISTANCE** The distance *d* Olimpia travels in her car while driving 55 miles per hour for 2.5 hours is given by the equation $\frac{d}{2.5} = 55$. How far did she travel?
- **34. ANIMALS** An adult Fitch ferret weighs about 1.8 kilograms. To find its weight in pounds *p*, you can use the equation $\frac{p}{1.8} = 2.2$. How many pounds does an adult Fitch ferret weigh?

Solve each equation. Check your solution.

35.
$$\frac{a}{-5} = 15$$
36. $-8 = \frac{r}{-2}$ **37.** $34.5 = \frac{5}{6}m$ **38.** $\frac{5}{7}x = -1.5$ **39.** $\frac{1}{4}t = \frac{3}{8}$ **40.** $\frac{3}{8}m = 1\frac{1}{2}$

For Exercises 41–46, define a variable and write an equation. Then solve.

- •41. **PRODUCE** San Diego County produces about 114,000 tons of avocados each year. This is about $\frac{3}{5}$ of the total California avocado crop. How many tons of avocados are produced in California each year?
- **42. MUSEUMS** Twenty-four students brought their permission slips to attend the class field trip to the local art museum. If this represented $\frac{4}{5}$ of the class, how many students are in the class?
- **43. MEASUREMENT** If one serving of cooked rice is $\frac{3}{4}$ cup, how many servings will $16\frac{1}{2}$ cups of rice yield?
- 44. **HIKING** After Alana hiked $2\frac{5}{8}$ miles along a hiking trail, she realized that she was only $\frac{3}{4}$ of the way to the end of the trail. How long is the trail?
- **45. SLEEP** The average person spends $\frac{1}{3}$ of their life asleep. According to this, if a person has spent 26 years asleep, how old are they?
- **46. ANALYZE TABLES** Tierra recorded the distance she ran each day last week. If she ran $\frac{5}{6}$ of her weekly running goal, what was her running goal?
- **47. REASONING** Complete the statement: If $8 = \frac{m}{4}$, then m 12 = 1. Explain your reasoning.

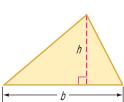
Distance Ran in One Week		
Day	Distance (mi)	
Monday	$1\frac{3}{4}$	
Wednesday	2	
Friday	$1\frac{1}{2}$	
Saturday	$2\frac{1}{4}$	

48. Which One Doesn't Belong? Identify the pair of numbers that does not belong with the other three. Explain.

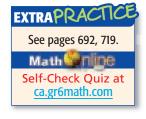
$$\frac{7}{8}, \frac{8}{7}$$
 5, $\frac{1}{5}$
 $\frac{2}{3}, 3$
 $\frac{10}{3}, \frac{3}{10}$

 CHALLENCE
 The formula for the area
 4 of
 4

49. CHALLENGE The formula for the area *A* of a triangle is $A = \frac{1}{2}bh$, where *b* is the base of the triangle and *h* is the height. Find the value of *b* in terms of *A* and *h*. Justify your answer using the properties of equality.



50. WRITING IN MATH Explain the Multiplication Property of Equality. Then give an example of an equation in which you would use this property to solve the equation.



Real-World Link .

Because of its mild climate, California is

nation's avocado crop

able to produce avocados year-round. About 95% of the

is produced in

California. **Source:** California Avocado Commission

H.O.T. Problems

STANDARDS PRACTICE

- 51. Audrey drove 200 miles in 3.5 hours. Which equation can you use to find the rate *r* at which Audrey was traveling?
 - A 200 = 3.5r
 - **B** $200 \cdot 3.5 = r$

C
$$\frac{r}{3.5} = 200$$

D 200r = 3.5

52. The table shows the results of a survey.

Music Preference		
Type Fraction of Students		
рор	<u>5</u> 8	
jazz	$\frac{1}{8}$	
rap	$\frac{1}{4}$	

If there are 420 students surveyed, which equation can be used to find the number of students *s* who prefer rap?

F
$$\frac{1}{4}s = 420$$
 H $s + \frac{1}{4} = 420$
G $s = \frac{1}{4} \cdot 420$ **J** $420 + s = \frac{1}{4}$



Multiply.	Write	in	simplest form.	(Lesson 5-5)
-----------	-------	----	----------------	--------------

54. $1\frac{1}{2} \times 6$ **55.** $2\frac{2}{5} \times \frac{1}{6}$ **56.** $1\frac{1}{2} \times 1\frac{7}{9}$ **53.** $\frac{3}{8} \times \frac{4}{9}$

61. 123%

57. COOKING Lawana had $4\frac{2}{3}$ cups of chopped walnuts. She used $1\frac{1}{4}$ cups in a recipe. How many cups of chopped walnuts are left? (Lesson 5-3)

Write each percent as a decimal. (Lesson 4-7)

59. 8%

58. 25%

- **60.** 25.6%
- 62. MEASUREMENT A farmer has a rectangular pumpkin field with a perimeter of 3,800 feet. If the width of the pumpkin field is 800 feet, what is the length of the field? (Lesson 3-6)

ALGEBRA Solve each equation. Check your solution. (Lesson 3-2)

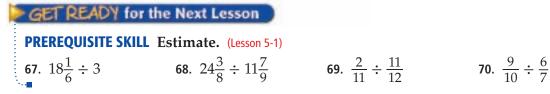
63. 7 = x + 8

64. k - 3 = -14

65. -2 = m + 6

66. **ALGEBRA** The table shows the time needed to complete 4 art projects. If the pattern continues, how much time is needed to complete the fifth art project? (Lesson 2-6)

Project	1	2	3	4	5
Time (min)	8	25	42	59	



READING Word Problems

Meaning of Division

You know that one meaning of division is to *put objects into equal groups*. But there are other meanings too. Look for these meanings when you're solving a word problem.

🔵 To share

Zach and his friend are going to share 3 apples equally. How many apples will each boy have?

$(e.g., \frac{5}{8} \div \frac{15}{16} = \frac{5}{8} \times \frac{16}{15} = \frac{2}{3}).$

Standard 6NS2.2

Explain the meaning of multiplication and division

of positive fractions and

perform the calculations

To take away equal amounts

Isabel is making bookmarks from a piece of ribbon. Each bookmark is 6.5 centimeters long. How many bookmarks can she make from a piece of ribbon that is 26 centimeters long?

To find how many times greater

The Nile River, the longest river on Earth, is 4,160 miles long. The Rio Grande River is 1,900 miles long. About how many times longer is the Nile than the Rio Grande?





PRACTICE

1. Solve each problem above.

Identify the meaning of division shown in each problem. Then solve the problem.

- **2**. A landscape architect wants to make a border along one side of a garden using bricks that are 0.25 meter long. If the garden is 11.25 meters long, how many bricks does she need?
- **3.** The Jackson family wants to buy a flat-screen television that costs \$1,200. They plan to pay in six equal payments. What will be the amount of each payment?
- **4**. A full-grown blue whale can weigh 150 tons. An adult African elephant weighs about 5 tons. How many times greater does a blue whale weigh than an African elephant?
- **5.** Each story in an office building is about 4 meters tall. The Eiffel Tower in Paris, France, is 300 meters tall. How many stories tall is the Eiffel Tower?



Dividing Fractions and Mixed Numbers

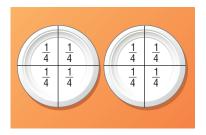
Main IDEA

Divide fractions and mixed numbers.

Standard 6NS2.1 Solve problems involving addition, subtraction, multiplication, and division of positive fractions and explain why a particular operation was used for a given situation. Standard 6NS2.2 Explain the meaning of multiplication and division of positive fractions and perform the calculations $(e.g., \frac{5}{8} \div \frac{15}{16} = \frac{5}{8} \times \frac{16}{15} = \frac{2}{3}).$

MINI Lab

- Cut two paper plates into four equal pieces each to show $2 \div \frac{1}{4}$.
- **1.** How many $\frac{1}{4}$'s are in 2 plates?
- **2**. How would you model $3 \div \frac{1}{2}$?
- **3.** What is true about $3 \div \frac{1}{2}$ and 3×2 ?



Dividing 8 by 2 gives the same result as multiplying 8 by $\frac{1}{2}$, which is the reciprocal of 2. In the same way, dividing 4 by $\frac{1}{3}$ is the same as multiplying 4 by the reciprocal of $\frac{1}{3}$, or 3.

reciprocals

$$8 \div 2 = 4$$
 $8 \cdot \frac{1}{2} = 4$
 $4 \div \frac{1}{3} = 12$
 $4 \cdot 3 = 12$

Is this pattern true for any division expression?

Consider $\frac{7}{8} \div \frac{3}{4}$ which	h can be rewritten as $\frac{\frac{7}{8}}{\frac{3}{4}}$.
$\frac{\frac{7}{8}}{\frac{3}{4}} = \frac{\frac{7}{8} \times \frac{4}{3}}{\frac{3}{4} \times \frac{4}{3}}$	4 Multiply the numerator and denominator by the reciprocal of $\frac{3}{4}$, which is $\frac{4}{3}$.
$=\frac{\frac{7}{8}\times\frac{4}{3}}{1}$	$\frac{3}{4} \times \frac{4}{3} = 1$
$=\frac{7}{8}\times\frac{4}{3}$	

So, $\frac{7}{8} \div \frac{3}{4} = \frac{7}{8} \times \frac{4}{3}$. These examples suggest the following rule for dividing fractions.

KEY C	ONCEPT	Divide by Fractions
Words	To divide by a fraction, n or reciprocal.	nultiply by its multiplicative inverse,
Examples	Numbers	Algebra
	$\frac{7}{8} \div \frac{3}{4} = \frac{7}{8} \cdot \frac{4}{3}$	$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c}$, where <i>b</i> , <i>c</i> , $d \neq 0$

EXAMPLE Divide by a FractionFind $\frac{3}{4} \div \frac{1}{2}$. Write in simplest form.Estimate $1 \div \frac{1}{2} = 1$ Think: How many groups of $\frac{1}{2}$ are in $1? 1 \div \frac{1}{2} = 2$ $\frac{3}{4} \div \frac{1}{2} = \frac{3}{4} \div \frac{2}{1}$ Multiply by the reciprocal of $\frac{1}{2}$, which is $\frac{2}{1}$. $= \frac{3}{4} \div \frac{1}{2}$ Divide 4 and 2 by their GCF, 2. $= \frac{3}{2}$ or $1\frac{1}{2}$ Multiply.Check for Reasonableness $1\frac{1}{2} \approx 2$ CHECK YOUR PROGRESSa. $\frac{3}{4} \div \frac{1}{4}$ b. $\frac{4}{5} \div \frac{8}{9}$ c. $\frac{5}{6} \div \frac{2}{3}$

To divide by a mixed number, first rename the mixed number as an improper fraction. Then multiply the first fraction by the reciprocal, or multiplicative inverse, of the second fraction.

EXAMPLE Divide by Mixed Numbers 2 Find $\frac{2}{3} \div 3\frac{1}{3}$. Write in simplest form. **Estimate** $\frac{1}{2} \div 3 = \frac{1}{2} \times \frac{1}{3}$ or $\frac{1}{6}$ $\frac{2}{3} \div 3\frac{1}{3} = \frac{2}{3} \div \frac{10}{3}$ Rename $3\frac{1}{3}$ as an improper fraction. $=\frac{2}{3}\cdot\frac{3}{10}$ Multiply by the reciprocal of $\frac{10}{3}$, which is $\frac{3}{10}$. $=\frac{\frac{1}{2}}{\frac{3}{2}}\cdot\frac{\frac{3}{2}}{\frac{1}{2}}$ Divide out common factors. $=\frac{1}{5}$ Multiply. **Check for Reasonableness** $\frac{1}{5}$ is close to $\frac{1}{6}$. CHECK Your Progress Divide. Write in simplest form. e. $-\frac{3}{4} \div 1\frac{1}{2}$ f. $2\frac{1}{3} \div 5$ d. $5 \div 1\frac{1}{2}$ g. **NUTS** In planning for a party, $5\frac{1}{4}$ pounds of cashews will be divided into $\frac{3}{4}$ pound bags. How many such bags can be made?

Dividing by a Whole Number Remember that a whole number can be written as a fraction with a 1 in the denominator. So, $2\frac{1}{3} \div 5$ can be rewritten as $2\frac{1}{3} \div \frac{5}{1}$.

Concepts in Motion BrainPOP® ca.gr6math.com

266 Chapter 5 Applying Fractions

Real-World EXAMPLE

WOODWORKING Students in a woodworking class are making butterfly houses. The side pieces of the house need to be $8\frac{1}{4}$ inches long. How many side pieces can be cut from a board measuring $49\frac{1}{2}$ inches long?



To find how many side pieces can be cut, divide $49\frac{1}{2}$ by $8\frac{1}{4}$.

Estimate Use compatible numbers. $48 \div 8 = 6$

 $= \frac{\frac{3}{99}}{\frac{2}{3}} \cdot \frac{\frac{2}{4}}{\frac{3}{33}}$ Divide out common factors. $=\frac{6}{1}$ or 6

 $49\frac{1}{2} \div 8\frac{1}{4} = \frac{99}{2} \div \frac{33}{4}$ Rename the mixed numbers as improper fractions. $=\frac{99}{2} \cdot \frac{4}{33}$ Multiply by the reciprocal of $\frac{33}{4}$, which is $\frac{4}{33}$.

Multiply.

So, 6 side pieces can be cut.

Check for Reasonableness The answer matches the estimate.

CHECK Your Progress

- **h. FOOD** Suppose a small box of cereal contains $12\frac{2}{3}$ cups of cereal. How many $1\frac{1}{3}$ -cup servings are in the box?
- i. **MEASUREMENT** The area of a rectangular bedroom is $108\frac{15}{32}$ square feet. If the width of the bedroom is $9\frac{3}{4}$ feet, find the length.

Bersonal Tutor at ca.gr6math.com

Your Understanding

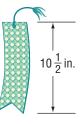
Examples 1–3 (p

Divide. Write in simplest form.

in miles per hour?

(pp. 266–267)	1. $\frac{1}{8} \div \frac{1}{3}$ 5. $\frac{1}{2} \div 7\frac{1}{2}$	2. $\frac{3}{5} \div \frac{1}{4}$ 6. $\frac{4}{7} \div 1\frac{2}{7}$	3. $3 \div \frac{6}{7}$ 7. $5\frac{3}{5} \div 4\frac{2}{3}$
Example 2 (p. 266)	one shown	mon is making book from a 15-yard spoo bookmarks can he r	l of ribbon.
Example 3 (p. 267)	10. WALKING C in $1\frac{2}{5}$ hours	On Saturday, Lindsay . What was her walk	walked $3\frac{1}{2}$ miles sing pace,





Exercises

HOMEWORKHELP

For Exercises	See Examples	
11-14	1	
15–32	2, 3	

Divide. Write in simplest form.

11. $\frac{3}{8} \div \frac{6}{7}$	12. $\frac{5}{9} \div \frac{5}{6}$	13. $\frac{2}{3} \div \frac{1}{2}$	14. $\frac{7}{8} \div \frac{3}{4}$
15. $6 \div \frac{1}{2}$	16. $\frac{4}{9} \div 2$	17. $2\frac{2}{3} \div 4$	18. $5 \div 1\frac{1}{3}$

- **19. FOOD** Mason has 8 cups of popcorn kernels to divide into $\frac{2}{3}$ -cup portions. How many portions will there be?
- **20. MOVIES** Cheryl is organizing her movie collection. If each movie case is $\frac{3}{4}$ inch wide, how many movies can fit on a shelf 5 feet wide?

Divide. Write in simplest form.

21. $\frac{2}{3} \div 2\frac{1}{2}$	22. $\frac{8}{9} \div 5\frac{1}{3}$	23. $4\frac{1}{2} \div 6\frac{3}{4}$	24. $5\frac{2}{7} \div 2\frac{1}{7}$
25. $3\frac{4}{5} \div 1\frac{1}{3}$	26. $9\frac{1}{2} \div 2\frac{5}{6}$	27. $5\frac{1}{5} \div \frac{2}{3}$	28. $6\frac{7}{8} \div \frac{3}{4}$

- **29. ICE CREAM** Vinh bought $4\frac{1}{2}$ gallons of ice cream to serve at his birthday party. If a pint is $\frac{1}{8}$ of a gallon, how many pint-sized servings can be made?
- **30. BEVERAGES** William has $8\frac{1}{4}$ cups of fruit juice. If he divides the juice into $\frac{3}{4}$ -cup servings, how many servings will he have?

• ANIMALS For Exercises 31 and 32, use the table that shows the maximum lengths of three animals common to California.

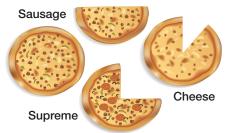
- **31**. How many times longer is the black-tailed jackrabbit than the American Kestrel?
- **32**. How many times longer is the pineconefish than the American Kestrel?

Animal	Maximum Length (ft)
Black-tailed Jackrabbit	$1\frac{2}{3}$
American Kestrel	<u>5</u> 6
Pineconefish	6 7 10

Source: Aquarium of the Pacific

Draw a model of each verbal expression and then evaluate the expression.

- **33**. one-half divided by two-fifths
- 34. five-eighths divided by one-fourth
- 35. one and three-eighths divided by one-half
- **36**. two and one-sixth divided by two-thirds
- **37. PIZZA** A concession stand sells three types of pizza. The diagram shows how much pizza of each type is left after the concession stand was open for one hour. If the pizza is sold in slices that are $\frac{1}{8}$ of a whole pizza, how many more slices can be sold?





Real-World Link •••

Black-tailed jackrabbits are able to reach speeds of 35 miles per hour and can jump about 5 feet. **Source:** Aquarium of the Pacific ALGEBRA Evaluate each expression if $g = \frac{1}{6}$, $h = \frac{1}{2}$, and $j = 3\frac{2}{3}$. 38. $j \div h$ 39. $g \div j$ 40. $3g \div h$ 41. $h \div \left(\frac{1}{2}j\right)$

- **42. SHOPPING** A supermarket sells pretzels in $\frac{3}{4}$ -ounce snack-sized bags or $12\frac{1}{2}$ -ounce regular-sized bags. How many times larger is the regular-sized bag than the snack-sized bag?
- **43. MEASUREMENT** A recipe calls for $2\frac{2}{3}$ cups of brown sugar and $\frac{2}{3}$ cup of confectioner's sugar. How many times greater is the number of cups of brown sugar in the recipe than of confectioner's sugar?

SCHOOL For Exercises 44 and 45, use the table that shows the number of hours students spend studying each week during the school year.

- **44**. How many times greater was the number of students who spent over 10 hours each week studying than those who spent only 1–2 hours each week studying?
- **45**. How many times greater was the number of students who spent 3 or more hours each week studying than those who spent less than 3 hours each week studying?

Weekly Study Hours		
Hours	Fraction of Students	
none	$\frac{1}{50}$	
1–2	$\frac{2}{25}$	
3–5	<u>11</u> 50	
6–7	<u>17</u> 100	
8–10	$\frac{1}{5}$	
Over 10	$\frac{1}{5}$	
Not sure	<u>3</u> 25	

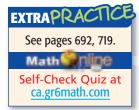
Source: Time Magazine

- **46. SCHOOL SUPPLIES** Tara bought a dozen folders. She took $\frac{1}{3}$ of the dozen and then divided the remaining folders equally among her four friends. What fraction of the dozen did each of her four friends receive and how many folders was this per person?
- **47. WEATHER** A meteorologist has issued a thunderstorm warning. So far, the storm has traveled 35 miles in $\frac{1}{2}$ hour. If it is currently 5:00 P.M., and the storm is 105 miles away from you, at what time will the storm reach you? Explain how you solved the problem.
- **48.** CHALLENGE If $\frac{5}{6}$ is divided by a certain fraction $\frac{a}{b'}$ the result is $\frac{1}{4}$. What is the fraction $\frac{a}{h}$?
- **49. SELECT A TOOL** Reynaldo cut a rope to make the running knot shown. The rope used to make the knot was $1\frac{1}{2}$ feet long and was $\frac{3}{4}$ of the original rope length. Which of the following tools could be used to determine the rope's original length? Justify your selection(s). Then use your tool(s) to find the length.

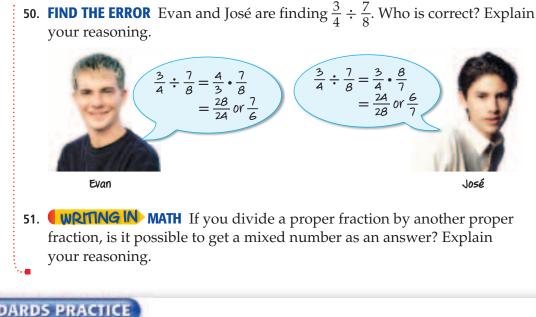
1

D

paper and pencil model	calculator	real object
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H.O.T. Problems



STANDARDS PRACTICE

52. The Corbet	tt family owns 300 acres of	f 53 . Ho
land that th	ney plan to rent to people	pea
for their ho	prses. How many $7\frac{1}{2}$ -acre	of
	ey make using the 300 acre	es? F
A 21	C $40\frac{1}{2}$	G
B 40	D $292\frac{1}{2}$	

ow many $1\frac{1}{8}$ -pound boxes of eanuts can be made using $6\frac{3}{4}$ pounds peanuts?

F	4	Η	6
G	5	J	7

Spiral Review

Find the mult	tiplicative inverse of e	each number. (Lesson 5-6)	
54. $\frac{6}{7}$	55. $\frac{4}{13}$	56. 8	57. $5\frac{1}{4}$
1	-		T

- **58.** Find $\frac{1}{10} \times \frac{5}{8}$. Write in simplest form. (Lesson 5-5)
- 59. **MEASUREMENT** Find the length of a rectangular flower bed if the perimeter is 12 feet and the width is 1.5 feet. (Lesson 3-6)
- 60. **ANIMALS** An elephant herd can move 50 miles in a day. At this rate, about how many miles can an elephant herd move each hour? (Lesson 1-1)

Cross-Curricular Project

Math and Health

A Well-Balanced Diet It's time to complete your project. Use the data you have gathered about the food you eat and about the Food Pyramid to prepare a Web page or poster. Be sure to include a chart and calculations with your project.

Math Cross-Curricular Project at ca.gr6math.com

Study Guide and **Review**



Download Vocabulary Review from ca.gr6math.com

DLDARLE

CHAPTER

Be sure the following Key Concepts are noted in your Foldable.



READY to Study

Key Concepts

Estimating with Fractions (Lesson 5-1)

- When the numerator is much smaller than the denominator, round the fraction to 0.
- When the numerator is about half of the denominator, round the fraction to $\frac{1}{2}$.
- When the numerator is almost as large as the denominator, round the fraction to 1.

Adding and Subtracting Fractions

(Lessons 5-2 and 5-3)

- To add or subtract like fractions, add or subtract the numerators and write the result over the denominator.
- To add or subtract unlike fractions, rename the fractions using the LCD. Then add or subtract as with like fractions.
- To add or subtract mixed numbers, first add or subtract the fractions. If necessary, rename them using the LCD. Then add or subtract the whole numbers and simplify if necessary.

Multiplying and Dividing Fractions

(Lessons 5-5 and 5-7)

- To multiply fractions, multiply the numerators and multiply the denominators.
- The product of a number and its multiplicative inverse is 1.
- To divide by a fraction, multiply by its multiplicative inverse, or reciprocal.

Solving Equations (Lesson 5-6)

If you multiply each side of an equation by the same nonzero number, the two sides remain equal.

Key Vocabulary

compatible numbers (p. 232) like fractions (p. 236) multiplicative inverse (p. 258) reciprocal (p. 258) unlike fractions (p. 237)

Vocabulary Check

Choose the correct term or number to complete each sentence.

- 1. To add like fractions, add the (numerators, denominators).
- **2.** The symbol \approx means is (*approximately*, exactly) equal to.
- 3. When dividing by a fraction, multiply by its (value, reciprocal).
- 4. When estimating, if the numerator of a fraction is much smaller than the denominator, round the fraction to $(0, \frac{1}{2})$.
- 5. Fractions with different denominators are called (like, unlike) fractions.
- **6.** The multiplicative inverse of $\frac{5}{6}$ is $\left(\frac{6}{5}, -\frac{5}{6}\right)$.
- 7. The mixed number $2\frac{4}{7}$ can be renamed as $\left(2\frac{7}{7}, 1\frac{11}{7}\right)$.
- 8. When multiplying fractions, multiply the numerators and (multiply, keep) the denominators.
- 9. The reciprocal of $\frac{1}{3}$ is (-3, 3). 10. The fractions $\frac{4}{16}$ and $\frac{2}{4}$ are (like, unlike) fractions.
- 11. Another word for multiplicative inverse is (reciprocal, denominator).
- 12. The fraction $\frac{x}{2}$ can be read x multiplied by $(2,\frac{1}{2}).$

Math Time Vocabulary Review at ca.gr6math.com



Lesson-by-Lesson Review

5-1

5-2

Estimating with Fractions (pp. 230–235)

Estimate.

- **13.** $2\frac{9}{10} \div 1\frac{1}{8}$ **14.** $6\frac{2}{9} 5\frac{1}{7}$ **15.** $\frac{13}{15} \times \frac{1}{5}$ **16.** $\frac{1}{2} + \frac{3}{8}$ **17.** $\frac{1}{2} \cdot 25$ **18.** $15\frac{6}{7} \div 7\frac{1}{3}$
- 19. **MEASUREMENT** Gina wishes to carpet her living room. It has a length of $18\frac{5}{8}$ feet and the width of her living room is $9\frac{1}{2}$ feet. About how many square feet of carpet would be needed for her living room?
- **20. FOOTBALL** Jamil practiced football for $1\frac{3}{4}$ hours on Saturday and $2\frac{2}{3}$ hours on Sunday. About how many more hours did he practice on Sunday than on Saturday?

Example 1 Estimate
$$5\frac{1}{12} + 2\frac{5}{6}$$
.
1 is much smaller than 12, so $5\frac{1}{2} \approx 5$.
5 is almost as large as 6, so $2\frac{5}{6} \approx 3$.

 $5\frac{1}{12} + 2\frac{5}{6} \approx 5 + 3 \text{ or } 8$

The sum is *about* 8.

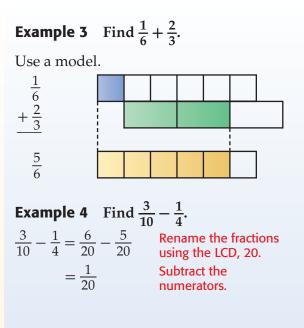
Example 2 Estimate $\frac{7}{8} - \frac{4}{7}$. 7 is almost as large as 8, so $\frac{7}{8} \approx 1$. 4 is about half of 7, so $\frac{4}{7} \approx \frac{1}{2}$. $\frac{7}{8} - \frac{4}{7} \approx 1 - \frac{1}{2}$ or $\frac{1}{2}$ The difference is *about* $\frac{1}{2}$.

Adding and Subtracting Fractions (pp. 236–241)

Add or subtract. Write in simplest form.

21. $\frac{2}{6} - \frac{1}{6}$	22. $\frac{3}{7} + \frac{9}{14}$
23. $\frac{1}{9} + \frac{5}{9}$	24. $\frac{9}{10} - \frac{3}{10}$
25. $\frac{5}{8} - \frac{5}{12}$	26. $\frac{3}{4} + \frac{7}{20}$

- 27. **RAIN** At 8 A.M., Della's rain gauge read $\frac{1}{8}$ inch. By 4 P.M., the gauge read $\frac{3}{4}$ inch. How much rain fell between 8 A.M. and 4 P.M.?
- **28. PIZZA** Owen ate $\frac{1}{8}$ of a pizza Tuesday night. The next day, he ate an additional $\frac{1}{2}$ of the pizza. What fraction of the pizza has he eaten?



Adding and Subtracting Mixed Numbers (pp. 242–246)

Add or subtract. Write in simplest form.

- **29.** $3\frac{2}{15} + 6\frac{9}{15}$ **30.** $4\frac{1}{3} 2\frac{2}{3}$ **31.** $8\frac{2}{7} + 1\frac{6}{7}$ **32.** $7\frac{11}{12} 4\frac{3}{12}$ **33.** $7\frac{3}{5} - 5\frac{1}{3}$ **34.** $5\frac{3}{4} + 1\frac{1}{6}$ **35.** $3\frac{5}{8} + 11\frac{1}{2}$ **36.** $4\frac{3}{10} - 2\frac{4}{5}$
- 37. BABY-SITTING Lucas watched his little sister for $2\frac{1}{2}$ hours on Friday, $3\frac{2}{3}$ hours on Saturday, and $1\frac{3}{4}$ hours on Sunday. How many hours did Lucas watch his little sister?

Example 5 Find
$$5\frac{2}{3} + 3\frac{1}{2}$$
.
 $5\frac{2}{3} + 3\frac{1}{2} = 5\frac{4}{6} + 3\frac{3}{6}$ Rename the fractions.
 $= 8\frac{7}{6}$ Add the whole numbers and add the fractions.
 $= 9\frac{1}{6}$ $8\frac{7}{6} = 8 + 1\frac{1}{6}$ or $9\frac{1}{6}$
Example 6 Find $4\frac{1}{5} - 2\frac{3}{5}$.
 $4\frac{1}{5} - 2\frac{3}{5} = 3\frac{6}{5} - 2\frac{3}{5}$ Rename $4\frac{1}{5}$ as $3\frac{6}{5}$.
 $= 1\frac{3}{5}$ Subtract the whole numbers and subtract the fractions.

5-4

5-3

PSI: Eliminate Possibilities (pp. 248–249)

Solve by eliminating possibilities.

- 38. SCHOOL It takes Beth 15 minutes to walk to school, $\frac{1}{2}$ mile away. What is her walking pace?
 - A 2 miles per hour
 - **B** 1 mile per hour
 - C 7.5 miles per hour
 - **D** 30 miles per hour
- **39. COOKING** Which of the following would yield a larger batch of bagels?
 - **F** Multiply a recipe by $\frac{1}{2}$.
 - **G** Divide a recipe by $\frac{1}{2}$.
 - **H** Multiply a recipe by $\frac{3}{4}$.
 - Divide a recipe by 3.

Example 7 A group of friends went to a theme park. Six of the friends rode the Ferris wheel. If this was $\frac{2}{3}$ of the group, how many friends were in the group?

A 3 **B** 6 **C** 9 **D** 12

Ε

4

Since 6 friends rode the Ferris wheel and this was $\frac{2}{2}$ of the total number of friends in the group, the number of friends in the group must be greater than 6. So, eliminate choices A and B.

If there were 12 friends in the group, the 6 that rode the Ferris wheel would represent $\frac{1}{2}$ of the group. So, eliminate choice D.

Choice C is the only remaining possibility. Since 6 out of 9 is $\frac{6}{9}$ or $\frac{2}{3}$, C is correct.



Multiplying Fractions and Mixed Numbers (pp. 252–257)

Multiply. Write in simplest form.

40.
$$\frac{3}{5} \times \frac{2}{7}$$
41. $\frac{5}{12} \times \frac{4}{9}$
42. $\frac{3}{5} \times \frac{10}{21}$
43. $4 \times \frac{13}{20}$
44. $2\frac{1}{3} \times \frac{3}{4}$
45. $4\frac{1}{2} \times 2\frac{1}{12}$

46. **MEASUREMENT** One lap around the high school track is $\frac{1}{4}$ of a mile. If Mika runs $4\frac{1}{2}$ laps, how far does she run?

Example 8 Find
$$\frac{5}{9} \times \frac{2}{3}$$
.
 $\frac{5}{9} \times \frac{2}{3} = \frac{5 \times 2}{9 \times 3}$ Multiply the numerators
and multiply the
denominators.
 $= \frac{10}{27}$ Simplify.
Example 9 Find $3\frac{1}{2} \times 2\frac{3}{4}$.
 $3\frac{1}{2} \times 2\frac{3}{4} = \frac{7}{2} \times \frac{11}{4}$ Rename $3\frac{1}{2}$ and $2\frac{3}{4}$.
 $= \frac{7 \times 11}{2 \times 4}$ Multiply the numerators
and multiply the
denominators.
 $= \frac{77}{8}$ or $9\frac{5}{8}$ Simplify.

5-6

5-7

CHAPTER

5-5

Algebra: Solving Equations (pp. 258–263)

Find the multiplicative inverse of each number.

47.
$$\frac{7}{12}$$
 48. 5 **49.** $3\frac{1}{3}$

Solve each equation. Check your solution.

50.
$$8 = \frac{w}{2}$$

51. $\frac{4}{5}b = 12$
52. $-7.6 = \frac{n}{3}$
53. $\frac{x}{0.3} = 2.5$

54. **BOOKS** Of the books on a shelf, $\frac{2}{3}$ are mysteries. If there are 10 mystery books, how many books are on the shelf?

2.5

Example 10 Find the multiplicative inverse of $\frac{9}{5}$. $\frac{9}{5} \cdot \frac{5}{9} = 1$ The product of $\frac{9}{5}$ and $\frac{5}{9}$ is 1. The multiplicative inverse of $\frac{9}{5}$ is $\frac{5}{9}$. **Example 11** Solve $\frac{3}{4}g = 2$. $\frac{3}{4}g = 2$ $\frac{4}{3} \cdot \frac{3}{4}g = \frac{4}{3} \cdot \frac{3}{4}g = \frac{4}{3} \cdot \frac{3}{3}g = \frac{4}{3} \cdot \frac{3}$ Write the equation. Multiply each side by

$$g = \frac{4}{3} \cdot 2$$

$$g = \frac{8}{3} \text{ or } 2\frac{2}{3}$$

$$g = \frac{8}{3} \text{ or } 2\frac{2}{3}$$

Simplify.

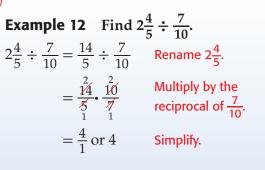
Dividing Fractions and Mixed Numbers (pp. 265–270)

Divide. Write in simplest form.

 55. $\frac{3}{5} \div \frac{6}{7}$ 56. $4 \div \frac{2}{3}$

 57. $2\frac{3}{4} \div \frac{5}{6}$ 58. $-\frac{2}{5} \div 3$

 59. $4\frac{3}{10} \div 2\frac{1}{5}$ 60. $-\frac{2}{7} \div \frac{8}{21}$
61. MEASUREMENT How many $\frac{1}{8}$ -inch lengths are in $6\frac{3}{4}$ inches?



CHAPTER

Practice Test

Estimate.

1.
$$5\frac{7}{9} - 1\frac{2}{13}$$
2. $3\frac{1}{12} + 6\frac{5}{7}$ 3. $\frac{3}{7} \times \frac{13}{15}$ 4. $5\frac{2}{3} \div 1\frac{4}{5}$

5. **BAKING** A restaurant uses $2\frac{3}{4}$ pounds of flour to make a batch of dinner rolls. About how many pounds of flour are needed if 3 batches of dinner rolls are to be made?

Add, subtract, multiply, or divide. Write in simplest form.

6. $\frac{4}{15} + \frac{8}{15}$	7. $\frac{7}{10} - \frac{1}{6}$
8. $\frac{5}{8} \times \frac{2}{5}$	9. $6 \times \frac{8}{21}$
10. $4\frac{5}{12} - 2\frac{1}{12}$	11. $6\frac{7}{9} + 3\frac{5}{12}$
12. $8\frac{4}{7} - 1\frac{5}{14}$	13. $4\frac{5}{6} \times 1\frac{2}{3}$
14. $\frac{8}{9} \div 5\frac{1}{3}$	15. $\frac{1}{6} \div 5$

- 16. **STANDARDS PRACTICE** Seth drove $5\frac{3}{4}$ miles to the bank, $6\frac{1}{3}$ miles to the post office, and $4\frac{5}{6}$ miles to the park. What is the total distance Seth drove?
 - **A** $15\frac{9}{13}$ miles **B** $\frac{7}{12}$ miles **C** $\frac{11}{12}$ miles **D** $16\frac{11}{12}$ miles
- 17. **SPORTS** Tyler's football practice lasted $2\frac{1}{2}$ hours. If $\frac{1}{4}$ of the time was spent catching passes, how many hours were spent catching passes?
- **18. MEASUREMENT** The floor of a moving van is $11\frac{1}{3}$ feet long and $7\frac{5}{12}$ feet wide. Find the area of the moving van floor.

STANDARDS PRACTICE For his birthday, Keith received a check from his grandmother. Of this amount, the table shows how he spent or saved the money.

Fraction of	How Spent or
Check	Saved
<u>2</u>	spent on
5	baseball cards
$\frac{1}{4}$	spent on a CD
<u>7</u>	deposited into
20	savings account

Two weeks later, he withdrew $\frac{2}{3}$ of the amount of the check he had deposited into his savings account. What fraction of the original check did he withdraw from his savings account?

F
$$\frac{2}{3}$$
 H $\frac{7}{30}$
G $\frac{9}{23}$ **J** $\frac{7}{40}$

20. MEASUREMENT An ounce is $\frac{1}{16}$ of a pound. How many ounces are in $8\frac{3}{4}$ pounds?

ALGEBRA Solve each equation. Check your solution.

21.
$$\frac{y}{3.7} = 8.1$$

22. $6 = \frac{2}{5}m$
23. $\frac{3}{4} = \frac{5}{8}x$
24. $3\frac{1}{6} = \frac{2}{3}p$

25. **STANDARDS PRACTICE** Maria is making a mural that is $9\frac{2}{3}$ feet long. She wants to divide the mural into sections that are each $\frac{5}{8}$ foot. Which equation can be used to find *n*, the number of sections in Maria's mural?

A
$$\frac{5}{8}n = 9\frac{2}{3}$$

B $9\frac{2}{3}n = \frac{5}{8}$
C $\frac{5}{8} + n = 9\frac{2}{3}$
D $n - \frac{5}{8} = 9\frac{2}{3}$

Mana Chapter Test at ca.gr6math.com

CHAPTER

California Standards Practice Cumulative, Chapters 1–5



Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.

1 Mrs. Brown needs to make two different desserts for a dinner party. The first recipe requires $2\frac{1}{4}$ cups of flour, and the second recipe requires $\frac{3}{4}$ cup less than the first. Which equation can be used to find *n*, the number of cups of flour needed for the second recipe?

A
$$n = 2\frac{1}{4} - \frac{3}{4}$$

B $n = 2\frac{1}{4} \cdot \frac{3}{4}$
C $n = 2\frac{1}{4} + \frac{3}{4}$
D $n = 2\frac{1}{4} \div \frac{3}{4}$

- 2 Which of the following is true concerning the least common multiple of 6 and 9?
 - **F** It is greater than the least common multiple of 8 and 12.
 - **G** It is greater than the least common multiple of 5 and 15.
 - **H** It is less than the least common multiple of 4 and 6.
 - It is less than the least common multiple T of 3 and 4.
- 3 Kyle's hockey team has 6 sixth graders, 9 seventh graders, and 5 eighth graders. Which statement below is true?
 - **A** One fourth of the team members are sixth graders.
 - **B** More than half of the team members are seventh graders.
 - C 25% of the team members are eighth graders.
 - **D** 30% of the team members are seventh graders.

4 The fraction $\frac{5}{6}$ is found between which pair of fractions on a number line?

F
$$\frac{1}{4}$$
 and $\frac{5}{8}$
G $\frac{1}{3}$ and $\frac{4}{9}$
H $\frac{11}{12}$ and $\frac{31}{36}$
J $\frac{7}{12}$ and $\frac{17}{18}$

5 The table shows the distance Kelly swam over a four-day period. What was the total distance, in miles, Kelly swam?

Kelly's Swimming					
Day	Distance (miles)				
Monday	1.5				
Tuesday	$2\frac{3}{4}$				
Wednesday	2.3				
Thursday	$3\frac{1}{2}$				

- C $10\frac{1}{20}$ miles **A** 10.5 miles **B** $10\frac{1}{4}$ miles D 9 miles
- 6 Which of the following gives the correct meaning of the expression $\frac{5}{8} \div \frac{1}{3}$?

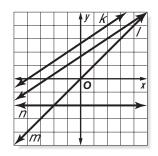
F
$$\frac{5}{8} \div \frac{1}{3} = \frac{8}{5} \times \frac{3}{1}$$

G $\frac{5}{8} \div \frac{1}{3} = \frac{5}{8} \times \frac{3}{1}$
H $\frac{5}{8} \div \frac{1}{3} = \frac{5+1}{8+3}$
J $\frac{5}{8} \div \frac{1}{3} = \frac{5}{8} \times \frac{1}{3}$

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More California Standards Practice For practice by standard, see pages CA1–CA39.

- 7 What is the value of the expression $(3+4)^2 \div 7 - 2 \times 6?$ A -9 C 30
 - **B** -5 **D** 1
- 8 Which line contains the ordered pair (-1, 2)?



- **F** Line *k*
- **G** Line *l*
- H Line m
- J Line *n*
- **9** A pizza shop tried 45 new types of pizza during the past year and 20% of them became popular. Which best represents the fraction of pizzas that did *not* become popular?



TEST-TAKING TIP

Question 9 Be sure to pay attention to emphasized words, or words that are capitalized. In Question 9, you are asked to find which answer is *not* correct.

10 Which description shows the relationship between a term and *n*, its position in the sequence?

Position	1	2	3	4	5	n
Value of Term	5	9	13	17	21	

- F Add 4 to n.
- **G** Multiply *n* by 4 and add 1.
- H Add 12 to *n*.
- J Multiply *n* by 1 and add 4.
- **11** Nicholas runs $\frac{3}{4}$ of a mile on Mondays and $\frac{3}{4}$ of a mile on Tuesdays. If he also runs $\frac{7}{8}$ of a mile on Thursdays, how many miles does he run each week?

A
$$2\frac{7}{8}$$
 milesC $2\frac{1}{4}$ milesB $2\frac{3}{8}$ milesD $1\frac{1}{4}$ miles

Pre-AP

Record your answers on a sheet of paper. Show your work.

- 12 A box of laundry detergent contains 35 cups. It takes $1\frac{1}{4}$ cups per load of laundry.
 - **a**. Write an equation to represent how many loads ℓ you can wash with one box.
 - **b.** How many loads can you wash with one box?
 - c. How many loads can you wash with 3 boxes?

NEED EXTRA HELP:												
If You Missed Question	1	2	3	4	5	6	7	8	9	10	11	12
Go to Lesson	5-2	4-8	4-6	4-9	4-5	5-7	1-4	3-7	4-6	1-10	5-2	5-7
For Help with Standard	NS.2.1	NS.2.4	NS.1.1	NS.1.1	NS.1.1	NS.2.2	AF1.3	MR2.4	NS1.1	MR2.4	NS2.1	NS2.1

Unit 3 Algebra and Number Sense: Proportions and Percents

Focus

Solve problems involving direct proportional relationships and percentages involving algebra, geometry, and measurement.

CHAPTER 6 Ratios and Proportions

BIG Idea) Analyze and use tables, graphs, and rules to solve problems involving rates and proportions.

CHAPTER 7 Applying Percents

BIG Idea) Compare and order positive and negative fractions, decimals, and mixed numbers. Solve problems involving fractions, ratios, proportions, and percentages.

Cross-Curricular Project

Math and Science

Lions, Tigers, and Bears, Oh My! Are you ready to join a team of animal experts? As part of your application to be a zoo's new coordinator, you must complete several challenging tasks. You'll make decisions about what animals to purchase for the zoo. You'll gather data about animals you choose, including their weight and expected lifespan. Finally, you'll present your findings to the hiring committee. So pack up your gear and don't forget your algebra tool kit. This adventure is going to be wild!

Math Math Log on to cagromath.com to begin.



BIG Ideas

- Standard 6NS1.0 Compare and order positive and negative fractions, decimals, and mixed numbers. Solve problems involving fractions, ratios, proportions, and percentages.
- **Standard 6AF2.0** Analyze and use tables, graphs, and rules to solve problems involving rates and proportions.

Key Vocabulary

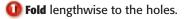
rate (p. 287) ratio (p. 282) proportional (p. 306)

Real-World Link

Statues A bronze replica of the Statue of Liberty can be found in Paris, France. The replica has the ratio 1:4 with the Statue of Liberty that stands in New York Harbor.



Ratios and Proportions Make this Foldable to help you organize your notes. Begin with a sheet of notebook paper.





Cut along the top line and then make equal cuts to form 7 tabs.



3 Label the major topics as shown.



Ratios and Proportions

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Alan Schein/zefa/CORBIS

GET READY for Chapter 6

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 2

Option 1

Math Online Take the Online Readiness Quiz at ca.gr6math.com.

Take the Quick Check below. Refer to the Quick Review for help.

 2×100 68

QUICKCheck

OUIICKReview

Evaluate each expression. Round to the nearest tenth if necessary. (Lesson 1-4)

1. $100 \times 25 \div 52$ **2.** $10 \div 4 \times 31$

$$3. \frac{63 \times 4}{34} \qquad \qquad 4.$$

Write each fraction in simplest form. (Lesson 4-4)

5.
$$\frac{9}{45}$$
 6. $\frac{16}{24}$ **7**. $\frac{38}{46}$

8. AGES Mikhail is 14 years old. His father is 49 years old. What fraction, in simplest form, of his father's age is Mikhail? (Lesson 4-4)

Write each decimal as a fraction in simplest form. (Lesson 4-5)

9. 0.78 **10**. 0.320 11. 0.06

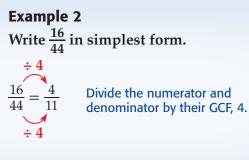
12. SAVINGS Belinda has saved 0.92 of the cost of a new bicycle. What fraction, in simplest form, represents her savings? (Lesson 4-5)

Multiply. (Lesson 1-2)

13 . 4.5 × 10 ²	14. 1.78×10^3
15. 0.22 $\times 10^4$	16. 0.03×10^5

Example 1 Evaluate $15 \times 32 \div 40$. $15 \times 32 \div 40 = 480 \div 40$ Multiply 15 by 32. = 12

Divide.



Example 3

Write 0.62 as a fraction in simplest form.

$0.62 = \frac{62}{100}$	0.62 is sixty-two hundredths.
$=\frac{31}{50}$	Divide the numerator and denominator by their GCF, 2.

Example 4 Find 3.9×10^3 . $3.9 \times 10^3 = 3,900$

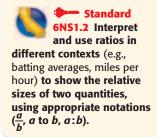
= 3,900

Move the decimal point 3 places to the right. Annex two zeros.

Ratios

Main IDEA

Write ratios as fractions in simplest form and determine whether two ratios are equivalent.



NEW Vocabulary

ratio equivalent ratios

GET READY for the Lesson

SCHOOL The student-teacher ratio of a school compares the total number of students to the total number of teachers.

Middle School	Students	Teachers
Prairie Lake	396	22
Green Brier	510	30

- 1. Write the student-teacher ratio of Prairie Lake Middle School as a fraction. Then write this fraction with a denominator of 1.
- 2. Can you determine which school has the lower student-teacher ratio by examining just the number of teachers at each school? just the number of students at each school? Explain.

KEY C	ONCEPT		Ratios
Words	A ratio is a comparison of	two quantities by division.	
Examples	Numbers	Algebra	
	3 to 4 3:4 $\frac{3}{4}$	a to b a: b $\frac{a}{b}$	

Ratios can express part to part, part to whole, or whole to part relationships and are often written as fractions in simplest form.

EXAMPLE Write Ratios in Simplest Form

GRILLING Seasonings are often added to meat prior to grilling. Using the recipe, write a ratio comparing the amount of garlic powder to the amount of dried oregano as a fraction in simplest form.

garlic powder $\frac{4 \text{ tsp}}{6 \text{ tsp}} = \frac{4 \text{ tsp}}{6 \text{ tsp}} \text{ or } \frac{2}{3}$

Recipe: Greek Style Seasonings
4 tsp. garlic powder
<u>6 tsp. dried oregano</u>
_2 tsp. pepper
المحمح وحمحا وحمحاطم

The ratio of garlic powder to dried oregano is $\frac{2}{3}$, 2:3, or 2 to 3. That is, for every 2 units of garlic powder there are 3 units of dried oregano.

CHECK Your Progress

Use the recipe to write each ratio as a fraction in simplest form.

a. pepper:garlic powder

b. oregano:pepper

READING in the Content Area

For strategies in reading this lesson, visit ca.gr6math.com.

Ratios that express the same relationship between two quantities are called **equivalent ratios**. Equivalent ratios have the same value.

Y 10

Writing Ratios Ratios greater than 1 are expressed as improper fractions and not as mixed numbers.

EXAMPLE Identify Equivalent Ratios

2 Determine whether the ratios 250 miles in 4 hours and 500 miles in 8 hours are equivalent.

Compare the ratios written in simplest form. **METHOD 1**

250 miles: 4 hours = $\frac{250 \div 2}{4 \div 2}$ or $\frac{125}{2}$ Divide the numerator and denominator by the GCF, 2 500 miles: 8 hours = $\frac{500 \div 4}{8 \div 4}$ or $\frac{125}{2}$ Divide the numerator and denominator by the GCF, 4

The ratios simplify to the same fraction. They are equivalent.

METHOD 2

Look for a common multiplier relating the two ratios.

The numerator and denominator of the ratios are related by the same multiplier, 2. The ratios of miles to hours are equivalent

CHOOSE Your Method

Determine whether the ratios are equivalent.

c. 20 nails for every 5 shingles, d. 2 cups flour to 8 cups sugar, 12 nails for every 3 shingles 8 cups flour to 14 cups sugar

Bersonal Tutor at ca.gr6math.com

Real-World EXAMPLE

PONDS For every 9 square feet of surface, a pond should have 2 fish. A pond that has a surface of 45 square feet contains 6 fish. Are these ratios equivalent? Justify your answer.

Recommended Ratio

Actual Ratio

 $9:2 = \frac{9}{2}$ square feet to fish $45:6 = \frac{45}{6}$ or $\frac{15}{2}$ square feet to fish

Since $\frac{9}{2} \neq \frac{15}{2}$, the ratios are not equivalent. So, the number of fish is not correct for the pond.

CHECK Your Progress

e. **SWIMMING** A community pool requires there to be at least 3 lifeguards for every 20 swimmers. There are 60 swimmers and 9 lifeguards at the pool. Is this the correct number of lifeguards based on the above requirement? Justify your answer.





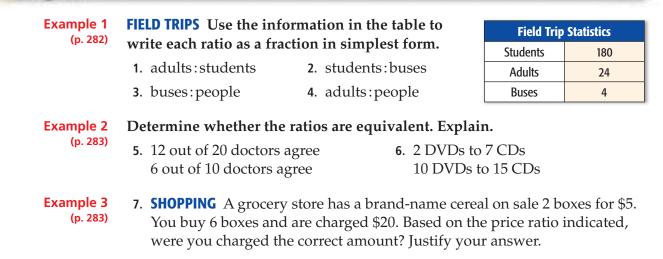
The recommended

pond is 1. Source:

sustland.umn.edu

number of water lilies for a 9-square foot

Your Understanding



Exercises

HOMEWORKHELP	
For Exercises	See Examples
8–17	1
18–21	2
22–23	3

SOCCER Use the Madi	ison Mavericks team
statistics to write each	h ratio as a fraction in
simplest form.	
8. wins:losses	9. losses:ties

Madison Mavericks		
Team Statistics		
Wins	10	
Losses	12	
Ties	8	

10. losses:games played 11. wins:games played

CARNIVALS Use the following information to write each ratio as a fraction in simplest form.

At its annual carnival, Brighton Middle School had 6 food booths and 15 games booths. A total of 66 adults and 165 children attended. The carnival raised a total of \$1,600. Of this money, \$550 came from ticket sales.

- 12. children: adults **13**. food booths: games booths
- 14. children: games booths

- 15. booths:money raised
- 16. people:children
- **17**. non-ticket sale money : total money

Determine whether the ratios are equivalent. Explain.

- 18. 20 female lions to 8 male lions, **19**. \$4 for every 16 ounces, 34 female lions to 10 male lions
- **20**. 27 students to 6 microscopes, 18 students to 4 microscopes
- \$10 for every 40 ounces
- **21**. 8 roses to 6 babies breath, 12 roses to 10 babies breath
- 22. **BAKING** It is recommended that a ham be baked 1 hour for every 2 pounds of meat. Latrell baked a 9-pound ham for 4.5 hours. Did he follow the above recommendation? Justify your answer.
- **23. FISHING** Kamala catches two similar looking fish. The larger fish is 12 inches long and 3 inches wide. The smaller fish is 6 inches long and 1 inch wide. Do these fish have an equivalent length to width ratio? Justify your answer.

MEASUREMENT The *aspect ratio* of a photograph is a ratio comparing the length and width. A 35 mm negative has an aspect ratio of 1 : 1.5. Photo sizes with the same aspect ratio can be printed full frame without cropping. Determine which size photos can be printed full frame from a 35 mm negative. Justify your answers.



24. $8'' \times 10''$ **25.** $5'' \times 7.5''$ **26.** $10'' \times 15''$

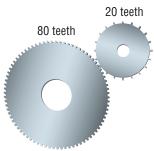
:•MAMMALS For Exercises 27 and 28, use the information below.



Real-World Link An orca whale, also called a killer whale, is not really a whale, but a dolphin. Its average birth weight is 300 pounds. Source: coolantarctica.com

Mammal	Average Brain Weight (lb)	Average Body Weight (lb)
Adult Human	3	150
Adult Orca Whale	12	5,500

- **27**. How much greater is the average weight of an adult orca whale's brain than the average weight of an adult human's brain?
- **28**. Find the brain to body weight ratio for each mammal. Are these ratios equivalent? If not, which mammal has the greater brain to body weight ratio? Justify your answer and explain its meaning.
- **29**. **GEARS** A *gear ratio* is a comparison of the number of teeth of a larger gear to the number of teeth of a smaller gear. What is the gear ratio of the two gears shown? How many times does the smaller gear turn for every turn of the larger gear?



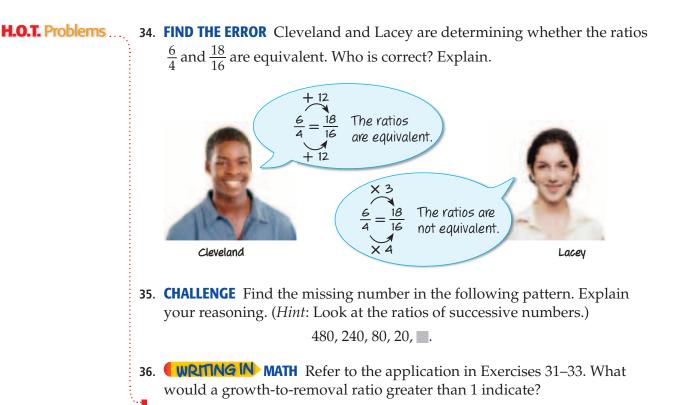
30. FOOD The ratio of the number of cups of chopped onion to the number of cups of chopped cilantro in a salsa recipe is 4:3. If the recipe calls for $\frac{2}{3}$ cup chopped onion, how many cups of chopped cilantro are needed?

ANALYZE TABLES For Exercises 31–33, use the table below that shows the logging statistics for three areas of forest.

Area	Estimated Number of Trees Left to Grow	Estimated Number of Trees Removed for Timber
A	440	1,200
В	1,625	3,750
C	352	960



- **31.** For which two areas was the growth-to-removal ratio the same? Explain.
- 32. Which area had the greatest growth-to-removal ratio? Justify your answer.
- **33**. Find the additional number of trees that should be planted and left to grow in area A so that its growth-to-removal ratio is the same as area B's. Justify your answer.



STANDARDS PRACTICE

- **37**. Which of the following ratios does *not* describe a relationship between the marbles in the jar?
 - A 8 white:5 black
 - B 2 white:5 blackC 5 black:13 total

D 8 white: 13 total



38. A class of 24 students has 15 boys. What ratio compares the number of girls to boys in the class?

F 3:5	H 3:8
G 5:3	J 8:3

Spiral Review

39. Find $1\frac{4}{7} \div 1\frac{5}{6}$. Write in simplest form. (Lesson 5-7)

ALGEBRA Solve each equation. Check your solution. (Lesson 5-6)

40. $\frac{y}{4} = 7$	41. $\frac{1}{3}x = \frac{5}{9}$	42. $4 = \frac{p}{2.7}$	43. $2\frac{5}{6} = \frac{1}{2}a$
------------------------------	---	--------------------------------	--

44. **MONEY** Grant and his brother put together their money to buy a present for their mom. If they had a total of \$18 and Grant contributed \$10, how much did his brother contribute? (Lesson 3-2)

GET READY for the Next Lesson

PREREQUISITE SKILL Divide. (p. 676)

45. 9.8 ÷ 2 **46.** \$4.30 ÷ 5 **47.** \$12.40 ÷ 40 **48.** 27.36 ÷ 3.2



Rates

Main IDEA

Determine unit rates.



batting averages, miles per hour) to show the relative sizes of two quantities, using appropriate notations $(\frac{a}{b}, a \text{ to } b, a \text{:} b).$

Standard 6AF2.2

Demonstrate an understanding that *rate* is a measure of one quantity per unit value of another quantity. Standard 6AF2.3 Solve problems involving rates, average speed, distance, and time.

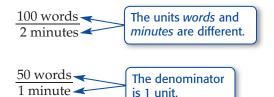
MINI Lab

Choose a page in a textbook and take turns reading as much as possible in 2 minutes.

- 1. Count the number of words that each of you read.
- 2. Write the ratio *number of words to number of minutes* as a fraction.
- **3**. Simplify the fractions by dividing the numerator and the denominator by 2.

A ratio that compares two quantities with different kinds of units is called a **rate**.

When a rate is simplified so that it has a denominator of 1 unit, it is called a **unit rate**.



The unit rate $\frac{50 \text{ words}}{1 \text{ minute}}$ can be read as 50 words per minute.

The table below shows some common unit rates.

Rate	Unit Rate	Abbreviation	Name
<u>number of miles</u> 1 hour	miles per hour	mi/h or mph	average speed
number of miles 1 gallon	miles per gallon	mi/gal or mpg	gas mileage
number of dollars 1 pound	price per pound	dollars/lb	unit price
number of dollars 1 hour	dollars per hour	dollars/h	hourly wage

NEW Vocabulary

Mental Math

quantity.

 $= \frac{24}{3} \text{ mi/h}$ = 8 mi/h

To find a unit rate mentally, divide the first quantity in the rate by the second

24 miles in 3 hours

rate unit rate

EXAMPLES Find Unit Rates

RUNNING Alethia ran 24 miles in 3 hours. What was her average speed in miles per hour?

Write the rate as a fraction. Then find an equivalent rate with a denominator of 1.

24 miles in 3 hours =
$$\frac{24 \text{ mi}}{3 \text{ h}}$$
 Write the rate as a fraction.
= $\frac{24 \text{ mi} \div 3}{3 \text{ h} \div 3}$ Divide the numerator and the denominator by 3.
= $\frac{8 \text{ mi}}{1 \text{ h}}$ Simplify.

Alethia's average speed, or unit rate, was 8 miles per hour.

it costs \$2 for six oranges. Round
Write the rate as a fraction.
Divide the numerator and the denominator by 6.
Simplify.
orange.
e nearest hundredth if necessary.
b . 220 miles on 8 gallons
ate if a 4-pack of mixed fruit sells

Unit rates are useful when you want to make comparisons.

STANDARDS EXAMPLE Compare Using Unit Rates

- Interprise of 3 different bags of dog food are given in the table. Which size bag has the lowest price per pound?
 - **A** The 40-lb bag only
 - **B** The 20-lb bag only
 - C The 8-lb bag only
 - **D** All three bag sizes have the same price per pound.

Dog Food Prices Bag Size Price (pounds) 40 \$49.00 20 \$23.44 8 \$9.88

Test-Taking Tip

Alternative Method

One 40-lb bag is equivalent to two 20-lb bags or five 8-lb bags. The cost for one 40-lb bag is \$49, the cost for two 20-lb bags is about 2 x \$23 or \$46, and the cost for five 8-lb bags is about $5 \times 10 or \$50. So the 20-lb bag has the lowest price per pound.

Read the Item

To determine the lowest price per pound, find and compare the unit price for each size bag.

Solve the Item

40-pound bag	$49.00 \div 40$ pounds = 1.225 per pound
20-pound bag	$23.44 \div 20$ pounds = 1.172 per pound
8-pound bag	$9.88 \div 8 \text{ pounds} = 1.235 \text{ per pound}$

At \$1.172 per pound, the 20-pound bag sells for the lowest price per pound. The answer is B.



Real-World Link Face paint can be made from 1 teaspoon cornstarch and $\frac{1}{2}$ teaspoon each of water and cold cream. **Source:** painting.about.com



- d. Tito wants to buy some peanut butter to donate to the local food pantry. If Tito wants to save as much money as possible, which brand should he buy?
 - F Nutty, because the quality of the peanut butter is better

Peanut Butter Sales		
Brand Sale Price		
Nutty	12 ounces for \$2.19	
Grandma's 18 ounces for \$2.79		
Bee's	28 ounces for \$4.69	
Save-A-Lot 40 ounces for \$6.60		

- G Grandma's, because the price per ounce is about \$0.16
- H Bee's, because the price per ounce is about \$0.14
- J Save-A-Lot, because he wants to buy 40 ounces

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Real-World EXAMPLE Use a Unit Rate

FACE PAINTING Lexi painted 3 faces in 12 minutes at the Arts and Crafts fair. At this rate, how many faces can she paint in 40 minutes?

Find the unit rate. Then multiply this unit rate by 40 to find the number of faces she can paint in 40 minutes.

3 faces in 12 minutes = $\frac{3 \text{ faces } \div 12}{12 \text{ min} \div 12} = \frac{0.25 \text{ faces}}{1 \text{ min}}$ Find the unit rate.

 $\frac{0.25 \text{ faces}}{1 \text{ min}} \cdot 40 \text{ min} = 10 \text{ faces}$ Divide out the common units.

Lexi can paint 10 faces in 40 minutes or $\frac{4 \text{ minutes}}{1 \text{ face}}$

CHECK Your Progress

e. **SCHOOL SUPPLIES** Kimbel bought 4 notebooks for \$6.32. At this same unit price, how much would he pay for 5 notebooks?

HECK Your Understanding

Find each unit rate. Round to the nearest hundredth if necessary.

- 1. 90 miles on 15 gallons
- 3. 5 pounds for \$2.49

- **2**. 1,680 kilobytes in 4 minutes
 - 4. 152 feet in 16 seconds

Example 3 (pp. 288–289)

Examples 1, 2

(pp. 287-288)

- 5. **STANDARDS PRACTICE** Four stores offer customers bulk CD rates. Which store offers the best buy?
 - A CD Express C Music Place
 - **B** CD Rack **D**
- D Music Shop
- Example 4 (p. 289)
 6. TRAVEL After 3.5 hours, Pasha had traveled 217 miles. At this same speed, how far will she have traveled after 4 hours?

Bulk CD Offers		
Store Offer		
CD Express 4 CDs for \$60		
Music Place 6 CDs for \$75		
CD Rack 5 CDs for \$70		
Music Shop 3 CDs for \$40		

Exercises

HOMEWORKHELP

For Exercises	See Examples
7–16	1, 2
17–20	3
21–24	4

Find each unit rate. Round to the nearest hundredth if necessary.

- **7**. 360 miles in 6 hours
- **9**. 152 people for 5 classes
- **11.** 45.5 meters in 13 seconds
- **13**. \$1.12 for 8.2 ounces

- 8. 6,840 customers in 45 days
- **10**. 815 Calories in 4 servings
- 12. \$7.40 for 5 pounds
- 14. 144 miles in 4.5 gallons
- 15. ESTIMATION Estimate the unit rate if 12 pairs of socks sell for \$5.79.
- **16. ESTIMATION** Estimate the unit rate if a 26 mile marathon was completed in 5 hours.
- **17. SPORTS** The results of a swim meet are shown. Who swam the fastest? Explain your reasoning.
- MONEY A grocery store sells three different packages of bottled water. Which package costs the least per bottle? Explain your reasoning.

NUTRITION For Exercises 19 and 20, use the table at the right.

- **19**. Which soft drink has about twice the amount of sodium per ounce than the other two? Explain.
- **20**. Which soft drink has the least amount of sugar per ounce? Explain.
- **21. WORD PROCESSING** Ben can type 153 words in 3 minutes. At this rate, how many words can he type in 10 minutes?
- **22. FABRIC** Marcus buys 3 yards of fabric for \$7.47. Later he realizes that he needs 2 more yards. How much will he pay for the extra fabric?
- **23. ESTIMATION** A player scores 87 points in 6 games. At this rate, about how many points would she score in the next 4 games?
- **24. JOBS** Dalila earns \$94.20, for working 15 hours as a holiday helper wrapping gifts. If she works 18 hours the next week, how much money will she earn?
- **•25**. **POPULATION** Use the information at the left. What is the *population density* or number of people per square mile in North Carolina?

	() BEAS
A.	
	CT PRO
-0	to put
	Passa a

Real-World Link ... North Carolina has approximately 8.2 million people in approximately 48,718 square miles. Source: quickfacts.census.gov

Name	Event	Time (s)
Tawni	50-m Freestyle	40.8
Pepita	100-m Butterfly	60.2
Susana	200-m Medley	112.4

9-pack

for \$4.50





6-pack for \$3.79

12-pack for \$6.89

Soft Drink Nutritional Information				
Soft Drink				
A	12	40	22	
В	8	24	15	
C	7	42	30	

ESTIMATION Estimate the unit price for each item. Justify your answers.



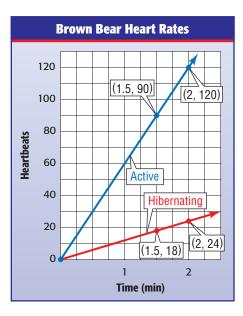
29. RECIPES A recipe that makes 10 mini-loaves of banana bread calls for $1\frac{1}{4}$ cups flour. How much flour is needed to make 2 dozen mini-loaves using this recipe?

•SPORTS For Exercises 30 and 31, use the information at the left.

- **30**. The wheelchair division for the Boston Marathon is 26.2 miles long. What was the average speed of the winner of the wheelchair division in 2005? Round to the nearest hundredth.
- **31**. At this rate, about how long would it take this competitor to complete a 30 mile race?
- **32. MONEY** Suppose that 1 European Euro is worth \$1.25. In Europe, a book costs 19 Euro. In Los Angeles, the same book costs \$22.50. In which location is the book less expensive?

ANIMALS For Exercises 33–37, use the graph that shows the average number of heartbeats for an active adult brown bear and a hibernating brown bear.

- **33**. What does the point (2, 120) represent on the graph?
- **34**. What does the point (1.5, 18) represent on the graph?
- **35**. What does the ratio of the *y*-coordinate to the *x*-coordinate for each pair of points on the graph represent?
- **36**. Use the graph to find the bear's average heart rate when it is active and when it is hibernating.

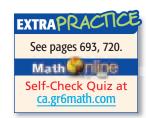


- **37**. When is the bear's heart rate greater, when it is active or when it is hibernating? How can you tell this from the graph?
- **38. TIRES** At Tire Depot, a set of 2 brand new tires sells for \$216. The manager's special advertises the same tires selling at a rate of \$380 for 4 tires. How much do you save per tire if you purchase the manager's special?

39. **FIND THE DATA** Refer to the California Data File on pages 16–19. Choose some data and write a real-world problem in which you would compare unit rates or ratios.



Real-World Link The winning time for the men's wheelchair division of the 2005 Boston Marathon in Massachusetts was 1 hour, 24 minutes, and 11 seconds. Source: boston.com



H.O.T. Problems ... CHALLENGE Determine whether each statement is *sometimes*, *always*, or *never* true. Give an example or a counterexample.

- 40. A ratio is a rate.41. A rate is a ratio.
- **42. OPEN ENDED** Create a rate and then convert it to a unit rate.
- **43. NUMBER SENSE** In which situation will the rate $\frac{x \text{ feet}}{y \text{ minutes}}$ increase? Give an example to explain your reasoning.
 - a. *x* increases, *y* is unchanged **b**.
 - unchanged **b.** *x* is unchanged, *y* increases
- 44. **WRITING IN MATH** Describe, using an example, how a *rate* is a measure of one quantity per unit of another quantity.

STANDARDS PRACTICE

45. Mrs. Ross needs to buy dish soap. There are four different size containers at a store.

Dish Soap Prices		
Brand Price		
Lots of Suds \$0.98 for 8 ounces		
Bright Wash \$1.29 for 12 ounces		
Spotless Soap \$3.14 for 30 ounces		
Lemon Bright \$3.45 for 32 ounces		

Mrs. Ross wants to buy the one that costs the least per ounce. Which brand should she buy?

- A Lots of Suds C Spotless Soap
- **B** Bright Wash **D** Lemon Bright

46. The table shows the total distance traveled by a car driving at a constant rate of speed.

Time (h)	Distance (mi)
2	130
3.5	227.5
4	260
7	455

Based on this information, how far will the car have traveled after 10 hours?

F 520 miles	Η	650 miles
--------------------	---	-----------

G 585 miles J 715 miles

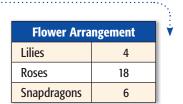


FLOWERS For Exercises 47–50, use the information in the table to write each ratio as a fraction in simplest form. (Lesson 6-1)

- 47. lilies:roses
- **49**. roses:flowers
- **48**. snapdragons:lilies

54. 104 ÷ 16

50. flowers:snapdragons



55. 4,200 ÷ 2,000

51. SANDWICHES Lawanda is making subs. She puts $1\frac{1}{2}$ slices of cheese on each sub. If she has 12 slices of cheese, how many subs can she make? (Lesson 5-6)

GET READY for the Next Lesson		
PREREQUISITE SKILI	Solve. (p. 674)	
52 . 2.5 × 20	53 . 3.5 × 4	

Algebra Lab Rate of Change

Main IDEA

Investigate rate of change.

Extend

(3-2)

Standard 6NS1.2 Interpret and use ratios in different contexts (e.g., batting averages, miles per hour) to show the relative sizes of two quantities, using appropriate notations $(\frac{a}{b}, a \text{ to } b, a \text{:} b).$

Standard 6AF2.2 Demonstrate an understanding that rate is a measure of one quantity per unit value of another quantity.

A rate of change is a ratio that shows a change in one quantity with respect to a change in another quantity. In this lab, you will use tables and graphs to investigate constant rates of change.

ACTIVITY

(STEP 1) Use tiles to build the figures shown below. Then continue the pattern to build the fourth and fifth figures.





Perimeter

(y)

STEP 2	For each figure, record the number of tiles and the	Figures	Number of Tiles (x)	
	perimeter of the figure in	1	1	
	a table like the one shown	2	3	
	at the right.	3	5	
STEPS	Draw a coordinate plane on	4		
	grid paper and graph the	5		

ANALYZE THE RESULTS

ordered pairs (x, y).

- 1. What do you notice about the points on the graph?
- 2. Find the ratio $\frac{\text{change in perimeter}}{\text{change in tiles}}$ between the second and third

points, the third and fourth points, and the fourth and fifth points. Each ratio is a rate of change. Describe what you observe.

- 3. Complete: As the number of tiles increases by 2 units, the perimeter of the models increases by units.
- 4. MAKE A PREDICTION Refer to the table at the right. Find the ratio change in earnings change in hours worked for Greg and Monica. Which person's earnings when graphed will form the steeper line? Explain your reasoning.

Hours	Earnir	ngs (\$)
Worked	Greg	Monica
1	4	5
2	8	10
3	12	15
4	16	20

5. Graph the ordered pairs (hours worked, earnings) for each person and connect to form a line. The graph of which relationship has the steeper line?

Extend 6-2 Algebra Lab: Rate of Change 293

Measurement: Changing Customary Units

Main IDEA

Change units in the customary system.



NEW Vocabulary

unit ratio

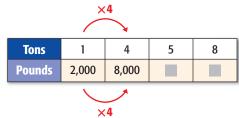
GET READY for the Lesson

ANIMALS The table shows the approximate weights in tons of several large land animals. One ton is equivalent to 2,000 pounds.

9	
Animal	Weight (T)
Grizzly Bear	1
White Rhinoceros	4
Hippopotamus	5
African Elephant	8

You can use a *ratio table*, whose columns are filled with ratios that have the same value, to convert each weight from tons to pounds.

 Copy and complete the ratio table. The first two ratios are done for you.



To produce equivalent ratios, multiply the quantities in each row by the same number.

2. Then graph the ordered pairs (tons, pounds) from the table. Label the horizontal axis *Weight in Tons* and the vertical axis *Weight in Pounds*. Connect the points. What do you notice about the graph of these data?

The relationships among the most commonly used customary units of length, weight, and capacity are shown in the table below.

KEY CONCEPT Equality Relationships for Customary Units			
Type of Measure	Larger Unit	\rightarrow	Smaller Unit
	1 foot (ft)	=	12 inches (in.)
Length	1 yard (yd)	=	3 feet
	1 mile (mi)	=	5,280 feet
	1 pound (lb)	=	16 ounces (oz)
Weight	1 ton (T)	=	2,000 pounds
	1 cup (c)	=	8 fluid ounces (fl oz)
Capacity	1 pint (pt)	=	2 cups
	1 quart (qt)	=	2 pints
	1 gallon (gal)	=	4 quarts

Each of the relationships above can be written as a unit ratio. Like a unit rate, a **unit ratio** is one in which the denominator is 1 unit.

$$\frac{3 \text{ ft}}{1 \text{ yd}} \qquad \frac{2,000 \text{ lb}}{1 \text{ T}} \qquad \frac{4 \text{ qt}}{1 \text{ gal}}$$

Notice that the numerator and denominator of each fraction above are equivalent, so the value of each ratio is 1. You can multiply by a unit ratio of this type to *convert* or change from larger units to smaller units.

EXAMPLES Convert Larger Units to Smaller Units

Convert 20 feet into inches.

Since 1 foot = 12 inches, the unit ratio is $\frac{12 \text{ in.}}{1 \text{ ft}}$.

$$20 \text{ ft} = 20 \text{ ft} \cdot \frac{12 \text{ in.}}{1 \text{ ft}}$$
$$= 20 \text{ ft} \cdot \frac{12 \text{ in.}}{1 \text{ ft}}$$

Divide out common units, leaving the desired unit, inches.

Multiply by $\frac{12 \text{ in.}}{1 \text{ ft}}$.

 $= 20 \cdot 12$ in. or 240 in. Multiply.

So, 20 feet = 240 inches.

2 GARDENING Clarence mixes $\frac{1}{4}$ cup of fertilizer with soil before planting each bulb. How many ounces of fertilizer does he use per bulb?

$$\frac{1}{4} c = \frac{1}{4} \varphi \cdot \frac{8 \text{ fl oz}}{1 \varphi}$$
$$= \frac{1}{4} \cdot 8 \text{ fl oz or 2 fl oz}$$

Since 1 cup = 8 fluid ounces, multiply by $\frac{8 \text{ fl oz}}{1 \text{ c}}$. Then, divide out common units. Multiply.

So, 2 fluid ounces of fertilizer are used per bulb.

CHECK Your Progress

Complete.

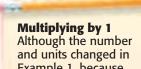
a. 36 yd = ft **b.** $\frac{3}{4}$ T = lb **c.** $1\frac{1}{2}$ qt = pt

To convert from smaller units to larger units, multiply by the reciprocal of the appropriate unit ratio.

EXAMPLES Convert Smaller Units to Larger Units

Convert 15 quarts into gallons.

Since 1 gallon = 4 quarts, the unit ratio is $\frac{4 \text{ qt}}{1 \text{ gal}}$, and its reciprocal is $\frac{1 \text{ gal}}{4 \text{ qt}}$. 15 qt = 15 qt $\cdot \frac{1 \text{ gal}}{4 \text{ qt}}$ = 15 qt $\cdot \frac{1 \text{ gal}}{4 \text{ qt}}$ Multiply by $\frac{1 \text{ gal}}{4 \text{ qt}}$. = 15 qt $\cdot \frac{1 \text{ gal}}{4 \text{ qt}}$ = 15 $\cdot \frac{1}{4}$ gal or 3.75 gal Multiplying 15 by $\frac{1}{4}$ is the same as dividing 15 by 4.

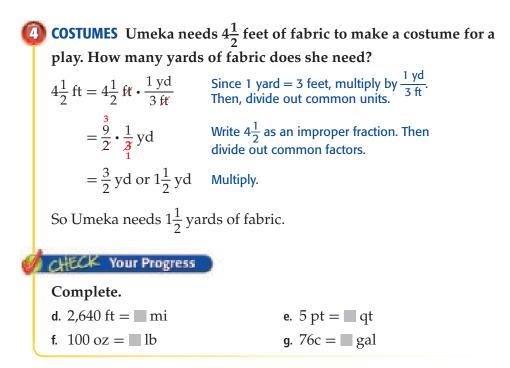


and units changed in Example 1, because the measure is multiplied by 1, the *value* of the converted measure is the same as the original.

REVIEW Vocabulary

reciprocal The product of a number and its reciprocal is 1; *Example*: The reciprocal of $\frac{3}{5}$ is $\frac{5}{3}$. (Lesson 5-7)

Math Calgreen Extra Examples at calgreen the calgreen com



Real-World EXAMPLE

5 FOOD The pork loin roast shown is cut into 10 smaller pork chops of equal weight. How many ounces does each pork chop weigh? Justify your answer.



Begin by converting 3 pounds to ounces.

Alternative Method For Example 5, you

could also begin by finding the number of pounds per pork chop. $\frac{3 \text{ lb}}{10 \text{ pork chops}} \text{ or}$ $\frac{3}{10} \text{ lb per pork chop}$

Then convert the number of pounds per pork chop to ounces.

 $\frac{\frac{3}{10} \text{ lb}}{1 \text{ pork chop}} \cdot \frac{16 \text{ oz}}{1 \text{ lb}}$ $= \frac{4.8 \text{ oz}}{1 \text{ pork chop}}$

 $3 \text{ lb} = 3 \text{ lb} \cdot \frac{16 \text{ oz}}{1 \text{ lb}}$

Since 1 pound = 16 ounces, multiply by $\frac{16 \text{ oz}}{11\text{ b}}$. Then, divide out common units.

 $= 3 \cdot 16 \text{ oz or } 48 \text{ oz}$ Multiply.

Find the unit rate which gives the number of ounces per pork chop.

 $\frac{\text{ounces}}{\text{pork chops}} = \frac{48 \text{ oz}}{10 \text{ pork chops}}$ or 4.8 ounces per pork chop

So, each pork chop weighs 4.8 ounces.

CHECK Your Progress

- **h. RECIPES** A recipe calls for 5 cups of strawberries. Are 2 pints of strawberries enough? Justify your answer.
- i. **TRUCKS** The height of a semi-truck is $4\frac{1}{2}$ yards. Will the truck fit under an overpass that is $14\frac{1}{2}$ feet tall? Justify your answer.

Personal Tutor at ca.gr6math.com

Your Understanding

1. 3 lb = oz

Examples 1, 2 Complete.

(p. 295)

- **2.** $5\frac{1}{3}$ yd = I ft **3**. 6.5 c = fl oz
- 4. FISH Grouper are members of the sea bass family. A large grouper can weigh $\frac{1}{3}$ ton. About how much does a large grouper weigh to the nearest pound?

Examples 3, 4

(pp. 295-296)

Complete.

- 5. 12 qt = gal 6. 28 in. = 100 ft7. 15 pt = qt
- 8. **VEHICLES** The world's narrowest electric vehicle is about 35 inches wide and is designed to move down narrow aisles in warehouses. About how wide is this vehicle to the nearest foot?

Example 5 (p. 296) **9. BIRDS** How many times greater is the weight of an ostrich egg that weighs about 4 pounds than a hummingbird egg that weighs about 0.05 ounce? Justify your answer.

Exercises

HOMEWO	RKHELP	Complete.		
For	See	10 . 18 ft = ■ yd	11. 72 oz = 🔤 lb	12 . 2 lb = oz
Exercises	Examples	13. 4 gal = 🔤 qt	14. $4\frac{1}{2}$ pt = c	15 . 3 c = fl oz
10-21	1–4	0 1	2	
22–23	2	16. 2 mi = 🛛 ft	17. $1\frac{1}{4}$ mi = \blacksquare ft	18 . 5,000 lb =
24–25	4		± 2	2
26–29	5	19 . 13 c = □ pt	20. $2\frac{3}{4}$ qt = \blacksquare pt	21. $3\frac{3}{8}T = \square lb$

- **22. PUMPKINS** One of the largest pumpkins ever grown weighed about $\frac{1}{2}$ ton. How many pounds did the pumpkin weigh?
- 23. SKIING Speed skiing takes place on a course that is $\frac{2}{3}$ mile long. How many feet long is the course?
- **24. BOATING** A 40-foot power boat is for sale by owner. About how long is this boat to the nearest yard?
- **25. BLOOD** A total of 35 pints of blood were collected at a local blood drive. How many quarts of blood is this?
- **26. CAR REPAIR** A car repair shop changes the oil of 50 cars. They recover $3\frac{1}{2}$ quarts of oil from each car. How many gallons of oil did they recover? Justify your answer.
- 27. **ESTIMATION** One bushel of apples weighs about 40 pounds. About how many bushels of apples would weigh 1 ton?

loz = T lb

- **28. PUNCH** Will a 2-quart pitcher hold the entire recipe of citrus punch given at the right? Explain your reasoning.
- 29. WEATHER On Monday, it snowed a total of 15 inches. On Tuesday and Wednesday, it snowed an additional $4\frac{1}{2}$ inches and $6\frac{3}{4}$ inches,



respectively. A weather forecaster says that over the last three days, it snowed about $2\frac{1}{2}$ feet. Is this a valid claim? Justify your answer.

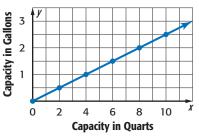
MEASUREMENT Complete the following statements.

- **30.** If 16 c = 1 gal, then $1\frac{1}{4}$ gal = $\Box c$
- **31.** If 1,760 yd = 1 mi, then 880 yd = 1 mi
- **32.** If 36 in. = 1 yd, then 2.3 yd = \square in.
- **33. ESTIMATION** Cristos is a member of the swim team and trains by swimming an average of 3,000 yards a day. About how many miles would he swim by training at this rate for 5 days, to the nearest half-mile?

MEASUREMENT For Exercises

34–37, use the graph at the right.

- 34. What does an ordered pair from this graph represent?
- **35**. Write two sentences that describe the graph.



- **36**. Use the graph to find the capacity in quarts of a 2.5 gallon container. Explain your reasoning.
- **37**. Use the graph to predict the capacity in gallons of a 12 quart container. Explain your reasoning.
- **38. OPEN ENDED** Write a problem about a real-world situation in which you would need to convert pints to cups.

REASONING Replace each • with <, >, or = to make a true sentence. Justify your answers.

39. 16 in. • $1\frac{1}{2}$ ft **40.** $8\frac{3}{4}$ gal • 32 qt **41.** 2.7 T • 86,400 oz

- **42. CHALLENGE** To whiten fabrics, a certain Web site recommends that you soak them in a mixture of $\frac{3}{4}$ cup vinegar, 2 quarts water, and some salt. Does a mixture that contains 1.5 ounces vinegar and 16 ounces water have the same vinegar to water ratio as the recommended mixture? Explain.
- **43. WRITING IN MATH** Use multiplication by unit ratios of equivalent measures to convert 5 square feet to square inches. Justify your answer.

EXTRAPRACTICE

See pages 693, 720. Math Self-Check Quiz at ca.gr6math.com

H.O.T. Problems ...

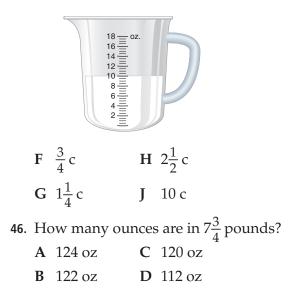
STANDARDS PRACTICE

44. Which situation is represented by the graph?

-18 -15	y					
12				-	Ŧ	
	-		-•	+		
6 3						
3						
Ò	, .	1 2	23	4	5 (3 x

- A Conversion of inches to yards
- **B** Conversion of feet to inches
- C Conversion of miles to feet
- D Conversion of yards to feet

45. How many cups of milk are shown below?





47. GROCERIES Three pounds of pears cost \$3.57. At this rate, how much would 10 pounds cost? (Lesson 6-2)

Write each ratio as a fraction in simplest form. (Lesson 6-1)

48 . 9 feet in 21 minutes 49 . 36 ca	alls in 2 hours
--	-----------------

50. 14 SUVs out of 56 vehicles

51. MEASUREMENT By doubling just the length of the rectangular ice skating rink in Will's backyard from 16 to 32 feet, he increased its area from 128 square feet to 256 square feet. Find the width of both rinks. (Lesson 3-6)

ALGEBRA For Exercises 52–54, use the

pay stub at the right. (Lesson 3-3)

- **52**. Write and solve an equation to find the regular hourly wage.
- **53**. Write and solve an equation to find the overtime hourly wage.
- 54. Write and solve an equation to find how many times greater Grace's overtime hourly wage is than her regular hourly wage.

GET READY for the Next Lesson

PREREQUISITE SKILL Multiply. (p. 674)

55. 14.5 × 8.2 **56.** 7.03 × 4.6

```
Martin, GraceEmployee #: 4211Description:Hours:Earnings ($):Regular hours:40300.00Overtime hours:222.50
```

57. 9.29 × 15.3

58. 1.84 × 16.7

Measurement: Changing Metric Units

Main IDEA

Change metric units of length, capacity, and mass.



Standard 6AF2.1

Convert one unit of

measurement to another (e.g., from feet to miles, from centimeters to inches).

NEW Vocabulary

metric system meter liter gram kilogram

MINI Lab

The lengths of two objects are shown below.

Object	Length (millimeters)	Length (centimeters)
paper clip	45	4.5
CD case	144	14.4

- 1. Select three other objects. Find and record the width of all five objects to the nearest millimeter and tenth of a centimeter.
- **2**. Compare the measurements of the objects, and write a rule that describes how to convert from millimeters to centimeters.
- **3**. Measure the length of your classroom in meters. Make a conjecture about how to convert this measure to centimeters. Explain.

The **metric system** is a decimal system of measures. The prefixes commonly used in this system are kilo-, centi-, and milli-.

Prefix	Meaning In Words	Meaning In Numbers
kilo-	thousands	1,000
centi-	hundredths	0.01
milli-	thousandths	0.001

In the metric system, the base unit of *length* is the **meter** (m). Using the prefixes, the names of other units of length are formed. Notice that the prefixes tell you how the units relate to the meter.

Unit	Symbol	Relationship to Meter	
kilometer	km	1 km = 1,000 m	1 m = 0.001 km
meter	m	1 m = 1 m	
centimeter	cm	1 cm = 0.01 m	1 m = 100 cm
millimeter	mm	1 mm = 0.001 m	1 m = 1,000 mm

The **liter** (L) is the base unit of *capacity*, the amount of dry or liquid material an object can hold. The **gram** (g) measures *mass*, the amount of matter in an object. The prefixes can also be applied to these units. Whereas the meter and liter are the base units of length and capacity, the base unit of mass is the **kilogram** (kg).

To change a metric measure of length, mass, or capacity from one unit to another, you can use the relationship between the two units and multiplication by a power of 10.

EXAMPLES Convert Units in the Metric System

Convert 4.5 liters to milliliters.

You need to convert liters to milliliters. Use the relationship 1 L = 1,000 mL.

1 L = 1,000 mL	Write the relationship.
$4.5 \times 1 L = 4.5 \times 1,000 mL$	Multiply each side by 4.5 since you have 4.5 L.
4.5 L = 4,500 mL	To multiply 4.5 by 1,000, move the decimal point 3 places to the right.

2) Convert 500 millimeters to meters.

You need to convert millimeters to meters. Use the relationship 1 mm = 0.001 m.

1 mm = 0.001 m	Write the relationship.
$500 \times 1 \text{ mm} = 500 \times 0.001 \text{ m}$	Multiply each side by 500 since you have 500 mm.
500 mm = 0.5 m	To multiply 500 by 0.001, move the decimal point 3 places to the left.
CHECK Your Progress	
Complete.	
a. 25.4 g = kg	b . 158 mm = m

Real-World EXAMPLE

BEARS The California Grizzly Bear was designated the official state animal in 1953. Use the information at the left to find the maximum weight of a grizzly bear in grams.

You are converting kilograms to grams. Since the maximum weight of a grizzly bear is 521.64 kilograms, use the relationship 1 kg = 1,000 g.

1 kg = 1,000 g	Write the relationship.
$521.64 \times 1 \text{ kg} = 521.64 \times 1,000 \text{ g}$	Multiply each side by 521.64 since you have 521.64 kg.
521.64 kg = 521,640 g	To multiply 521.64 by 1,000, i

To multiply 521.64 by 1,000, move the decimal point 3 places to the right.

So, the maximum weight of a grizzly bear is 521,640 grams.

CHECK Your Progress

c. FOOD A bottle contains 1.75 liters of juice. How many milliliters is this?

Personal Tutor at ca.gr6math.com



Metric Conversions

When converting from a larger unit to a smaller unit, the power of ten being multiplied will be greater than 1.

When converting

from a smaller unit to a larger unit, the

power of ten will be less than 1.

Real-World Link . . . The maximum weight of a grizzly bear is 521.64 kilograms. Source: bear.org To convert measures between customary units and metric units, use the relationships below.

KEY CONCEPTS Customary and Metric Relationships			
Type of Measure	Customary	\rightarrow	Metric
Length	1 inch (in.)	≈	2.54 centimeters (cm)
	1 foot (ft)	~	0.30 meter (m)
	1 yard (yd)	~	0.91 meter (m)
	1 mile (mi)	≈	1.61 kilometers (km)
Weight/Mass	1 pound (lb)	~	453.6 grams (g)
	1 pound (lb)	≈	0.4536 kilogram (kg)
	1 ton (T)	≈	907.2 kilograms (kg)
Capacity	1 cup (c)	≈	236.59 milliliters (mL)
	1 pint (pt)	≈	473.18 milliliters (mL)
	1 quart (qt)	~	946.35 milliliters (mL)
	1 gallon (gal)	≈	3.79 liters (L)

EXAMPLES Convert Between Measurement Systems

4) Convert 17.22 inches to centimeters. Round to the nearest hundredth if necessary.

Use the relationship 1 inch \approx 2.54 centimeters.

1 inch \approx 2.54 cm	Write the relationship.
17.22×1 in. $\approx 17.22 \times 2.54$ cm	Multiply each side by 17.22 since you have 17.22 in.
$17.22 \text{ in.} \approx 43.7388 \text{ cm}$	Simplify.

So, 17.22 inches is approximately 43.74 centimeters.

5 Convert 828.5 milliliters to cups. Round to the nearest hundredth if necessary.

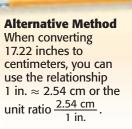
Since 1 cup \approx 236.59 milliliters, multiply by $\frac{1 \text{ c}}{236.59 \text{ mL}}$. 828.5 mL \approx 828.5 mL \bullet $\frac{1 \text{ c}}{236.59 \text{ mL}}$ Multiply by $\frac{1 \text{ c}}{236.59 \text{ mL}}$. $\approx \frac{828.5 \text{ c}}{236.59}$ or 3.5 c Simplify.

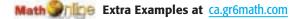
So, 828.5 milliliters is approximately 3.5 cups.

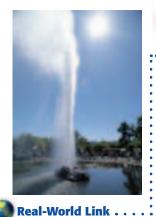
CHECK Your Progress

Complete. Round to the nearest hundredth if necessary.

d. 7.44 c \approx mL e. 22.09 lb \approx kg f. 35.85 L \approx gal







Old Faithful Geyser is one of the three geysers in the world

whose eruptions are

roadsideamerica.com

predictable.

Source:

Real-World EXAMPLE

GEYSERS Old Faithful Geyser of California, in Calistoga, averages an eruption height of 60 feet. Find the approximate average eruption height in meters.

Since the eruption height is 60 feet, use the relationship 1 ft \approx 0.30 m.

Write the relationship.

$1 \text{ ft} \approx 0.30 \text{ m}$	
$60 \times 1 \text{ ft} \approx 60 \times 0.30 \text{ m}$	
$60 \text{ ft} \approx 18 \text{ m}$	

Multiply each side by 60 since you have 60 ft. Simplify.

So, the eruption height is about 18 meters.

CHECK Your Progress

g. WATER A bottle contains 1,800 milliliters of water. About how many quarts of water does the bottle contain?

CHECK Your Understanding

	Complete. Round to the nearest hundredth if necessary.	
(pp. 301–302)	1. $3.7 \text{ m} = 100 \text{ cm}$	2 . 550 m = km
	3 . 1,460 mg = ■ g	4 . 2.34 kL = □ L
	5. 9.36 yd ≈ ■ m	6. 11.07 pt ≈ ■ mL
	7. 58.14 kg ≈ ∎lb	8. 38.44 cm \approx in .

Examples 3, 6 (pp. 302–303)9. SPORTS About how many feet does a team of athletes run in a 1,600-meter relay race?

Exercises

HOMEWO	RKHELP	Complete. Round to the nearest hundredth if necessary.	
For	See	10 . 720 cm = m	11 . 983 mm = m
Exercises	Examples 1, 2, 4, 5	12. $3.2 \text{ m} = 100 \text{ cm}$	13. $0.03 \text{ g} = 100 \text{ mg}$
24-27	3, 6	14 . 997 g = ■ kg	15 . 82.1 g = ■ kg
		16. 9.1 L = mL	17 . 130.5 kL = L
		18. 3.75 c ≈ m L	19. 41.8 in. \approx 19. cm
		20. 156.25 lb \approx kg	21 . 9.5 gal ≈ ■ L

- 24. **WATERFALLS** At 979 meters tall, Angel Falls in Venezuela is the highest waterfall in the world. How many kilometers tall is the waterfall?
- **25. FOOD** An 18-ounce jar contains 510 grams of grape jelly. How many kilograms of grape jelly does the jar contain?

Math I Extra Examples at ca.gr6math.com

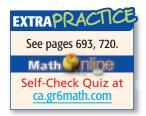
22. 680.4 g \approx **b**

Lesson 6-4 Measurement: Changing Metric Units 303

23. 4.725 m ≈ ft

(t)Lois Ellen Frank/CORBIS, (bl)Jonathan Nourok/PhotoEdit, (br)Michael Newman/PhotoEdit

Real-World Link The Golden Gate Bridge was the longest bridge in the world until 1964. Source: gocalifornia.about.com



H.O.T. Problems

- **26. BUILDINGS** The Taipei Financial Center in Taipei, Taiwan, is about 0.508 kilometers tall. About how tall is the building in feet?
- **27. BIRDS** The world's largest bird is the ostrich whose mass can be as much as 156.5 kilograms. What is this approximate weight in pounds?

Complete. Round to the nearest hundredth if necessary.

28. 8.18 qt ≈ ■ L	29 . 15.09 km ≈ ■ yd
30. 72.26 cm ≈ ■ ft	31 . 0.445 T \approx g

Order each set of measures from least to greatest.

32. 0.02 km, 50 m, 3,000 cm

34. 0.32 kg, 345 g, 35,100 mg

•36. **ANALYZE TABLES** The table shows the lengths of bridges in the United States. Which bridges are about 1 kilometer in length? Justify your answer.

37. CARPENTRY Jacinta needs a 2.5-meter pole for a birdfeeder that she is building. How many centimeters will she need to cut off a 3-meter pole in order to use it for the birdfeeder?

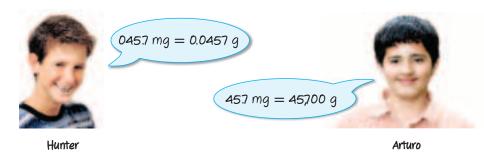
Bridge	Length (m)
Mackinac, MI	1,158
George Washington, NY	1,067
Tacoma Narrows II, WA	853
Oakland Bay, CA	704
Pennybacker, TX	345
Sunshine Skyway, FL	8,712
Golden Gate, CA	2,780

33. 660 mL, 0.06 L, 6.6 kL

35. 2,650 mm, 130 cm, 5 m

38. BAKING A bakery uses 900 grams of peaches per cobbler. How many cobblers can be made using 10.5 pounds of peaches?

39. FIND THE ERROR Hunter and Arturo are converting 45.7 milligrams to grams. Who is correct? Explain your reasoning.



CHALLENGE For Exercises 40–42, use the following information.

The metric prefix *giga* refers to something one billion times larger than the base unit.

- 40. How many meters are in one gigameter?
- **41**. About how many miles are in one gigameter? Round to the nearest hundredth.
- **42**. The distance from Earth to the Sun is approximately 93 million miles. About how many gigameters is this? Round to the nearest hundredth.

43. WRITING IN MATH Explain why it makes sense to multiply by a power of 10 that is greater than 1 when changing from a larger unit to a smaller unit.

STANDARDS PRACTICE

44. The table shows the mass of four wireless telephones. Find the approximate total mass of the telephones in kilograms.

Telephone Owner	Mass (g)
Elena	100.4
Kevin	70.8
Marissa	95.6
Corey	120.4

- A 0.39 kilogram
- **B** 3.9 kilograms
- C 39.0 kilograms
- D 390.0 kilograms

- **45.** Which relationship between the given units of measure is correct?
 - **F** One gram is $\frac{1}{100}$ of a centigram.
 - **G** One meter is $\frac{1}{100}$ of a centimeter.
 - **H** One gram is $\frac{1}{1.000}$ of a kilogram.
 - J One milliliter is $\frac{1}{100}$ of a liter.

Spiral Review

46. MEASUREMENT A certain car weighs 3,200 pounds. What is the weight of the car in tons? (Lesson 6-3)

.....

Find each unit rate. Round to the nearest hundredth if necessary. (Lesson 6-2)

- 47. 468 miles on 18 gallons
- 48. \$13.28 for 8 pounds
- 49. 732 Calories in 6 servings
- 50. 1,020 kilobytes in 3 minutes

Add or subtract. Write in simplest form. (Lesson 5-3)

51.
$$3\frac{4}{7} + 1\frac{1}{7}$$
 52. $8\frac{3}{5} - 2\frac{2}{5}$ **53.** $9\frac{1}{6} + 4\frac{3}{8}$ **54.** $11\frac{7}{10} - 5\frac{3}{4}$

55. BASKETBALL Jared made thirty-seven percent of his free-throw attempts during basketball practice. Write this percent as a decimal. (Lesson 4-7)

GET READY for the Next Lesson

PREREQUISITE SKILL Solve each equation. (Lesson 3-3)

56. $5 \cdot 4 = x \cdot 2$ **57.** $9 \cdot 24 = 27 \cdot x$ **58.** $x \cdot 15 = 12 \cdot 4$ **59.** $8\frac{1}{2} \cdot x = 11 \cdot 17$

Algebra: Solving Proportions

Main IDEA

Solve proportions.

Standard GNS1.3 Use proportions to solve problems (e.g. determine the value of *n* if $\frac{4}{7} = \frac{n}{21}$, find the length of a side of a polygon similar to a known polygon). Use crossmultiplication as a method for solving such problems, understanding it as the multiplication of both sides of an equation by a multiplicative inverse.

NEW Vocabulary

proportional cross product



Inverses

The product of a number and its multiplicative inverse is 1; *b* and $\frac{1}{b}$ are multiplicative inverses, as are *d* and $\frac{1}{d}$.

GET READY for the Lesson

NUTRITION The table shows the amount of vitamin C in different serving sizes of a certain cereal.

1. Write the rate $\frac{\text{vitamin C}}{\text{serving size}}$

for each serving size of cereal.

2. Find the number of milligrams per cup for each serving size. What do you notice?

Vitamin C (mg)	Serving Size (c)
15	0.5
60	2

Two quantities are **proportional** if they have a constant rate or ratio. In the example above, notice that the serving size and amount of vitamin C change or *vary* in the same way.

The unit rates for these different-sized

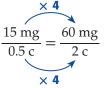
milligrams per cup. So, the amount of

vitamin C is proportional to the serving

relationship is by writing a proportion.

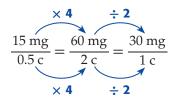
servings are the same, a constant 30

size. Another way of expressing this



When the serving size quadruples, the number of milligrams of vitamin C also quadruples.

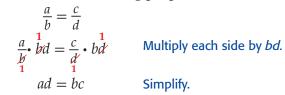
Proportion



KEY CONCEPT

Words	A proportion is an equation stating that two ratios or rates are equivalent.		
Symbols	Numbers	Algebra	
	$\frac{1}{2} = \frac{3}{6}, \frac{8 \text{ ft}}{10 \text{ s}} = \frac{4 \text{ ft}}{5 \text{ s}}$	$\frac{a}{b} = \frac{c}{d}$, where <i>b</i> , $d \neq 0$	

Consider the following proportion.



The products *ad* and *bc* are called the **cross products** of this proportion. The cross products of any proportion are equal. You can compare unit rates or cross products to identify proportional relationships.

306 Chapter 6 Ratios and Proportions

Doug Martin

EXAMPLE Identify Proportional Relationships

RECREATION A carousel makes 4 complete turns after 64 seconds and 5 complete turns after 76 seconds. Based on this information, is the number of turns made by this carousel proportional to the time in seconds? Explain.

METHOD 1 Compare unit rates.

seconds	\rightarrow	64 s	16 s	
complete turns	\rightarrow	4 turns	1 turn	

 $\frac{76 \text{ s}}{5 \text{ turns}} = \frac{15.2 \text{ s}}{1 \text{ turn}}$

Since the unit rates are not equal, the number of turns is not proportional to the time in seconds.

METHOD 2 Compare ratios by comparing cross products.

seconds $\rightarrow \frac{64}{4} \stackrel{?}{=} \frac{76}{5}$ \leftarrow seconds complete turns $\rightarrow \frac{64}{4} \stackrel{?}{=} \frac{76}{5}$ \leftarrow complete turns $64 \cdot 5 \stackrel{?}{=} 4 \cdot 76$ Find the cross products. $320 \neq 304$ Multiply.

Since the cross products are not equal, the number of turns is not proportional to the time in seconds.

CHOOSE Your Method

Determine if the quantities in each pair of ratios are proportional. Explain.

- a. 60 voted out of 100 registered and 84 voted out of 140 registered
- **b**. \$12 for 16 yards of fabric and \$9 for 24 yards fabric

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You can also use cross products to find a missing value in a proportion. This is known as *solving the proportion*.

EXAMPLES Solve a Proportion 2 Solve $\frac{21}{5} = \frac{c}{7}$. $\frac{21}{5} = \frac{c}{7}$ Write the proportion. $21 \cdot 7 = 5 \cdot c$ Find the cross products. 147 = 5c Multiply. $\frac{147}{5} = \frac{5c}{5}$ Divide each side by 5. 29.4 = c Simplify. Check for Reasonableness Since $\frac{21}{5} \approx \frac{20}{5}$ or $\frac{4}{1}$ and $\frac{29.4}{7} \approx \frac{28}{7}$ or $\frac{4}{1}$, the answer is reasonable. \checkmark

Mental Math Some proportions can be solved using mental math. $\frac{2.5}{10} = \frac{x}{30}$

VOY TH

COncepts in MOtion BRAINPOP® ca.gr6math.com

• (Solve $\frac{2.6}{13} = \frac{8}{n}$.	
	$\frac{2.6}{13} = \frac{8}{n}$	Write the proportion.
	$2.6 \cdot n = 13 \cdot 8$	Find the cross products.
	2.6n = 104	Multiply.
	$\frac{2.6n}{2.6} = \frac{104}{2.6}$	Divide each side by 2.6.
	n = 40	Simplify.
6	CHECK Your Pro	gress Solve each proportion.
	c. $\frac{16}{k} = \frac{2}{3}$	d. $\frac{2}{6} = \frac{5}{h}$ e. $\frac{10}{k} = \frac{2.5}{4}$

Real-World EXAMPLE

SCIENCE In one species, a 6-foot crocodile has a 2-foot skull. If skull length is proportional to body length, what is the length of a crocodile of that same species with a 3.5-foot skull?

METHOD 1 Write and solve a proportion.

Let *b* represent the length of the crocodile with a 3.5-foot skull.

body length $\rightarrow \frac{6 \text{ ft}}{2 \text{ ft}} = \frac{b \text{ ft}}{3.5 \text{ ft}}$	Write a proportion.
$6 \cdot 3.5 = 2 \cdot b$	Find the cross products.
21 = 2b	Multiply.
10.5 = b	Divide each side by 2.

METHOD 2 Find and use a unit rate or ratio.

body length skull length -

→ →	$\frac{6 \text{ ft} \div 2}{2 \text{ ft} \div 2} = \frac{3}{1}$	There ratio of body length to skull length is 3:1.

Words	The body length is 3 times the skull length.
Variable	Let <i>b</i> represent the length of the crocodile with a 3.5 foot skull.
Equation	$b = 3 \cdot 3.5$

 $b = 3 \cdot 3.5$ or 10.5 Multiply.

So, a crocodile with a 3.5-foot skull is about 10.5 feet long.

CHOOSE Your Method

f. **RUNNING** Salvador can run 120 meters in 24 seconds. If he runs at the same rate, how many seconds will it take him to run a 300-meter race?



How Does a Paleontologist use Math? In 2001, paleontologists discovered a 6-foot skull of a prehistoric crocodile called SuperCroc. By using proportions, they estimated its total length as 40 feet.



C Your Understanding

Example 1

(p. 307)

Determine if the quantities in each pair of ratios are proportional. Explain.

- 1. 2 adults for 10 children and 3 adults for 12 children
- 2. 12 inches by 8 inches and 18 inches by 12 inches
- **3**. 8 feet in 21 seconds and 12 feet in 31.5 seconds
- 4. \$5.60 for 5 pairs of socks and \$7.12 for 8 pairs of socks

Examples 2, 3 Solve each proportion.

(pp. 307-308)

5. $\frac{5}{6} = \frac{t}{18}$	6. $\frac{6}{k} = \frac{24}{28}$	7. $\frac{21}{5} = \frac{c}{7}$
8. $\frac{15}{w} = \frac{2}{5}$	9. $\frac{3}{n} = \frac{2.7}{18}$	10. $\frac{0.2}{3} = \frac{3}{d}$

Example 4 (p. 308)

- 11. **GROCERIES** Orange juice is on sale 3 half-gallons for \$5. At this rate, find the cost of 5 half-gallons of orange juice to the nearest cent.
- 12. **TRAVEL** Franco drove 203 miles in 3.5 hours. At this rate, how long will it take him to drive another 29 miles to the next town?

Exercises

HOMEWORKHELP		
For Exercises	See Examples	
13–20	1	
21–32	2, 3	
33–40	4	

Determine if the quantities in each pair of ratios are proportional. Explain.

- 13. 20 children from 6 families to 16 children from 5 families
- **14**. 5 pounds of dry ice melts in 30 hours and 4 pounds melts in 24 hours
- 15. 16 winners out of 200 entries and 28 winners out of 350 entries
- 16. 5 meters in 7 minutes and 25 meters in 49 minutes
- 17. 1.4 tons produced every 18 days and 10.5 tons every 60 days
- **18.** 3 inches for every 4 miles and 7.5 inches for every 10 miles
- **19. READING** Leslie reads 25 pages in 45 minutes. After 60 minutes, she has read a total of 30 pages. Is her time proportional to the number of pages she reads? Explain.
- 20. PETS A store sells 2 hamsters for \$11 and 6 hamsters for \$33. Is the cost proportional to the number of hamsters sold? Explain.

Solve each proportion.

21. $\frac{3}{8} = \frac{b}{40}$	22. $\frac{x}{12} = \frac{12}{4}$	23. $\frac{c}{7} = \frac{18}{42}$	24. $\frac{5}{k} = \frac{10}{22}$
25. $\frac{3}{8} = \frac{n}{4}$	26. $\frac{15}{4} = \frac{3}{g}$	27. $\frac{45}{5} = \frac{d}{7}$	28. $\frac{30}{a} = \frac{8}{20}$
29. $\frac{1.6}{m} = \frac{2}{3}$	30. $\frac{4.5}{5} = \frac{t}{7}$	31. $\frac{2.5}{4.5} = \frac{7.5}{x}$	32. $\frac{3.8}{5.2} = \frac{7.6}{z}$

- **33. SCHOOL** If 4 notebooks weigh 2.8 pounds, how much do 6 of the same notebooks weigh?
- **34. COOKING** There are 6 teaspoons in 2 tablespoons. How many teaspoons are in 1.5 tablespoons?

ANALYZE TABLES For Exercises 35–38, use the table.



- **35.** How many stalks of celery yield $3\frac{1}{2}$ cups of celery slices?
- 36. How many cups of broccoli florets would 1 pound of broccoli produce?
- 37. About how many ounces of carrots yields 2 cups sliced?
- **38**. How many cups of sliced celery would $7\frac{1}{2}$ stalks of celery yield?
- **39. SCIENCE** The ratio of salt to water in a certain solution is 4 to 15. If the solution contains 6 ounces of water, how many ounces of salt does it contain?
- **40. CONCERTS** Alethia purchased 7 advanced tickets for herself and her friends to a concert and paid \$164.50. If the total cost of tickets to the concert is proportional to the number purchased, how many tickets to the same concert did Serefina purchase if she paid a total of \$94?
- **41. SAVINGS** Pao spent \$140 of his paycheck and put the remaining \$20 in his savings account. If the number of dollars he spends is proportional to the number he saves, how much of a \$156-paycheck will he put into savings?
- **:-42.** MOVIES After 30 seconds, 720 frames of film have passed through a movie projector. At this rate, what is the approximate running time in minutes of a movie made up of 57,000 frames of film?
 - **43. SCHOOL** There are 325 students and 13 teachers at a school. Next school year, the enrollment is expected to increase by 100 students. Write and solve a proportion to find the number of teachers that must be hired so the student-teacher ratio remains the same.
 - 44. **FIND THE DATA** Refer to the California Data File on pages 16–19. Choose some data and write a real-world problem in which you would solve a proportion.

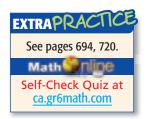


46. CHALLENGE In a cleaning solution, the ratio of bleach to water is 1:5. If there are 36 cups of cleaning solution, how many cups of water are needed? Explain your reasoning.



Real-World Link . .

Film for an IMAX projection system passes through the projector at the rate of 330 feet per minute or 5.5 feet per second. **Source:** hfmgv.org



- **47. SELECT A TECHNIQUE** Sweet corn is on sale at \$2.50 for a dozen at a farmer's market. Select one or more of the following technique(s) to determine how many ears you can buy for \$10. Then use this technique to solve the problem.
- mental math
 estimation
 number sense

 48.
 WRITING IN MATH Explain why the cross products of a proportion are equal. Use the term *multiplicative inverse* in your explanation.

STANDARDS PRACTICE

49. Mirma gives away 84 flyers over a 3-hour period. If the number of flyers she is able to give away per hour remains the same, which proportion can be used to find *x*, the number of flyers that she would give away over a 5-hour period?

A
$$\frac{3}{84} = \frac{x}{5}$$
 C $\frac{5}{3} = \frac{84}{x}$
B $\frac{84}{3} = \frac{x}{5}$ **D** $\frac{3}{84} = \frac{x}{8}$

- **50**. A recipe that makes 16 muffins calls for $\frac{1}{2}$ cup of flour. How much flour is needed to make 3 dozen muffins using this recipe?
 - **F** $1\frac{1}{8}c$
 - **G** 1 c **H** $1\frac{1}{4}$ c
 - J $1\frac{1}{2}c$

Spiral Review

51. MEASUREMENT Felicia bought 5 pounds of onions. About how many kilograms of onions did she buy? (Lesson 6-4)

MEASUREMENT Complete. (Lesson 6-3)

52. 5 qt = 1 pt **53.** $3\frac{1}{2} \text{ lb} = 1 \text{ oz}$

Multiply. Write in simplest form. (Lesson 5-5)

55. $3\frac{1}{2} \times 5\frac{7}{8}$ **56.** $1\frac{2}{3} \times 5\frac{4}{5}$

GET READY for the Next Lesson

58. PREREQUISITE SKILL Mr. Andres is filling up his car with gas that costs \$2.50 per gallon. His car's gas gauge before filling up is shown at the right. If his car's gas tank holds 16 gallons, about how much will Mr. Andres pay to fill up his tank? Use the *eliminate possibilities* strategy. (Lesson 5-4)

Α	\$15.00	С	\$27.00

B \$25.00 **D** \$35.00



54. 28 c = qt

57. $2\frac{1}{4} \times 7\frac{5}{8}$

Statistics Lab Wildlife Sampling

Main IDEA

Use proportions to estimate populations.

Extend

6-5

Standard 6SDAP2.1 **Compare different** samples of a population with the data from the entire population and identify a situation in which it makes sense to use a sample.

Standard 6MR2.1 Use estimation to verify the reasonableness of calculated results.

Naturalists can estimate the population in a wildlife preserve by using the capturerecapture technique. In this lab, you will model this technique using dried beans in a bowl to represent deer in a forest.

ACTIVITY



Fill a small bowl with dried beans.

STEP2 Use the paper cup to scoop out some of the beans. These represent the original *captured* deer. Record the number in a table like the one shown at the right. Mark each bean with an \times on both sides. Then return these beans to the bowl and mix well.



Original Number Captured			
Trial Sample Recaptured			
	<u> </u>	<u> </u>	

- **STUP3** Scoop another cup of beans from the bowl and count them. This is the *sample* for Trial A. Count the beans with the \times 's. These are the *recaptured* deer. Record both numbers.
- **STEP 4** Use the proportion below to estimate the total number of beans in the bowl. This represents the total population P. Record the value of *P* in the table.

captured	_	recaptured
total population (P)	_	sample

Return all of the beans to the bowl.

STEPS Repeat Steps 3–5 nine times.

ANALYZE THE RESULTS

- 1. **ESTIMATION** Find the average of the estimates in column P. Is this a good estimate of the number of beans in the bowl? Explain your reasoning.
- 2. Count the actual number of beans in the bowl. How does this number compare to your estimate?

CHAPTED

Mid-Chapter Quiz

Lessons 6-1 through 6-5

RECIPE For Exercises 1–3, use the information in the table to write each ratio as a fraction in simplest form. (Lesson 6-1)

Cherry Punch Recipe		
Cherry Juice	4 cups	
Apple Juice	2 cups	
Ginger Ale	16 cups	

- 1. cherry juice: apple juice
- 2. apple juice : ginger ale
- 3. cherry juice: ginger ale

Determine whether the ratios are equivalent. Explain. (Lesson 6-1)

- 6 out of 9 words spelled correctly
 2 out of 3 words spelled correctly
- 150 athletes to 15 coaches 3 athletes to 1 coach
- 6. 24 points in 4 games 72 points in 8 games

Find each unit rate. Round to the nearest hundredth if necessary. (Lesson 6-2)

- **7**. 200 miles in 4 hours
- 8. \$6.20 for 5 pounds
- 9. 98 carbohydrates in 8 servings
- STANDARDS PRACTICE Celeste's favorite type of chocolate comes in four different amounts. Which amount of chocolate shown in the table has the best unit price? (Lesson 6-2)

	Weight (oz)	Cost (\$)
	12	2.50
	18	3.69
	24	4.95
	30	6.25
A 12 oz		C 24 oz

B 18 oz **D** 36 oz

Complete. (Lesson 6-3)

- 42 ft = yd
 7,600 lb = T
- **12.** 9 pt = \blacksquare qt **14.** $7\frac{1}{2}$ gal = \blacksquare qt
- 15. STANDARDS PRACTICE Which situation is best represented by the graph? (Lesson 6-3)

72	y						
12							
60-							
48-		-			-		
36-	-			-			
24-			<u> </u>				
72 [.] 60 [.] 48 [.] 36 [.] 24 [.] 12 [.]							
0	, 1		į į	3 4	1 5	5 6	5 X

- **F** Conversion of inches to yards
- G Conversion of feet to inches
- H Conversion of inches to miles
- J Conversion of yards to feet

Complete. Round to the nearest hundredth if necessary. (Lesson 6-4)

16.	12.5 mi ≈	km	17 . 4.75 gal ≈ L	,

18. 76 cm \approx **19.** 31.8 kg \approx **1**b

Determine if the quantities in each pair of ratios are proportional. Explain. (Lesson 6-5)

- **20.** 8 pages in 5 minutes and 40 pages in 25 minutes
- **21.** 40 blank CDs for \$9.60 and 24 blank CDs for \$4.80

Solve each proportion. (Lesson 6-5)

22. $\frac{3}{d}$ =	$=\frac{12}{20}$	23. $\frac{7}{8} = \frac{m}{48}$	24. $\frac{w}{8} = \frac{1}{3}$
----------------------------	------------------	---	--

25. **MEASUREMENT** It took 45 minutes to fill a circular pool of uniform depth to a level of 18 inches. At this rate, how long will it take to fill the pool to a level of 35 inches? (Lesson 6-5)

5-6 **Problem-Solving Investigation**

MAIN IDEA: Solve problems by drawing a diagram.

Standard 6MR2.5 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning. **Standard 6NS2.1** Solve problems involving addition, subtraction, multiplication, and division of positive fractions and explain why a particular operation was used for a given situation.

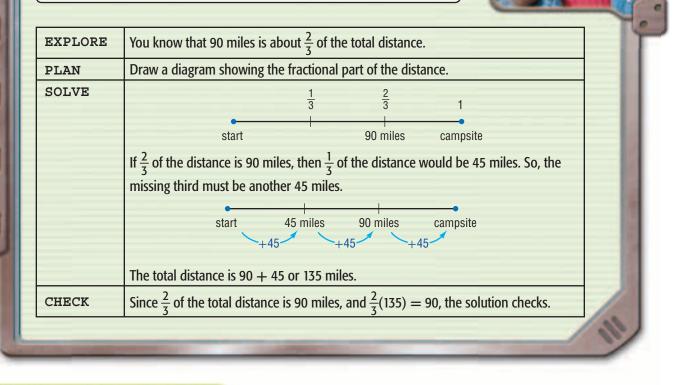
P.S.I. TERM +

I-M: DRAW A DIAGRAM

YOUR MISSION: Draw a diagram to solve the problem.

THE PROBLEM: How much farther do we have to drive?

Frieda: We've gone about 90 miles, which is about $\frac{2}{3}$ of the way to the campsite. So, how much farther do we have to go?



Analyze The Strategy

- 1. Determine how far the trip would have been if the 90 miles were only $\frac{1}{3}$ of the total distance. Draw a new diagram for this situation.
- 2. **WRITING IN MATH** Write a problem that could be solved by drawing a diagram. Exchange your problem with a classmate and solve.

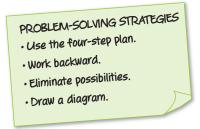
Mixed Problem Soluing



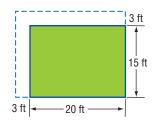
Solve Exercises 3–5. Use the *draw a diagram* strategy.

- 3. **PHYSICAL SCIENCE** A ball is dropped from a height of 10 feet. It hits the ground and bounces up half as high as it fell. This is true for each successive bounce. What height does the ball reach on the fourth bounce?
- 4. **FAMILY** At Nelia's family reunion, $\frac{4}{5}$ of the people are 18 years of age or older. Half of the remaining people are under 12 years old. If 20 children are under 12 years old, how many people are at the reunion?
- 5. VOLUME A swimming pool is being filled with water. After 25 minutes, $\frac{1}{6}$ of the swimming pool is filled. How much longer will it take to completely fill the pool, assuming the water rate is constant?

Use any strategy to solve Exercises 6–8. Some strategies are shown below.



6. **MEASUREMENT** Jamila is adding 3 feet to the length and width of her rectangular garden, as shown.



Which expression represents the area of land to be added to the original garden?

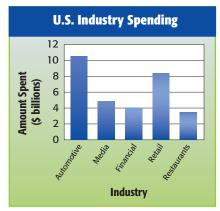
- A (15+3)(20+3)
- **B** (15+3)(20+3) (15)(20)
- **C** (15-3)(20-3)
- **D** (15-3)(20-3) (15)(20)

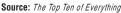
- 7. **GAMES** Six members of a video game club are having a tournament. In the first round, every player will play a video game against every other player. How many games will be in the first round of the tournament?
- 8. **BASEBALL** Of Lee's baseball cards, $\frac{1}{5}$ show California players. Of these, $\frac{3}{8}$ show San Diego Padres players. Is the fraction of Lee's collection that show Padres players $\frac{23}{40}$, $\frac{4}{13}$, or $\frac{3}{40}$?

Select the Operation

For Exercises 9 and 10, select the appropriate operation(s) to solve the problem. Justify your selection(s) and solve the problem.

9. BUSINESS The graph shows the annual spending by five industries in the United States.





Estimate how much more the automotive industry spends than the retail industry.

10. TESTS The scores on a test are found by adding or subtracting points as shown below. If Salazar's score on a 15-question test was 86 points, how many of his answers were correct, incorrect, and blank?

Answer	Points
Correct	+8
Incorrect	—4
No answer	-2

Scale Drawings

Main IDEA

Solve problems involving scale drawings.

Standard GNS1.3 Use proportions to solve problems (e.g. determine the value of *n* if $\frac{4}{7} = \frac{n}{21}$, find the **length of a side of a polygon similar to a known polygon). Use crossmultiplication as a method for solving such problems,** understanding it as the multiplication of both sides of an equation by a multiplicative inverse.

NEW Vocabulary

scale drawing scale model scale scale factor



Scale A map scale can be written in different ways, including the following:

1 cm = 20 km

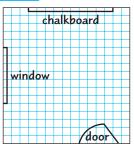
1 cm:20 km <u>1 cm</u> 20 km

MINI Lab

COncepts in MOtion

Interactive Lab ca.gr6math.com

- Measure the length of each wall, door, window, and chalkboard in your classroom.
- Record each length to the nearest $\frac{1}{2}$ foot.
- Let 1 unit on the grid paper represent 1 foot. So, 6 units = 6 feet. Convert all of your measurements to units.
- 2. On grid paper, make a drawing of your classroom like the one shown at the right.



A map is an example of a scale drawing. **Scale drawings** and **scale models** are used to represent objects that are too large or too small to be drawn or built at actual size. The **scale** gives the ratio that compares the measurements of the drawing or model to the measurements of the real object. The measurements on a drawing or model are proportional to measurements of the actual object.

EXAMPLE Use a Map Scale

MAPS What is the actual distance between Sacramento and San Francisco?

Step 1 Use a centimeter ruler to find the map distance between the two cities. The map distance is about 3.7 centimeters.



Step 2 Write and solve a

proportion using the scale. Let d represent the actual distance between the cities.

ScaleSacramento
to San Franciscomap
actual \rightarrow $\frac{1 \text{ centimeter}}{20 \text{ miles}} = \frac{3.7 \text{ centimeters}}{d \text{ miles}} \leftarrow \text{ map}$
 $\leftarrow \text{ actual}$ $1 \times d = 20 \times 3.7$
d = 74Cross products.
Simplify.

The distance between the cities is about 74 miles.



a. MAPS On the map of Arkansas shown, find the distance between Clarksville and Little Rock. Use a ruler to measure.



A blueprint is another example of a scale drawing.

Alternate Method You could also set up and solve the proportion below. in. w ft

So, w = 14 ft.

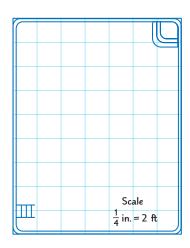
EXAMPLE Use a Blueprint Scale

2) **POOLS** On the blueprint of the pool, each square has a side length of $\frac{1}{4}$ inch. What is the actual width of the pool?

The pool on the blueprint is

 $1\frac{3}{4}$ inches wide. Write and

solve a proportion using the scale. Let *w* represent the actual width of the pool.



Scale Width of Pool $= \frac{1\frac{3}{4} \text{ inches}}{w \text{ feet}}$

blueprint
$$\rightarrow$$

actual \rightarrow
 $\frac{\frac{1}{4} \operatorname{inch}}{2 \operatorname{feet}} = \frac{1\frac{3}{4}}{u}$
 $\frac{1}{4} \cdot w = 2 \cdot$
 $\frac{1}{4} w = \frac{14}{4}$
 $w = 14$

<- blueprint

 $2 \cdot 1\frac{3}{4}$

 $\frac{14}{4}$

<- actual

Cross products

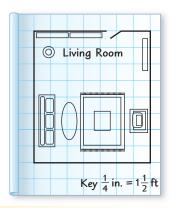
Multiply.

Simplify. Multiply each side by 4.

The actual width of the pool is 14 feet.

CHECK Your Progress

b. INTERIOR DESIGN On the blueprint of the living room, each square has a side length of $\frac{1}{4}$ inch. What are the actual dimensions of the living room?



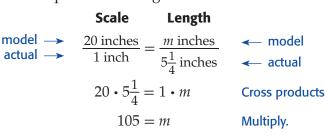


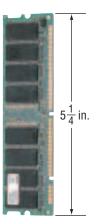
Scale The scale is the ratio of the drawing/model measure to the actual measure. It is not always the ratio of a smaller measure to a larger measure.

EXAMPLE Use a Scale Model

COMPUTERS Designers are creating a larger model of the computer memory board. If they use a scale of 20 inches = 1 inch, what is the length of the model?

Write a proportion using the scale. Let *m* represent the length of the model.





The scale model is 105 inches long.

CHECK Your Progress

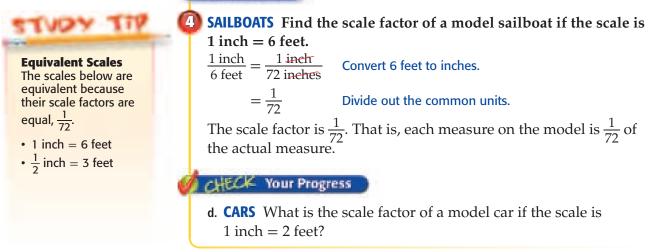
c. **SCOOTERS** A scooter is $3\frac{1}{2}$ feet long. Find the length of a scale model of the scooter if the scale is 1 inch = $\frac{3}{4}$ feet.

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In Lesson 6-3, you used ratios to convert units. You can use a similar method to simplify a scale. A scale written as a ratio without units in simplest form is called the **scale factor**.

scale
$$\frac{1}{4}$$
 inch
 2 feet $\frac{1}{4}$ inch
 24 inchesConvert 2 feet to inches. $=\frac{4}{4} \cdot \frac{\frac{1}{4}$ inch
 $\frac{1}{24}$ inchesMutiply by $\frac{4}{4}$ to eliminate the
fraction in the numerator. $=\frac{1}{96}$ scale factor

EXAMPLE Find a Scale Factor



Matt Meadows

HECK Your Understanding

Example 1 (pp. 316–317)

GEOGRAPHY Find the actual distance between each pair of cities in New Mexico. Use a ruler to measure.

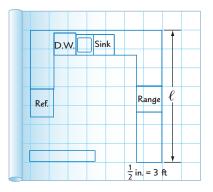
- 1. Carlsbad and Artesia
- 2. Hobbs and Eunice
- 3. Artesia and Eunice
- 4. Lovington and Carlsbad



Example 2 (p. 317)

BLUEPRINTS For Exercises 5 and 6, use the blueprint. Each square has a side length of $\frac{1}{2}$ inch.

- **5**. Find the actual length ℓ of the kitchen.
- **6**. Estimate the walking distance from the range to the refrigerator.



Example 3 (p. 318) BRIDGES For Exercises 7 and 8, use the following information.

A engineer makes a model of the bridge using a scale of 1 inch = 3 yards.



- **7**. What is the length of the model?
- 8. What is the height of the model?

Example 4

Find the scale factor of each scale drawing or model.

(p. 318)

9.

- 1 inch = 4 feet
- 11. **CITY PLANNING** In the aerial view of a city block at the right, the length of Main Street is 2 inches. If Main Street's actual length is 2 miles, find the scale factor of the drawing.



1 centimeter = 15 millimeters



Exercises

HOMEWORKHELP		
For Exercises	See Examples	
12–15	1	
16–17	2	
18–24	3, 4	

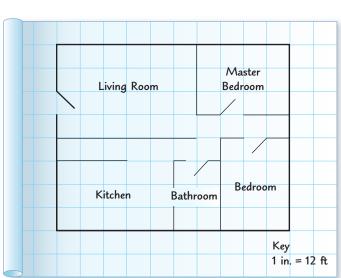
GEOGRAPHY Find the actual distance between each pair of locations in South Carolina. Use a ruler to measure.



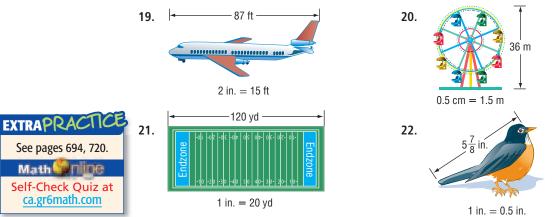
- **12**. Columbia and Charleston
- 13. Hollywood and Sumter
- 14. Congaree Swamp and Charleston 15. Sumter and Columbia

For Exercises 16–18, use the blueprint of an apartment at the right. Each square has a side length of $\frac{1}{4}$ inch.

- **16.** What is the actual length of the living room?
- **17**. Find the actual dimensions of the master bedroom.
- **18**. Find the scale factor for this blueprint.



Find the length of each model. Then find the scale factor.

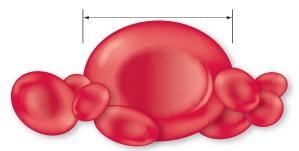


320 Chapter 6 Ratios and Proportions



Real-World Link Mount Rushmore is a sculpture that was carved using a model with a scale of 1 inch: 1 foot. Source: freeourparks.org

- **23. GEOGRAPHY** A map of Bakersfield, California, has a scale of 1 inch to 5 miles. If the city is $5\frac{1}{5}$ inches across on the map, what is the actual distance across the actual city? Use estimation to check your answer.
- 24. **TREES** A model of a tree is made using a scale of 1 inch: 25 feet. What is the height of the actual tree if the height of the model is $4\frac{3}{8}$ inches?
- •25. **SCULPTURES** Refer to the information at the left. Find the scale factor and the actual height of George Washington's face on the sculpture if the height of the model's face is 5 feet.
- **26. GEOGRAPHY** Lexington and Elizabethtown, Kentucky, are 79 miles apart. If the distance on the map is $2\frac{1}{2}$ inches, find the scale of the map.
- **27. RESEARCH** Find the dimensions of any U.S. presidential monument. Give an appropriate scale that can be used to make a scale model of the monument. State the dimensions of the model using your scale.
- **28. IGLOOS** The diameter of the circular floor of an igloo is 10 feet. If you were to make a model of the igloo with sugar cubes, which might be an appropriate scale: 1 in. = 1 ft or 1 in. = 50 ft? Explain your reasoning.
- **29. LIFE SCIENCE** A scale drawing of a red blood cell is shown below. If the blood cell's actual diameter is 0.008 millimeter, use a ruler to find the scale factor of the drawing.



H.O.T. Problems

- **30. OPEN ENDED** On grid paper, create a scale drawing of a room in your home. Include the scale that you used.
- **31. CHALLENGE** Montoya constructed three models, A, B, and C, of the same figure, with scales of 0.5 cm = 1 mm, 1.5 mm = 4 cm, and 0.25 cm = 2.5 mm, respectively.
 - a. Which model is larger than the actual figure? Justify your answer.
 - **b.** Which model is smaller than the actual figure? Justify your answer.
 - c. Which model is the same size as the actual figure? Justify your answer.
- **32. REASONING** Compare and contrast the terms *scale* and *scale factor*. Include an example in your comparison.
- **33. WRITING IN MATH** Explain how you could use estimation to find the actual distance between San Diego, California, and Seattle, Washington, on a map.

GET READY for the Next Lesson

PREREQUISITE SKILL	Divide. Write in	simplest form. (Lesson 5-7)
48. $2\frac{3}{4} \div 10$	49. $4\frac{1}{3} \div 10$	50. $30\frac{2}{3} \div 100$

35. A certain map has a scale of $\frac{1}{4}$ inch 34. A scale drawing of a doctor's office is

- = 30 miles. How many miles are represented by 4 inches on this map?
 - F 480 miles
 - G 120 miles
 - H 30 miles
 - J 16 miles
- **36**. Ernesto drew a map of his school. He used a scale of 1 inch: 50 feet. What distance on Ernesto's map should represent the 625 feet between the cafeteria and the science lab?
 - A 8 in.
 - **B** 10.5 in.
 - C 12.5 in.
 - **D** 15 in.



STANDARDS PRACTICE

Doctor's

Office

3 in.

What are the actual dimensions of the

2 in.

Key 1 in. = 20 ft

shown.

2 in.

doctor's office?

A 24 feet by 48 feet

B 30 feet by 52 feet

C 40 feet by 60 feet

D 37.5 feet by 65 feet

37. BIRDS In a certain pair of binoculars, of ear to be only 1 foot away. If a goldfinch is 368 distance appear to be in the binoculars? Round son 6-5)

Find each unit rate. (Lesson 6-2)

- **38.** 200 miles in 5 hours **39.** 99¢ for 30 ounces 40. 150 meters in 12 seconds
- 41. JOGGING The table shows the number of miles Tonya jogged each week for the past several weeks. Estimate the total number of miles she jogged. (Lesson 5-1)

Find the LCM of each set of numbers. (Lesson 4-8)

42. 2, 4	43 . 4, 8, 12
44 . 3, 7, 5	45 . 5, 10, 15
46 . 2, 6, 9	47 . 3, 15, 20

objects 35 feet away appe
feet away, what will the o
to the nearest tenth. (Less

Week	Miles
1	$7\frac{1}{6}$
2	$\frac{7\frac{1}{6}}{8\frac{3}{4}}$
3	10
4	$12\frac{1}{4}$
5	$12\frac{1}{4}$ $6\frac{2}{3}$

Extend 6-7

Main IDEA

Use a spreadsheet to calculate measurements for scale drawings.

Standard 6NS1.3 Use proportions to

solve problems (e.g. determine the value of *n* if

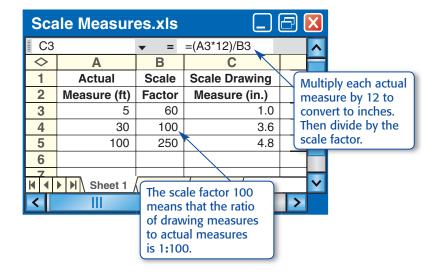
 $\frac{4}{7} = \frac{n}{21}$, find the length of a side of a polygon similar to a known polygon). Use crossmultiplication as a method for solving such problems, understanding it as the multiplication of both sides of an equation by a multiplicative inverse. Standard 6MR3.3 Develop generalizations of the results obtained and the strategies used and apply them in new problem situations.

Spreadsheet Lab Scale Drawings

A computer spreadsheet is a useful tool for calculating measures for scale drawings. You can change the scale factors and the dimensions, and the spreadsheet will automatically calculate the new values.

ACTIVITY

Suppose you want to make a scale drawing of your school. Set up a spreadsheet like the one shown below. In this spreadsheet, the actual measures are in feet, and the scale drawing measures are in inches.



ANALYZE THE RESULTS

- 1. The length of one side of the school building is 100 feet. If you use a scale factor of 1:250, what is the length on your scale drawing?
- **2**. The length of a classroom is 30 feet. What is the scale factor if the length of the classroom on a scale drawing is 3.6 inches?
- **3**. Calculate the length of a 30-foot classroom on a scale drawing if the scale factor is 1:10.
- **4**. The width of a hallway is 20 feet. What is the scale factor if the width of the hallway on a scale drawing is 2.5 inches?
- 5. Suppose the actual measures of your school are given in meters. Describe how you could use a spreadsheet to calculate the scale drawing measures in centimeters using a scale factor of 1:50.
- **6**. Choose three rooms in your home and use a spreadsheet to make scale drawings. First, choose an appropriate scale and calculate the scale factor. Include a sketch of the furniture drawn to scale in each room.

Fractions, Decimals, and Percents

Main IDEA

Write percents as fractions, and decimals and vice versa.



Reinforcement of Standard 5NS1.2

Interpret percents as a part of a hundred; find decimal and percent equivalents for common fractions and explain why they represent the same value; compute a given percent of a whole number.

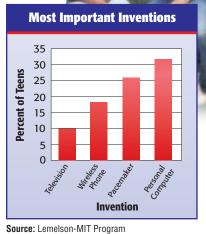
REVIEW Vocabulary

percent a ratio that compares a number to 100 (Lesson 4-6)

GET READY for the Lesson

SURVEYS The graph shows the results of a survey in which teens were asked to name the most important invention of the 20th century.

- What percent of the teens said that the personal computer was the most important invention?
- 2. How is this percent written as a ratio?
- **3**. Simplify the ratio.



In Lesson 4-6, you wrote percents like 32% as fractions by writing fractions with denominators of 100 and then simplifying. You can use the same method to write percents like 16.8% and $8\frac{1}{3}$ % as fractions.

EXAMPLES Percents as Fractions

HOCKEY In men's college hockey, 16.8% of the players are from Ontario, Canada. What fraction is this? Write in simplest form.

$$16.8\% = \frac{16.8}{100}$$
Write a fraction with a denominator of 100. $= \frac{16.8}{100} \cdot \frac{10}{10}$ Multiply by $\frac{10}{10}$ to eliminate the decimal in the
numerator. $= \frac{168}{1,000}$ or $\frac{21}{125}$ Simplify.

So, out of every 125 players, 21 are from Ontario.

Write
$$8\frac{1}{3}$$
% as a fraction in simplest form.

$$8\frac{1}{3}\% = \frac{8\frac{1}{3}}{100}$$
 Write a fraction.
$$= 8\frac{1}{3} \div 100$$
 Divide.
$$= \frac{25}{3} \div 100$$
 Write $8\frac{1}{3}$ as an improper fraction.
$$= \frac{25}{3} \cdot \frac{1}{100}$$
 Multiply by the reciprocal of 100, which is $\frac{1}{100}$.
$$= \frac{25}{300}$$
 or $\frac{1}{12}$ Simplify.





Write each percent as a fraction in simplest form.

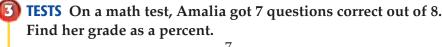
b. $17\frac{1}{2}\%$

a. 15%

c. $33\frac{1}{3}\%$

To write a fraction like $\frac{8}{25}$ as a percent, multiply the numerator and the denominator by a number so that the denominator is 100. If the denominator is not a factor of 100, you can write fractions as percents by using a proportion.

EXAMPLES Fractions as Percents



To find Amalia's grade, write $\frac{7}{8}$ as a percent.

- **Choose the Method** To write a fraction as a percent,
- use multiplication when a fraction has a denominator that is a factor of 100,
- use a proportion for any type of fraction.

Estimate $\frac{6}{8} = \frac{3}{4}$ or 75%. So, $\frac{7}{8}$ is greater than 75%. $\frac{7}{8} = \frac{n}{100}$ Write a proportion. 700 = 8n Find the cross products. $\frac{700}{8} = \frac{8n}{8}$ Divide each side by 8. $87\frac{1}{2} = n$ Simplify. So, $\frac{7}{8} = 87\frac{1}{2}\%$ or 87.5%.

Check for Reasonableness 87.5% > 75% ✔

4 Write $\frac{4}{15}$ as a percent. Round to the nearest hundredth.

Estimate $\frac{4}{15}$ is about $\frac{4}{16}$, which equals $\frac{1}{4}$ or 25%. $\frac{4}{15} = \frac{n}{100}$ Write a proportion. 400 = 15n Find the cross products. $\frac{400}{15} = \frac{15n}{15}$ Divide each side by 15. $26.67 \approx n$ Simplify. So, $\frac{4}{15}$ is about 26.67%.

Check for Reasonableness 26.67% ≈ 25% ✓

CHECK Your Progress

Write each fraction as a percent. Round to the nearest hundredth if necessary.

d.
$$\frac{2}{15}$$
 e. $\frac{7}{16}$ f. $\frac{17}{25}$
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- Standard 6NS1.0 Compare and order positive and negative fractions, decimals, and mixed numbers. Solve problems involving fractions, ratios, proportions, and percentages.
- Standard 6AF1.0 Write verbal expressions and sentences as algebraic expressions and equations; evaluate algebraic expressions, solve simple linear equations, and graph and interpret the results.

Key Vocabulary

percent equation (p. 361) percent of change (p. 369) percent proportion (p. 350)

Real-World Link

Population In a three-year period, the population of San Francisco increased from 751,682 to 776,733. You can use ratios to find the percent of change.

OLDABLES

Applying Percents Make this Foldable to help you organize your notes. Begin with a piece of 11" by 17" paper.

Applying Percents

0 Fold the paper in half lengthwise.



Open and refold the paper into fourths along the opposite axis.

		-
/		

Irace along the fold lines and label each section with a lesson title or number.

.........

7-1	7-2
7-3	7-4
7-5	7-6
7-7	7-8



340 **Chapter 7** Applying Percents

Wes Thompson/COBBIS

GET READY for Chapter 7

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 2

Option 1

Math Online Take the Online Readiness Quiz at ca.gr6math.com.

Take the Quick Check below. Refer to the Quick Review for help.

QUICKCheck

Multiply. (Prior Grade)

- **1.** $300 \times 0.02 \times 8$ **2.** $85 \times 0.25 \times 3$
- **3.** $560 \times 0.6 \times 4.5$ **4.** $154 \times 0.12 \times 5$
- 5. **MONEY** If Nicole saves \$0.05 every day, how much money will she have in 3 years? (Prior Grade)

Simplify. Write as a decimal. (Prior Grade)

6. $\frac{22-8}{8}$ 7. $\frac{50-33}{50}$ 8. $\frac{35-7}{35}$

9. BASEBALL CARDS Tim has 56 baseball cards. He gives 14 of them away. What decimal represents the portion he has left? (Prior Grade)

ALGEBRA Solve. Round to the nearest tenth if necessary. (Lesson 3-3)

10 . 0.4 <i>m</i> = 52	11 . 21 = 0.28 <i>a</i>
12 . 13 = 0.06s	13. $0.95z = 37$

Write each percent as a decimal.

(Lesson 4-7)

14. 40%	15 . 17%	16 . 110%
17. 157%	18 . 3.25%	19 . 7.5%

20. FOOD Approximately 92% of a watermelon is water. What decimal represents this amount? (Lesson 4-7)

QUICKReview

Example 1

Evaluate $240 \times 0.03 \times 5$.

 $\begin{array}{ll} 240 \times 0.03 \times 5 \\ = 7.2 \times 5 \\ = 36 \end{array} \qquad \begin{array}{l} \mbox{Multiply 240 by 0.03.} \\ \mbox{Simplify.} \end{array}$

Example 2

Simplify $\frac{17-8}{8}$. Write as a decimal. $\frac{17-8}{8} = \frac{9}{8}$ Subtract 8 from 17. = 1.125 Divide 9 by 8.

Example 3

Solve 0.6k = 7.80.6k = 7.8 Write the equation. k = 13 Divide each side by 0.6.

Example 4

Write 9.8% as a decimal.

9.8% = 0.098 Move the decimal point two places to the left and remove the percent symbol.

Math Lab Percent of a Number

Main IDEA

Use a model to find the percent of a number.

Explore

7 🗖 |

Standard 6NS1.4 Calculate given percentages of quantities and solve problems involving discounts at sales, interest earned, and tips. Standard 6MR3.2 Note

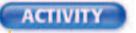
the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.



Equal Units To determine equal units, you can use division. Since $$50 \div 10 = 5 , use an interval of \$5.

Do you enjoy shopping? If so, you may have seen sales or other discounts represented as percents. For example, consider the following situation. A backpack is on sale for 30% off the original price. If the original price of the backpack is \$50, how much will you save?

In this situation, you know the percent. You need to find what part of the original price you will save. In this lab, you will use a model to find the percent of a number or *part* of a whole.



Find 30% of \$50 using a model.

STEPI Draw a 1-by-10 rectangle as shown on grid paper. Label the units on the right from 0% to 100% as shown.

	Pa	ırt	Pe	rce	nt	
				0%	, 9	
			-1	0%	, 9	
			2	0%	<u>,</u>	
			-3	80%	<u>,</u>	
				0%	<u>,</u>	
<u> </u>			-5	0%	<u>,</u>	
			 6	0%	/ D	
<u> </u>			 -7	0%	/ P	
			-8	80%	/ D	
				0%		
			1C	0%	/ 9	

- (STEP2) Since \$50 represents the original price, mark equal units from \$0 to \$50 on the left side of the model as shown.
- Draw a line from 30% on the STEP 3 right side to the left side of the model as shown and shade the portion of the rectangle above this line.

Part	P	erce	nt	
\$o		09	,	
			T I	
\$5		10%	6	
\$10		2 0 %	6	
\$15		30%	6	
\$20		409	<u>(</u>	
\$25		509	「	
1 1 1			「	
\$30		6 0 9	6	
\$35	+ $+$	<mark>7</mark> 0%	6	
\$40		80%	6	
\$45		909		
\$50		009	T I	
J \$20		,0,	0	

The model shows that 30% of \$50 is \$15. So, you will save \$15.

CHECK Your Progress

Draw a model to find the percent of each number.

a. 20% of 120

b. 60% of 70

c. 90% of 400

Suppose a bicycle is on sale for 35% off the original price. How much will you save if the original price of the bicycle is \$180?

ACTIVITY

2) Find 35% of \$180 using a model.

Draw a 1-by-10 rectangle as shown on grid paper. Label the units on the right from 0% to 100% as shown.

Pa	rt	Pe	rce	nt	
			0%	,	
		1	0%	<u>,</u>	
			0%		
			0%		
		4	0%	,	-
			0%		-
			0% '0%		
			0%		
			0%		
			0%		
			9.		

Percent

0%

10%

20%

30%

40%

50%

60%

70%

80%

90%

100%

Part

\$O

\$18

\$36

\$54

\$72

\$90

\$108

\$126

\$1<mark>44</mark>

\$162

\$18O



Equal Units For the model at the right, use an interval of \$18 since $$180 \div 10 = 18 .

- The original price is \$180. So, mark equal units from \$0 to \$180 on the left side of the model as shown.
- **STEP3)** Draw a line from 35% on the right side to the left side of the model.

The model shows that 35% of \$180 is halfway between \$54 and \$72, or \$63.

So, you will save \$63.

CHECK Your Progress

Draw a model to find the percent of each number. If it is not possible to find an exact answer from the model, estimate.

d . 25% of 140	e . 7% of 50	f. 0.5% of 20
-----------------------	---------------------	---------------

ANALYZE THE RESULTS

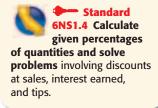
- 1. Tell how to determine the units that get labeled on the left side of a percent model.
- **2**. Explain how to find 40% of 30 using a model.
- **3. REASONING** How does knowing 10% of a number help you find the percent of the number when the percent is a multiple of 10%?

Percent of a Number

Main IDEA

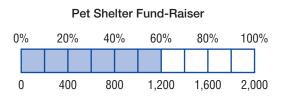
Find the percent of a number.

7/=1|



GET READY for the Lesson

FUND-RAISING A group of students are collecting money for a local pet shelter. The model shows that the students have raised 60% of their \$2,000 goal or \$1,200.



- 1. Sketch the model and label using decimals instead of percents.
- 2. Sketch the model using fractions instead of percents.
- **3.** Use these models to write two multiplication sentences that are equivalent to 60% of 2,000 = 1,200.

To find the percent of a number such as 60% of 2,000, you can use one of the following methods.

- Write the percent as a fraction and then multiply, or
- Write the percent as a decimal and then multiply.

EXAMPLE Find the Percent of a Number

1 Find 5% of 300.

To find 5% of 300, you can use either method.

METHOD 1 Write the percent as a fraction. $5\% = \frac{5}{100} \text{ or } \frac{1}{20}$ $\frac{1}{20} \text{ of } 300 = \frac{1}{20} \times 300 \text{ or } 15$

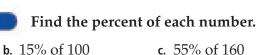
METHOD 2 Write the percent as a decimal.

$$5\% = \frac{5}{100}$$
 or 0.05

a. 40% of 70

 $0.05 \text{ of } 300 = 0.05 \times 300 \text{ or } 15$





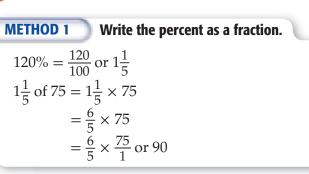
Math Tige Extra Examples at ca.gr6math.com

EXAMPLE Use Percents Greater Than 100%



Check for Reasonableness 120% is a little more than 100%. So, the answer should be a little more than 100% of 75 or a little more than 75.

2) Find 120% of 75.



METHOD 2 Write the percent as a decimal.

 $120\% = \frac{120}{100}$ or 1.2 1.2 of 75 = 1.2 × 75 or 90

So, 120% of 75 is 90. Use a model to check the answer.

HOOSE Your Method

d. Find 150% of 20.

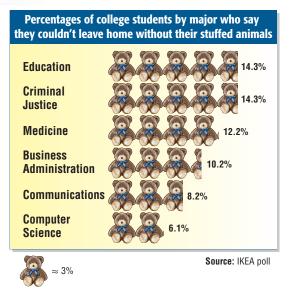
e. Find 160% of 35.

Real-World EXAMPLE

3 ANALYZE GRAPHS Refer to the graph. If a college has 350 students majoring in medicine, how many can be expected to have stuffed animals in their dorm room?

> To find 12.2% of 350, write the percent as a decimal. Then multiply.

 $12.2\% \text{ of } 350 = 12.2\% \cdot 350$ = 0.122 \cdot 350 = 42.7



So, about 43 students can

be expected to have stuffed animals in their dorm room.

CHECK Your Progress

f. **ANALYZE GRAPHS** Refer to the graph above. Suppose there are 550 students majoring in education. How many can be expected to have stuffed animals in their dorm room?

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Find each number. Round to the nearest tenth if necessary.

Examples 1–2	1. 8% of 50	2. 95% of 40	3. 42% of 263
(pp. 344–345)	4. 110% of 70	5. 115% of 20	6. 130% of 78

Example 3 (p. 345)

7. TAXES Mackenzie wants to buy a new backpack that costs \$50. If the tax rate is 6.5%, how much tax will she pay when she buys the backpack?

Exercises

HOMEWORKHELP

For Exercises	See Examples		
8–13, 20–25	1		
14–19	2		
26–27	3		

Find each number. Round to the nearest tenth if necessary.

8. 65% of 186	9 . 45% of \$432	10. 23% of \$640
11. 54% of 85	12 . 12% of \$230	13. 98% of 15
14. 130% of 20	15. 175% of 10	16. 150% of 128
17. 250% of 25	18 . 108% of \$50	19. 116% of \$250
20 . 3.2% of 40	21 . 5.4% of 65	22. 23.5% of 128
23. 75.2% of 130	24. 67.5% of 76	25. 18.5% of 500

- **26. BASEBALL** Tomás got on base 60% of the times he was up to bat. If he was up to bat 5 times, how many times did he get on base?
- **27. INTERNET** A family pays \$19 each month for Internet access. Next month, the cost will increase 5%. After this increase, what will be the cost for the Internet access?

Find each number. Round to the nearest hundredth if necessary.

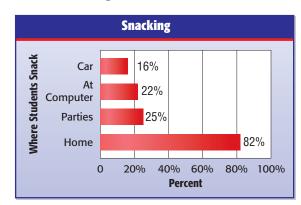
28. $\frac{4}{5}$ % of 500	29. $5\frac{1}{2}\%$ of 60	30. $20\frac{1}{4}\%$ of 3
31 . 1,000% of 99	32 . 100% of 79	33 . 520% of 100
34. 0.15% of 250	35. 0.3% of 80	36 . 0.28% of 50

- **37. TIPPING** A customer wants to tip 15% of the restaurant bill. How much change should there be after the tip if the customer pays with a \$50 bill?
- **38. ESTIMATION** A mountain bike costs \$288 plus a 4.8% delivery charge. What is the approximate cost of the bike including the delivery charge?

Sal's Bis	tro
Herbed Salmon	\$16.25
Chicken Pasta	15.25
Iced Tea	1.75
Iced Tea	1.75
Total	\$35.00

39. BUSINESS A store sells a certain brand of a lawn mower for \$275. Next year, the cost of the lawn mower will increase by 8%. What will be the cost of the lawn mower next year?

ANALYZE GRAPHS For Exercises 40–42, use the graph below that shows the results of a poll of 1,746 college students.



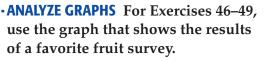
- 40. How many students can be expected to snack at their computer?
- 41. How many students can be expected to snack at home?
- **42**. Determine how many more students can be expected to snack at parties than in a car.

Use mental math to find each percent. Justify your answer.

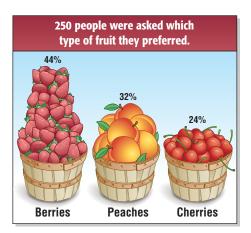
43 . 53% of 60	
-----------------------	--

44. 24% of 48

45. 75% of 19



- **46**. How many people were surveyed?
- **47**. Of those surveyed, how many people prefer peaches?
- **48**. Which type of fruit did more than 100 people prefer?
- **49**. Of those surveyed, how many people did *not* prefer cherries? Explain how you arrived at the answer.



- **50. SHOPPING** The Leather Depot sells a certain leather coat for \$179.99. If sales tax is 6.25%, what will be the approximate total cost of the coat?
- **51. SCHOOL** Suppose there are 20 questions on a multiple-choice test. If 25% of the answers are choice B, how many of the answers are *not* choice B?
- **52. COMMISSION** In addition to her salary, Ms. Sierra earns a 3% *commission*, or fee paid based on a percent of her sales, on every vacation package that she sells. One day, she sold the three vacation packages shown. What was her total commission?





Real-World Link California, the largest producer of peaches produces about 60% of all the peaches grown in the U.S. **Source:** California Tree Fruit Agreement





- **53. OPEN ENDED** Give two examples of real-world situations in your life in which you would find the percent of a number.
- **54. SELECT A TECHNIQUE** Maggie uses a \$50 gift card to buy a pair of shoes that cost \$24.99 and a purse that costs \$19.99. If the tax rate is 7%, will the gift card cover the entire purchase? Select and use one or more of the following techniques to solve the problem. Justify your selection(s).



- **55. CHALLENGE** Suppose you add 10% of a number to the number, and then you subtract 10% of the total. Is the result *greater than, less than,* or *equal to* the original number? Explain your reasoning.
- **56. WRITING IN MATH** Explain which method you prefer to use to find the percent of a number: write the percent as a fraction or write the percent as a decimal. Explain your reasoning.

STANDARDS PRACTICE

- **57.** A football player has made about 80% of the field goals he has attempted in his career. If he attempts 45 field goals in a season, how many would he be expected to make?
- 58. Tanner has 200 baseball cards. Of those, 42% are in mint condition. How many of the cards are *not* in mint condition?
 - **F** 72
 - **G** 84
 - **H** 110
 - **J** 116

.

A 40

B 36

C 30

D 25

Spiral Review

Write each percent as a decimal. (Lesson 6-9)

59 . 750%	60 . 900%	61. 0.04%	62 . 0.18%

63. PETS In Rebecca's class, 17 out of 24 students have pets. What percent of the students have pets? Round to the nearest percent. (Lesson 6-8)

 Add or subtract. Write in simplest form. (Lesson 6-2)

 64. $\frac{7}{10} - \frac{1}{10}$

 65. $\frac{20}{21} - \frac{3}{7}$

 66. $\frac{5}{6} - \frac{1}{8}$

67. ALGEBRA What are the next three numbers in the pattern 3, 10, 17, 24, ...? (Lesson 1-9)

GET READY for the Next Lesson

PREREQUISITE SKILL Solve each equation. (Lesson 3-3)

68. 12b = 144**69.** 9x = 630**70.** 8,100 = 100k

READING Word Problems

Meaning of Percent

When you solve percent problems, look for three parts: the *part*, the *whole*, and the *percent*. Consider this example.

The table at the right shows the results of a survey about favorite flavor of sugarless gum.

🔵 Part

Ten students chose cinnamon as their favorite.

🔵 Whole

Forty students were surveyed.

Percent

25% of the students who were surveyed (10 out of 40) chose cinnamon as their favorite.

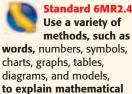
Using all three parts, 25% of 40 is 10.

PRACTICE

Identify each statement as the *part*, the *whole*, or the *percent*. Then write a sentence using all three parts.

- 1. The table at the right shows the results of a survey about which "bugs" people dislike most.
 - a. Fifty people were surveyed.
 - **b.** 60% disliked spiders the most.
 - c. Thirty people disliked spiders.
- **2**. Suppose you find a sale at the mall.
 - a. Everything was 20% off.
 - **b**. The original price of a jacket was \$30.
 - **c**. You saved \$6.
- **3**. You and your family are eating at a restaurant.
 - a. The meal cost \$34.
 - **b**. You want to leave a tip of 15%.
 - **c**. The tip is \$5.10
- 4. Your sister plays basketball.
 - a. She usually makes 75% of her free-throws.
 - **b**. In the last game, she made 6 free-throws.
 - c. She had 8 free-throws.

rvey	Least Favori	Least Favorite "Bug"		
20	Kind	Number		
	Centipede	2		
	Cockroach	18		
	Spider	30		
A CONTRACTOR	Total	50		
79999				



reasoning. Standard 6NS1.4 Calculate given percentages of quantities and solve problems involving discounts at sales,

interest earned, and tips.

Favorite Flavor
of Sugarless GumFlavorNumberCinnamon10Peppermint18Watermelon12Total40

The Percent Proportion

Main IDEA

Solve problems using the percent proportion.



problems (e.g. determine the value of *n* if $\frac{4}{7} = \frac{n}{21}$, find the length of a side of a polygon similar to a known polygon). Use cross-multiplication as a method for solving such problems, understanding it as the multiplication of both sides of an equation by a multiplicative inverse.

Standard 6NS1.4 Calculate given percentages of quantities and solve problems involving discounts at sales, interest earned, and tips.

NEW Vocabulary

percent proportion

GET READY for the Lesson

SPACE The engine on the space shuttle weighs approximately 19,700 pounds. The entire space shuttle weighs 178,000 pounds.

- 1. Write the ratio of engine weight to total weight as a fraction.
- **2**. Use a calculator to write the fraction as a decimal to the nearest hundredth.
- **3**. About what percent of the space shuttle's weight is the engine?

In a **percent proportion**, one ratio or fraction compares part of a quantity to the whole quantity, also called the *base*. The other ratio is the equivalent percent written as a fraction with a denominator of 100.

4 out of 5 is 80%. part $\rightarrow \frac{4}{5} = \frac{80}{100}$ percent

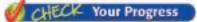
When given two of these pieces of information—part, whole, or percent—you can use the proportion to find the missing information.

EXAMPLE Find the Percent

What percent of \$15 is \$9?

The number 15 comes after the word *of*, so the whole is 15. You are asked to find the percent, so the part is the remaining number, 9.

Words	What percent of \$15 is \$9?
Variable	Let <i>n</i> % represent the percent.
Proportion	$\frac{\text{part}}{\text{whole}} \xrightarrow{\rightarrow} \frac{9}{15} = \frac{n}{100} \text{ percent}$
$\frac{9}{15} = \frac{n}{100}$	Write the proportion.
$9 \cdot 100 = 15 \cdot n$	Find the cross products.
900 = 15n	Simplify.
$\frac{900}{15} = \frac{15n}{15}$ $60 = n$	Divide each side by 15.
So, \$9 is 60% of \$	15.



Find each number. Round to the nearest tenth if necessary.

a. What percent of 25 is 20?

b. \$12.75 is what percent of \$50?

EXAMPLE Find the Part

2) What number is 40% of 120?

The percent is 40%. Since the number 120 comes after the word *of*, the whole is 120. You are asked to find the part.

What number is 40% of 120?		
Let <i>p</i> represent the part.		
$\frac{\text{part}}{\text{whole}} \xrightarrow{p} \frac{p}{120} = \frac{40}{100} \text{ percent}$		
Write the proportion.		
Find the cross products.		
Simplify.		
Divide each side by 100.		

CHECK Your Progress

Find each number. Round to the nearest tenth if necessary.

c. What number is 5% of 60? d. 12% of 85 is what number?

EXAMPLE Find the Whole

18 is 25% of what number?

The percent is 25%. The words *what number* come after the word *of*. So, you are asked to find the whole. Thus, 18 is the part.

Words	18 is 25% of what number?
Variable	Let w represent the whole.
Proportion	$\frac{\text{part}}{\text{whole}} \xrightarrow{\longrightarrow} \frac{18}{w} = \frac{25}{100} \text{ percent}$

(continued on the next page)



The Percent Proportion The part usually comes before or after the word *is* and the whole usually comes before or after the word *of.*

 $\frac{18}{w} = \frac{25}{100}$ Write the proportion. $18 \cdot 100 = w \cdot 25$ Find the cross products. 1,800 = 25wSimplify. $\frac{1,800}{25} = \frac{25w}{25}$ Divide each side by 25. 72 = w

So, 18 is 25% of 72.

CHECK Your Progress

Find each number. Round to the nearest tenth if necessary.

Western Lowland **Gorilla's Diet**

Percent

67%

17%

16%

Food

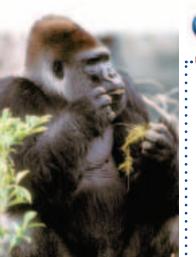
Fruit Seeds, Leaves,

Stems, and Pith

Insects/

Insect Larvae

e. 40% of what number is 26? f. 80 is 75% of what number?



Real-World Link . . . Male Western Lowland gorillas weigh about 350-400 pounds. Females weigh about 160-200 pounds. Source: colszoo.org

Real-World EXAMPLE

ANIMALS The average adult male Western 4 Lowland gorilla eats about 33.5 pounds of fruit each day. How much food does the average adult male gorilla eat each day?

You know that 33.5 pounds of fruit is 67% of the total amount eaten daily. So, the problem asks 33.5 is 67% of what number. Thus, you need

d the whole.
a the whole.
Write the proportion.
Find the cross products.
Simplify.
Divide each side by 67.

So, the average adult male gorilla eats 50 pounds of food each day.

CHECK Your Progress

50 = w

 $33.5 \cdot 100 = w \cdot$

g. **ZOO** If 200 of the 550 reptiles in a zoo are on display, what percent of the reptiles are on display? Round the nearest whole number.

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CONCEPT Summary Types of Percent Problems		
Туре	Example	Proportion
Find the Percent	What percent of 6 is 3?	$\frac{3}{6} = \frac{n}{100}$
Find the Part	What number is 50% of 6?	$\frac{P}{6} = \frac{50}{100}$
Find the Whole	3 is 50% of what number?	$\frac{3}{w} = \frac{50}{100}$

Donna Ikenberry/Animals Animals



Examples 1–3

(pp. 350–352)

Find each number. Round to the nearest tenth if necessary.

- 1. What percent of 50 is 18?
- **3**. What number is 2% of 35?
- **5**. 9 is 12% of which number?
- 2. What percent of \$90 is \$9?
- 4. What number is 25% of 180?
- **6**. 62 is 90.5% of what number?

- Example 4 (p. 352)
- **7. MEASUREMENT** If a box of Brand A cereal contains 10 cups of cereal, how many more cups of cereal are in a box of Brand B cereal?



Exercises

HOMEWORK HELP		
For Exercises	See Examples	
8–9	1	
10-11	2	
12-13	3	
14–17	4	

Find each number. Round to the nearest tenth if necessary.

- 8. What percent of 60 is 15?
- **10**. What number is 15% of 60?
- **12**. 9 is 45% of what number?
- 9. \$3 is what percent of \$40?11. 12% of 72 is what number?
- **13.** 75 is 20% of what number?
- 14. **SCHOOL** Roman has 2 red pencils in his backpack. If this is 25% of the total number of pencils, how many pencils are in his backpack?
- **15. SHOPPING** A paperback book is on sale for \$7.50. This is 60% of the original price. What was the original price of the book?
- **16. MOVIES** Sarah and Monique have \$40. They spent 35% of their money on movie tickets. How much money did they spend on movie tickets?
- **17. BOOKS** Of the 60 books on a bookshelf, 24 are non-fiction. What percent of the books are non-fiction?

Find each number. Round to the nearest hundredth if necessary.

- **18.** What percent of 25 is 30?
 19. What number is 8.2% of 50?
- **20.** 40 is 50% of what number?
 21. 12.5% of what number is 24?
- **22**. What number is 0.5% of 8? **23**. What percent of 300 is 0.6?
- 24. **BUSINESS** The first week of June there were 404 customers at an ice cream parlor. Eight weeks later, the number of customers was 175% of this amount. How many customers were there eight weeks later?
- **25. MONEY** Ajamu saves 40% of his allowance each week. If he saves \$16 in 5 weeks, how much allowance does Ajamu receive each week?
- **26. POPULATION** In 2000, the population of San Bernardino, California, was about 185,400 people. If the population grew by about 4.98% from 2000 to 2004, what was the approximate population of San Bernardino in 2004?

Math 🎇 🛯 🛄					
and the second se	Jupiter's radius?		Mercury	2,440	
If-Check Quiz			Mars	3,397	
ca.gr6math.con	Neptune s faulus, what is	the radius	Jupiter	71,492	
	of Neptune?				
	29 . Earth's radius is about 261	2			
	radius. What is the radius	of Earth?			
.T. Problem	30. OPEN ENDED Write a prop	ortion that can be u	used to find th	he percent sco	
	on a science quiz that has	10 questions.			
	31. CHALLENGE Without calcu	CHALLENGE Without calculating, arrange the following from greatest to			
	least value. Justify your re	0 0	0	0	
	20% of 2	100, 20% of 500, 5%	of 100		
	32. WRITING IN MATH Crea	te a problem involv	ving a percen	t that can be	
	solved by using the propo		ing a percen		
		<i>b</i> 100 [•]			
STR	NDARDS PRACTICE				
-					
	the 273 students in a school,	34. A custom			
	volunteered to work the book sale.	-	70. This amou		
	bout what percent of the students			juation can be	
	d <i>not</i> volunteer?	the food h	nd x , the tota	amount of	
	55%			15 v	
В	65%	F $\frac{2.70}{15} =$	$\frac{15}{100}$ H	$\frac{15}{2.70} = \frac{x}{100}$	
C	70%	G $\frac{2.70}{}$ =	$\frac{15}{100}$ J	x = 15	
	75%		100 y	2.70 100	

EXTRAPRACTICE ASTRONOMY For Exercises 27–29, use the table shown.

See pages 696, 721.

27. Mercury's radius is what percent of

represents this percent? (Lesson 6-9)

MEASUREMENT Complete. (Lesson 6-3)

38. 3,000 lb = T
39. 36 in. = ft
GET READY for the Next Lesson
PREREQUISITE SKILL Multiply. (Lesson 5-5)

42. $\frac{3}{4} \cdot 28$

43. $\frac{2}{5} \cdot 45$

40. $4\frac{1}{2}$ lb = oz

Radius (km)

Planet

41. $\frac{1}{2} \cdot 60$

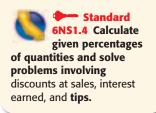
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Percent and Estimation

Main IDEA

Estimate percents by using fractions and decimals.



GET READY for the Lesson

GRILLING The graph shows the results of a survey in which 80 people were asked which holiday was their favorite for grilling outdoors.

- What fraction of people surveyed chose Labor Day as their favorite grilling day? How many of the 80 people surveyed is this?
- 2. Explain how you could use a fraction to estimate the numbers of people who chose the Fourth of July as their favorite grilling day. Then estimate.

Favorite Grilling Days



Source: Market Facts for Butterball Turkey

3. Use a fraction to estimate the number of people surveyed who chose Memorial Day as their favorite grilling day.

Sometimes an exact answer is not needed when using percents. One way to estimate the percent of a number is to use a fraction.

Real-World EXAMPLE

SPORTS Ricardo is the quarterback for the Johnstown Junior High Eagles. He completes 53% of the passes he throws. If he throws 159 passes in a season, about how many will he complete?

You need to estimate 53% of 159.

53% is about 50% and 159 is about 160.

53% of
$$159 \approx \frac{1}{2} \cdot 160$$
 53% $\approx \frac{1}{2}$ and 159 ≈ 160
 ≈ 80 Multiply.

So, Ricardo will complete about 80 out of 159 passes in a season.

CHECK Your Progress

a. **REPTILES** Box turtles have been known to live for 120 years. American alligators have been known to live 42% as long as box turtles. About how long can an American alligator live?



Real-World Link In a recent year, the Internal Revenue Service estimated that Americans paid \$15.37 billion in tips. Source: money.cnn.com Another method for estimating the percent of a number is to first find 10% of the number and then multiply. For example, $70\% = 7 \cdot 10\%$. So, 70% of a number equals 7 times 10% of the number.

Real-World EXAMPLE

MONEY Marita decides to leave a 20% tip on a restaurant bill of \$14.72. About how much money should she tip the restaurant server? You need to estimate 20% of \$14.72.

 METHOD 1
 Use a fraction to estimate.

 20% is $\frac{2}{10}$ or $\frac{1}{5}$.

 20% of \$14.72 $\approx \frac{1}{5} \cdot 15.00

 20% of \$14.72 $\approx \frac{1}{5} \cdot 15.00
 $\approx 3.00

 Multiply.

Step 1Find 10% of the number.
\$14.72 is about \$15.00.
10% of \$15.00 = $0.1 \cdot 15.00 To multiply by 10%, move the
= \$1.50Step 2Multiply.
20% of \$15.00 is 2 times 10% of \$15.00.
 $2 \cdot $1.50 = 3.00

So, Marita should tip the restaurant server about \$3.00.

CHOOSE Your Method

b. MONEY Dante plans to put 80% of his paycheck into a savings account. His paycheck this week was \$295. About how much money will he put into his savings account?

Dersonal Tutor at ca.gr6math.com

You can also estimate percents of numbers when the percent is greater than 100 or the percent is less than 1.

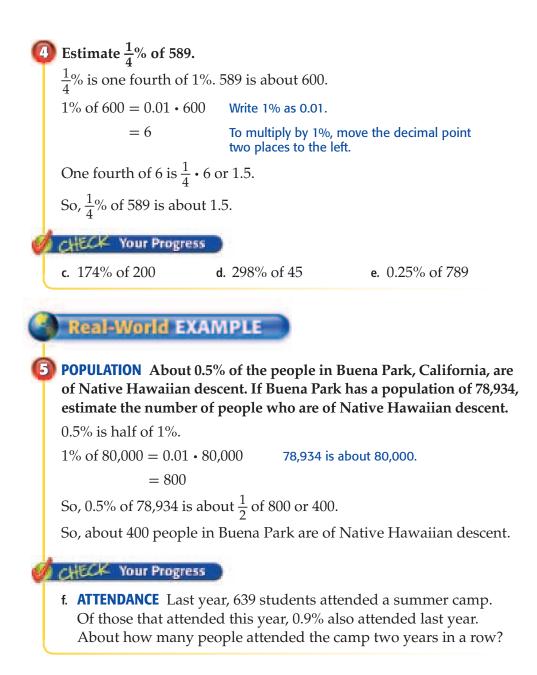
STUDY TIP

EXAMPLES Percents Greater Than 100 or Less Than 1

Check for Reasonableness When estimating the percent of a number and the percent is greater than 100, the estimate will always be greater than the number.

3) Estimate 122% of 50. 122% is about 120%. 120% of 50 = (100% of 50) + (20% of 50) 120% = $(1 \cdot 50) + (\frac{1}{5} \cdot 50)$ 100% = 50 + 10 or 60 Simp

So, 122% of 50 is about 60.



CHECK Your Understanding

Examples 1–4	Estimate.			
(pp. 355–357)	1. 52% of 10	2. 7% of 20	3. 38% of 62	
	4. 79% of 489	5. 151% of 70	6. $\frac{1}{2}$ % of 82	
Example 1 (p. 355)	5	ele store increases its price mer pay for a bicycle that	es by 23%. About how much originally costs \$200?	
Example 2 (p. 356)		e 78 teenagers at a youth o w many have birthdays ii	camp, 63% have birthdays in t n the spring?	he
Example 5 (p. 357)		ut 0.8% of the land in Ma	ine is federally owned.	

357) If Maine is 19,847,680 acres, about how many acres are federally owned?

Exercises

HOMEWORKHELP		
For Exercises	See Examples	
10–21	1,3	
22–23	2	
24–25	3	
26–27, 30	4	
28–29, 31	5	

Estimate.

10. 47% of 70	11. 21% of 90	12 . 39% of 120
13 . 76% of 180	14. 57% of 29	15. 92% of 104
16. 24% of 48	17. 28% of 121	18. 88% of 207
19. 62% of 152	20. 65% of 152	21. 72% of 238

- **22. MONEY** Jessica spent \$42 at the hair salon. About how much money should she tip the hair stylist if she wants to leave a 15% tip?
- **23. HEALTH** You use 43 muscles to frown. When you smile, you use 32% of these same muscles. About how many muscles do you use when you smile?

Estimate.

24. 132% of 54	25. 224% of 320	26. $\frac{1}{2}$ % of 412
27. $\frac{3}{4}$ % of 168	28. 0.4% of 510	29 . 0.9% of 74

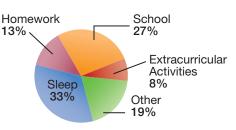
- **30. GEOGRAPHY** The United States has 12,383 miles of coastline. If $\frac{4}{5}$ % of the U.S. coastline is located in Georgia, about how many miles of coastline are in Georgia?
- •31. BIRDS During migration, 450,000 sandhill cranes stop to rest in Nebraska.About 0.6% of these cranes stop to rest in Oregon. About how many sandhill cranes stop in Oregon during migration?

Estimate.

32.	67% of 8.7	33. 54% of 76.8	34. 32% of 89.9
35.	10.5% of 238	36. 22.2% of 114	37 . 98.5% of 45

ANALYZE GRAPHS For Exercises 38–40, use the graph shown.

Amanda's Day

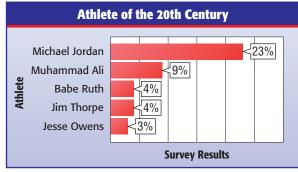


Real-World Link About 75% of the entire world sandhill crane population stop to rest in Nebraska during migration. Source: World Book of Records

- **38**. About how many hours does Amanda spend doing her homework each day?
- **39**. About how many more hours does Amanda spend sleeping than doing the activities in the "other" category? Justify your answer.
- **40**. What is the approximate number of minutes Amanda spends each day on extracurricular activities?

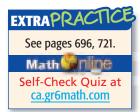


41. ANALYZE GRAPHS In a survey, 1,031 people were asked to choose the greatest athlete of the 20th century. The top five choices are shown. About how many more people chose Michael Jordan than Muhammad Ali?





- **42. ANIMALS** The average white rhinoceros gives birth to a single calf that weighs about 3.8% as much as its mother. If the mother rhinoceros weighs 3.75 tons, about how many pounds does its calf weigh?
- **43. POPULATION** According to the 2000 U.S. Census, about 7.8% of the people in Minnesota live in Minneapolis. If the population of Minnesota is about 4,920,000, estimate the population of Minnesota.

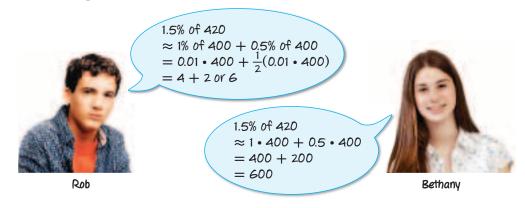


H.O.T. Problems ...

GEOLOGY For Exercises 44 and 45, use the following information.

Granite, a stone found in New Hampshire and Vermont, is 0.8% water.

- 44. About how many pounds of water are there in 3,000 pounds of granite?
- **45**. About how much water is contained in a piece of granite that is $\frac{3}{4}$ -inch thick and weighs 15 pounds?
- **46**. **OPEN ENDED** Write a real-world problem in which the answer can be found by estimating 12% of 50.
- **47. CHALLENGE** Explain how you could find $\frac{3}{8}$ % of \$800.
- **48. FIND THE ERROR** Rob and Bethany are estimating 1.5% of 420. Who is correct? Explain.



49. NUMBER SENSE Is an estimate for the percent of a number *always*, *sometimes*, or *never* greater than the actual percent of the number? Give an example or a counterexample to support your answer.

50. WRITING IN MATH Estimate 22% of 136 using two different methods. Justify the steps used in each method.

STANDARDS PRACTICE

 51. The graph shows the results of a survey of 510 students. Pet Preferences Bird 8% 	52 . Megan is buying an entertainment system for \$1,789.43. The speakers are 39.7% of the total cost. Which is the best estimate for the cost of the speakers?
Cat 24% Fish 20% Dog 38% Other 5%	 F \$540 H \$720 G \$630 J \$810 53. Daniel decides to leave a 20% tip on a restaurant bill of \$28.92. About how
Which is the best estimate for the number of students who prefer cats?	much money should he tip the restaurant server?
A 75 C 225	A \$2.00 C \$4.00
B 125 D 450	B \$3.00 D \$6.00



Find each number. Round to the near	rest tenth if necessary. (Lesson 7-2)	
54 . 6 is what percent of 15?	55 . Find 72% of 90.	,
56 . What number is 120% of 60?	57 . 35% of what number is 55?	
58 . HEALTH Adults have 32 teeth. Kids adults. How many teeth do kids h		
Estimate. (Lesson 5-1)		
59. $\frac{8}{9} + \frac{1}{12}$ 60. $\frac{4}{7} + \frac{7}{16}$	61. $\frac{7}{8} - \frac{7}{16}$ 62. $\frac{4}{5} - \frac{9}{10}$	
Solve. Round to the nearest tenth if r	necessary. (Lesson 3-3)	

63. 40 = 0.8x **64.** 10r = 61 **65.** 0.07t = 25 **66.** 56 = 0.32n

GET READY for the Next Lesson

Solve each equation. Check your solution. (Lesson 3-3)67. $14 = n \cdot 20$ 68. $25 = n \cdot 40$ 69. $28.5 = n \cdot 38$ 70. $36 = n \cdot 80$



Algebra: The Percent Equation

Main IDEA

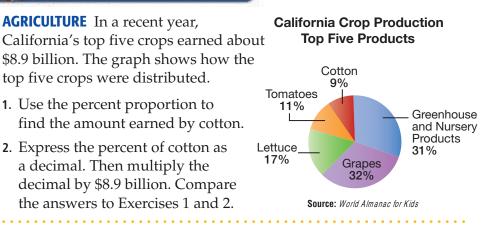
Solve problems by using the percent equation.

 Standard 6NS1.4 Calculate given percentages
 of quantities and solve problems involving discounts at sales, interest earned, and tips.
 Standard 6AF1.1
 Write and solve one-step linear equations in one variable.

NEW Vocabulary

percent equation

GET READY for the Lesson



In Lesson 7-2, you used a percent proportion to find the missing part, percent, or whole. You can also use an equation. It is important to note that a percent must always be converted to a decimal or a fraction when it is used in an equation.

$$\frac{\text{part}}{\text{whole}} = \text{percent}$$

The percent must be written as a decimal or fraction.

Multiply each side by the base.

whole $part = percent \cdot whole$

part

This form is called the **percent equation**.



• whole = percent • whole

1) What number is 12% of 150? Estimate 12% of $150 \approx 0.1 \cdot 150$ or 15

Write 12% as a decimal, 0.12. The whole is 150. You need to find the part. Let p represent the part.

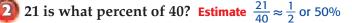
```
part = percent \cdot wholep = 0.12 \cdot 150p = 18Multiply. The part is 18.So, 18 is 12% of 150.Check for Reasonableness18 is close to 15.
```

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.

a. What is 6% of 19? b. Find 72% of 90.

Lesson 7-4 Algebra: The Percent Equation 361

EXAMPLE Find the Percent



The part is 21. The whole is 40. You need to find the percent. Let *n* represent the percent.

 $part = percent \cdot whole$ 21 = п • 40 Write the percent equation. $=\frac{40n}{10}$ 21 Divide each side by 40. 40 0.525 = nSince *n* represents the decimal form, the percent is 52.5%. So, 21 is 52.5% of 40.

Check for Reasonableness 52.5% ≈ 50% ✓

CHECK Your Progress

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.

- c. 35 is what percent of 70? d. What percent of 125 is 75?
- e. What percent of 40 is 9? f. 27 is what percent of 150?

EXAMPLE Find the Whole

3 13 is 26% of what number? Estimate $\frac{1}{4}$ of 48 = 12

The part is 13. The percent is 26, which when written as a decimal, is 0.26. You need to find the whole. Let *w* represent the whole.

part = percent • whole $13 = 0.26 \cdot w$ Write the percent equation. 26% = 0.26 $\frac{13}{0.26} = \frac{0.26w}{0.26}$ Divide each side by 0.26. 50 = wThe number is 50. So, 13 is 26% of 50. Check for Reasonableness 50 is close to 48. ✓ CHECK Your Progress

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.

- **g**. 39 is 84% of what number? h. 26% of what number is 45?
- i. 14% of what number is 7? j. 24 is 32% of what number?



Percent Remember to write the decimal as a percent in your final answer.



Real-World Link In the U.S., Anchorage, Alaska, has the highest percent of cell phone users. Source: Polk's Research

Real-World EXAMPLE

CELL PHONES Luxembourg has the highest percent of people who have cell phones, 96.7%. If there are about 447,421 people in Luxembourg with cell phones, what is its population?

Words 447,421	447,421 people is 96.7% of what number of people?		
Variable Let <i>n</i> represent the number of people.			
Equation $447,421 = 0.967 \cdot n$			
$447,421 = 0.967 \cdot n$	Write the percent equation. $96.7\% = 0.967$		
$\frac{447,421}{0.967} = \frac{0.967n}{0.967}$	Divide each side by 0.967. Use a calculator.		
462,690 $\approx n$	Simplify.		

The population of Luxembourg is about 462,690.

CHECK Your Progress

k. POPULATION The Louisville-Jefferson County metropolitan area contains 17.2% of the population of Kentucky. If the population of Kentucky is about 4,040,000 people, what is the population of the Louisville-Jefferson County metropolitan area?

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CONCEPT Summary Types of Percent Problems		
Туре	Example	Proportion
Find the Part	What number is 50% of 6?	$p = 0.5 \cdot 6$
Find the Percent	3 is what percent of 6?	3 = <i>n</i> • 6
Find the Whole	3 is 50% of what number?	$3 = 0.5 \cdot w$

CHECK Your Understanding

Examples 1–3 Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.

- **1**. What number is 88% of 300? **2**. What
- **3**. 75 is what percent of 150?
- **5**. 3 is 12% of what number?
- **2**. What number is 12% of 250?
- 4. 24 is what percent 120?
 - **6**. 84 is 60% of what number?
- Example 4 (p. 363)7. BUSINESS A local bakery sold 60 loaves of bread in one day. If 65% of these were sold in the afternoon, how many loaves were sold in the afternoon?

Exercises

HOMEWORKHELP		
For Exercises	See Examples	
8–11	1	
12–15	2	
16–19	3	
20–23	4	

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.

- **8**. What number is 65% of 98?
- **10**. Find 24% of 25.
- **12**. 9 is what percent of 45?
- 14. What percent of 392 is 98?
- **16**. 33% of what number is 1.45?
- **18**. 17 is 40% of what number?

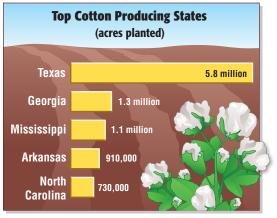
- **9**. Find 39% of 65.
- **11**. What number is 53% of 470?
- **13**. What percent of 96 is 26?
- **15**. 30 is what percent of 64?
- **17.** 84 is 75% of what number?
- **19**. 80% of what number is 64?
- **20. BOOKS** Emma bought 6 new books for her collection. This increased her collection by 12%. How many books did she have before her purchases?
- **21. VIDEO GAMES** A store sold 550 video games during the month of December. If this made up 12.5% of their yearly video game sales, about how many video games did the store sell all year?
- **22. SALES** Ms. Allon received a \$325 *commission* on her sales. If her sales totaled \$8,125, what is the percent that she earns?
- **23. LOBSTERS** Approximately 0.02% of North Atlantic lobsters are born bright blue in color. Out of 5,000 North Atlantic lobsters, how many would you expect to be blue in color?

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.

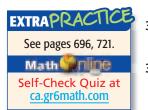
- **24**. Find 135% of 64. **25**. What num
- **26.** 450 is 75.2% of what number?
- **25**. What number is 0.4% of 82.1?
- **27**. What percent of 200 is 230?
- **28. SALARY** A landscape architect who earns an annual salary of \$57,680 receives a 2.5% raise. What will be her annual salary after the raise?

ANALYZE GRAPHS Almost 13.5 million acres are planted in cotton in the United States. For Exercises 29–31, use the graph at the right.

- **29**. About what percent of U.S. cotton is planted in Texas?
- **30**. About what percent of U.S. cotton is planted in Georgia?
- **31**. About what percent of U.S. cotton is planted in states other than those listed?



Source: National Cotton Council



- **32. MEASUREMENT** A pool that holds 320 cubic feet of water is 84% filled to capacity. Another pool that holds 400 cubic feet of water is 82.5% filled to capacity. Which pool contains more water? How much more?
- - **34. CHALLENGE** If you need to find the percent of a number, explain how you can predict whether the part will be less than, greater than, or equal to the number.
 - **35. WRITING IN MATH** Compare the percent equation and the percent proportion. Then explain when it might be easier to use the percent equation rather than the percent proportion.

STANDARDS PRACTICE

36. In a survey, 150 students were asked to choose their favorite take-out food. The table shows the results.

Favorite Take-Out Food		
Type of Food Percent		
Pizza	40	
Sandwiches 32		
Fried chicken 28		

Based on this data, predict how many out of 1,800 students would choose sandwiches.

A	504	C		680
B	576	D)	720

37. If 60% of a number is 18, what is 90% of the number?

F	3	Η	27
G	16	J	30

38. Taryn's grandmother took her out to dinner. If the dinner was \$34 and she left a 20% tip, how much money did Taryn's grandmother spend?

Α	\$6.80	С	\$39.50
---	--------	---	---------

B \$27.20 **D** \$40.80



39. ROLLER COASTERS A roller coaster travels its track length of 2,800 feet in about 2 minutes. What is a reasonable distance the coaster travels each second? Use the *reasonable answers* strategy. (Lesson 7-4)

Estimate by using fractions. (Lesson 7-3)

40. 11% of 79**41.** 30.5% of 50

42. 48% of 311

Ý

GET READY for the Next Lesson

43. PREREQUISITE SKILL To estimate the age of a dog in human years, count the first year as 15 human years, the second year as 10 human years, and all of the following years as 3 human years. How old in human years is a 6-year old dog? (Lesson 1-1)

7-5 Problem-Solving Investigation

MAIN IDEA: Solve problems by determining reasonable answers.

Standard 6NS1.4 Calculate given percentages of quantities and solve problems involving discounts at sales, interest earned, and tips. Standard 6MR3.1 Evaluate the reasonableness of the solution in the context of the problem.

P.S.I. TERM +

e-Mail: DETERMINE REASONABLE ANSWERS

YOUR MISSION: Determine reasonable answers to problems.

THE PROBLEM: How much money should Chase leave if he wants to give the server a 15% tip?

Chase: The cost of our meal is \$38.95. I think I should leave a tip of \$4. I'll estimate to determine if this is reasonable.

EXPLORE	The total cost of the meal is \$38.95. Chase wants to leave a 15% tip.	
PLAN	Round \$38.95 to \$40. Then use mental math to find 15% of 40.	
SOLVE	Round \$38.95 to \$40.	
	$10\% \text{ of } 40 = 0.1 \cdot 40 \text{ or } 4$ Use mental math. $10\% = 0.1$	
	5% of $40 = \frac{1}{2} \cdot 4$ or 2	
	15% of 40 = (10% of 40) + (5% of 40)	
	= 4 + 2 or 6	
	So, \$6 would be a better amount to leave for a tip than \$4.	
CHECK	Use a calculator to check. 0.15×38.95 ENTER The result is 5.8425, so the answer, 6, is reasonable.	
		0

Analyze The Strategy

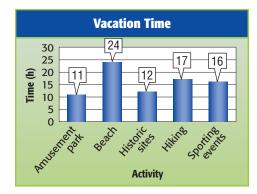
- 1. Describe other problem-solving strategies that you could use to determine whether answers are reasonable.
- 2. **WRITING IN MATH** Write a problem that has an unreasonable answer and ask a classmate to explain why the answer is unreasonable.

Mixed Problem Soluing



Determine reasonable answers for Exercises 3–6.

- 3. **COMMUNICATION** Mykia makes a long distance phone call to her sister and talks for 45 minutes. If the phone company charges \$0.08 per minute, how much would the call cost: about \$1, \$4, or \$6?
- 4. **SCHOOL** Of 423 students, 57.6% live within 5 miles of the school. What is a reasonable estimate for the number of students living within 5 miles of the school? Explain.
- 5. **MUSIC** A survey showed that 71% of teens who use computers listen to music at the same time. Suppose there are 410 teens in your school who use computers. Would the number of students who listen to music while on the computer be about 120, 280, or 380? Justify your answer.
- 6. **ANALYZE GRAPHS** Refer to the graph. Is 30% a reasonable estimate of how much time a family spent at the amusement park during their vacation? Explain.

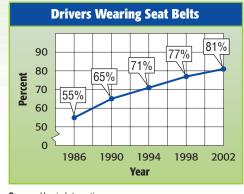


Use any strategy to solve Exercises 7–11. Some strategies are shown below.



7. COINS John has 10 coins that total \$0.83. What are the coins?

8. **ANALYZE GRAPHS** Refer to the graph. Is 95% a reasonable estimation for the percent of drivers who will wear seat belts in 2010?





- **9. MEASUREMENT** Leo uses a 2.5-liter container to fill a tank that holds 24 liters of water. How many times will he need to fill the container?
- **10. BASKETBALL** Sandra made 18 points in one basketball game. How many possible shot combinations of 2- and 3-pointers could she have made assuming she made, no free-throw shots?
- **11. TIPS** Shawnda decides to leave a 20% tip on a restaurant bill of \$17.50. How much should she tip the restaurant server?

Select the Operation

For Exercises 12 and 13, select the appropriate operation(s) to solve the problem. Justify your selection(s) and solve the problem.

- FUND-RAISER During a popcorn sale for a fund-raiser, the soccer team gets to keep 25% of the sales. One box of popcorn sells for \$1.50, and the team has sold 510 boxes so far. Has the team raised a total of \$175?
- **13. MEASUREMENT** How many square yards of carpet are needed to carpet the two rooms described below?

Room	Dimensions
living room	15 ft by 18 ft
TV room	18 ft by 20 ft

Mid-Chapter Quiz

Lessons 7-1 through 7-5

Find each number. Round to the nearest tenth if necessary. (Lesson 7-1)

1. Find 17% of 655.

CHAPTER

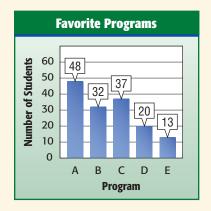
- **2**. What is 235% of 82?
- **3**. Find 75% of 160.
- 4. What number is 162.2% of 55?
- 5. **STANDARDS PRACTICE** Ayana has 220 coins in her piggy bank. Of those, 45% are pennies. How many coins are *not* pennies? (Lesson 7-1)
 - A
 121
 C
 109

 B
 116
 D
 85

Find each number. Round to the nearest tenth if necessary. (Lesson 7-2)

- 6. What percent of 84 is 12?
- **7**. 15 is 25% of what number?
- **8**. 85% of 252 is what number?

ANALYZE GRAPHS For Exercises 9 and 10, refer to the graph that shows the results of a survey of students' favorite TV programs. (Lesson 7-2)



- **9.** Of the 150 students surveyed, what percent of the students preferred Program A?
- **10.** Of the five TV programs, which program did about 25% of the students report as their favorite?

(Lesson 7-3)

11 . 20% of 392	12. 78% of 112
13. 52% of 295	14. 30% of 42

- **15**. 79% of 88
- **16**. 41.5% of 212
- **STANDARDS PRACTICE** Miyoki has read 82% of a book that has 214 pages. About how many pages does she have left to read? (Lesson 7-3)

F	16 pages	Н	65 pages
G	40 pages	J	80 pages

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary. (Lesson 7-4)

- **18**. What number is 35% of 72?
- **19**. 16.1 is what percent of 70?
- **20.** 27.2 is 68% of what number?
- **21**. 16% of 32 is what number?
- **22.** 55% of what number is 1.265?
- **23.** 17 is 40% of what number?
- 24. **ANALYZE TABLES** The table shows the costs of owning a dog over an average 11-year lifespan. What percent of the total cost is veterinary bills? (Lesson 7-4)

Dog Ownership Costs		
Item	Cost (\$)	
Food	4,020	
Veterinary Bills	3,930	
Grooming, Equipment	2,960	
Training 1,220		
Other	2,470	
Source: American Kennel Club		

Source: American Kennel Club

25. **SHOPPING** A desktop computer costs \$849.75 and the hard drive is 61.3% of the total cost. What is a reasonable estimate for the cost of the hard drive? (Lesson 7-5)



Percent of Change

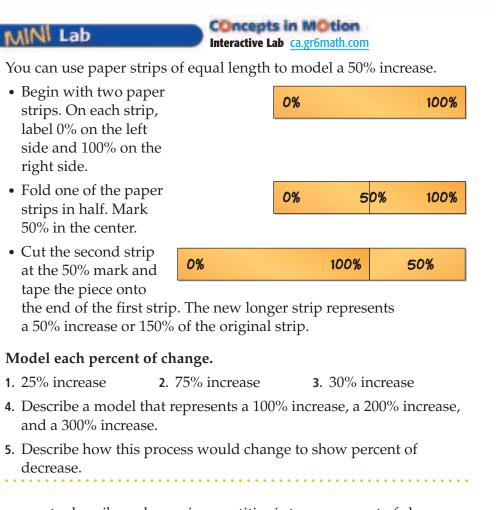
Main IDEA

Find the percent of increase or decrease.

Standard 6NS1.2 Interpret and use ratios in different contexts (e.g., batting averages, miles per hour) to show the relative sizes of two quantities, using appropriate notations $(\frac{a}{b}, a$ to b, a:b).

NEW Vocabulary

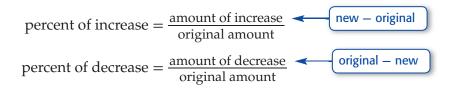
percent of change percent of increase percent of decrease



One way to describe a change in quantities is to use percent of change.

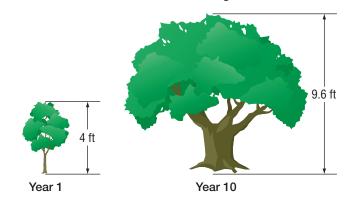
KEY C	ONCEPT Percent of Change	
Words	ords A percent of change is a ratio that compares the change in quantity to the original amount.	
Equation	percent of change = $\frac{\text{amount of change}}{\text{original amount}}$	

The percent of change is based on the original amount. If the original quantity is increased, then it is called a **percent of increase**. If the original quantity is decreased, then it is called a **percent of decrease**.





TUDY TH **ID TREES** Find the percent of change in tree height from year 1 to year 10. Round to the nearest whole percent if necessary.



Since the new height is greater than the original height, this is a percent of increase. The amount of increase is 9.6 - 4 or 5.6 feet.

percent of increase =	$=\frac{\text{amount o}}{\text{original}}$	f increase amount
	original	aniount
=	$=\frac{5.6}{4}$	Substitution
=	= 1.4	Simplify.
=	= 140%	Write 1.4 as a percent.

CHECK Your Progress

a. **MEASUREMENT** Find the percent of change from 10 yards to 13 yards.

EXAMPLE Find Percent of Decrease

STOCKS The table shows the original price of a stock and its new price after one month on the stock exchange. Find the percent of change in the price. Round to the nearest whole percent if necessary.

Stock	Price
original	\$75
new	\$60

Since the new price is less than the original price, this is a percent of decrease. The amount of decrease is 75 - 60 or \$15.

percent of decrease = $\frac{\text{amount of decrease}}{1}$ original amount $=\frac{15}{75}$ Substitution

- = 0.2Simplify.
- = 20%Write 0.2 as a percent.

CHECK Your Progress

b. MONEY Find the percent of change from \$20 to \$15.

Percents In the percent of change formula, the decimal must be written as a percent.



Real-World Career ...

Stockbroker Use Math?

A stockbroker must be able to compare

percents of change of different stock prices.

How Does a



STANDARDS EXAMPLE

3 The table shows about how many people attended the home games of a high school football team for five consecutive years. Which statement is supported by the information in the table?

A The attendance in 2003 was 15% greater than the attendance in 2002.

Attendance of Home Games		
Year Total Attendance (thousands)		
2000	16.6	
2001	16.4	
2002	15.9	
2003	17.4	
2004	17.6	

- **B** The greatest decrease in attendance occurred from 2000 to 2001.
- C The attendance in 2002 was 3% less than the attendance in 2001.
- **D** The greatest increase in attendance occurred from 2003 to 2004.

Read the Item

You need to determine which statement is best supported by the information given in the table.

Solve the Item

- Check A. The percent of change from 2002 to 2003 was <u>17.4 - 15.9</u> or about 10%, not 15%.
- Check **B**.

From 2000 to 2001, the decrease was 16.6 - 16.4 or 0.2. From 2001 to 2002, the decrease was 16.4 - 15.9 or 0.5. This statement is not supported by the information.

• Check **C**. The percent of change from 2001 to 2002 was $\frac{16.4 - 15.9}{16.4}$ or about 3%. This statement is supported by the information.

• Check **D**.

From 2002 to 2003, the increase was 17.4 - 15.9 or 1.5. From 2003 to 2004, the increase was 17.6 - 17.4 or 0.2. This statement is not supported by the information.

The solution is **C**.

CHECK Your Progress

- c. Which of the following represents the greatest percent of change?
 - **F** A savings account that had \$500 now has \$470.
 - **G** An MP3 player that stored 15 GB now stores 30 GB.
 - H A plant grew from 3 inches to 8 inches in one month.
 - J An airplane ticket that was originally priced at \$345 is now \$247.

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Check the Results If you have time, check all of the choices given. By doing so, you will verify that your choice is correct.



Find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an *increase* or a *decrease*.

Examples 1, 2 (p. 370)

- 1. 30 inches to 24 inches
- 2. 20.5 meters to 35.5 meters

3. \$126 to \$150

4. \$75.80 to \$94.75

Example 3 (p. 371) 5. **STANDARDS PRACTICE** The table shows the number of youth 7 years and older that played soccer from 1996 to 2004. Which statement is supported by the information in the table?

- **A** The greatest decrease in the number of players occurred from 1998 to 2000.
- **B** There were 7% fewer youth playing soccer in 2004 than in 2002.
- **C** The number of players in 2002 was 6% greater than the number of players in 2000.

Playing Soccer		
Year Number (millions		
1996	13.9	
1998	13.2	
2000	12.9	
2002	13.7	
2004	13.3	

Source: nsga.org

D There were 10% more youth playing soccer in 1998 than in 1996.

Exercises

HOMEWORKHELP		
For Exercises	See Examples	
6–7, 14–15 18–19	1	
8–13 16–17	2	
39, 40	3	

For Exercises 6–19, find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an *increase* or a *decrease*.

6.	15 yards to 18 yards	7.	100 acres to 140 acres
8.	\$12 to \$6	9.	48 notebooks to 14 notebooks
10.	125 centimeters to 87.5 centimeters	11.	\$15.60 to \$11.70
12.	1.6 hours to 0.95 hour	13.	132 days to 125.4 days
14.	\$240 to \$320	15.	624 feet to 702 feet

- **16. BOOKS** On Monday, Kenya spent 60 minutes reading her favorite book. Today, she spent 45 minutes reading this book.
- **17. EXERCISE** Three months ago, Ernesto could walk 2 miles in 40 minutes. Today he can walk 2 miles in 25 minutes.
- SCHOOL Last school year the enrollment of Gilboa Middle School was 465 students. This year the enrollment is 525.
- 19. MONEY Jake had \$782 in his checking account. He now has \$798.

Find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an *increase* or a *decrease*.

20.
$$\frac{1}{2}$$
 to $\frac{1}{4}$ **21.** $\frac{4}{6}$ to $\frac{1}{6}$ **22.** $\frac{1}{5}$ to $\frac{4}{5}$ **23.** $\frac{2}{3}$ to $\frac{5}{3}$

MEASUREMENT For Exercises 24 and 25, refer to the rectangle at the right. Suppose the side lengths are doubled.

8 cm

3 cm

24. Find the percent of change in the perimeter.

- **25**. Find the percent of change in the area.
- **26. EDUCATION** In a recent year, a person with a high school diploma earned an average of \$18,711 per year. A person who attended college earned an average of \$21,982 per year. What was the percent of change?
- 27. **FIND THE DATA** Refer to the California Data File on pages 16–19. Choose some data and write a real-world problem in which you would find the percent of change.
- **28. ANALYZE GRAPHS** Use the graphic shown to find the percent of change in hot dog consumption from 2003 to 2004 at American baseball parks.
- 29. ART In 2001, the sales of fine art were \$40.8 billion. Art sales increased by about 25% from 2001 to 2005. Find the projected amount of art sales in 2005.
- **30. BABY-SITTING** The table shows how many hours Catalina spent baby-sitting during the months of April and May. If Catalina charges \$6.50 per hour, what is the percent of change in the amount of money earned from April to May?

ANALYZE TABLES For Exercises 31–33, refer to the table at the right.

- **31**. Find the percent of increase of allowance from age 13 to 14. Round to the nearest whole percent.
- **32**. State two consecutive ages where the change in allowance is a percent of decrease. Then find the percent of decrease. Round to the nearest tenth.

percent of change.

33. Between which two consecutive years is the percent of increase the greatest? What is the percent of increase? Round to the nearest whole percent.

34. OPEN ENDED Write a percent of change problem using the quantities 14 and 25, and state whether there is a percent of increase or decrease. Find the

35. NUMBER SENSE The costs of two different sound systems were decreased by \$10. The original costs of the systems were \$90 and \$60, respectively. Without calculating, which had greater percent of decrease? Explain.

Source: National Hotdog and Sausage Council

2004

2003

Hot Dog Consumption at

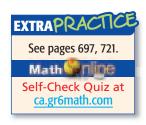
American Ballparks

Month	Hours Worked
April	40
May	32

24.2 million

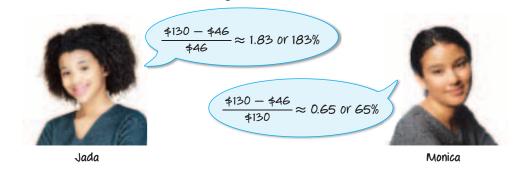
25.9 million

Age	Average Weekly Allowance
12	\$9.58
13	\$9.52
14	\$13.47
15	\$15.57
16	\$17.84
17	\$30.66



H.O.T. Problems ..

36. FIND THE ERROR Jada and Monica are finding the percent of change from \$46 to \$130. Who is correct? Explain.



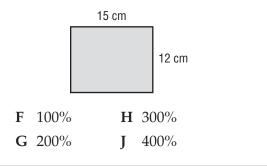
- **37. CHALLENGE** If a quantity increases by 10% and then decreases by 10%, will the result be the original quantity? Explain.
- **38. WRITING IN MATH** Explain how you know whether a percent of change is a percent of increase or a percent of decrease.

.....

STANDARDS PRACTICE

- **39**. Which of the following represents the least percent of change?
 - A A coat that was originally priced at \$90 is now \$72.
 - **B** A puppy who weighed 6 ounces at birth now weighs 96 ounces.
 - C A child grew from 54 inches to 60 inches in 1 year.
 - **D** A savings account increased from \$500 to \$550 in 6 months.

40. If each dimension of the rectangle is doubled, what is the percent of increase in the area?



Spiral Review

ALGEBRA Write an equation for each problem. Then solve. Round to the nearest tenth if necessary. (Lesson 7-4)

- **41.** 30% of what number is 17?**42.** What is 21% of 62?
- **43. SHOPPING** Four pounds of pecans costs \$12.75. How much is this per pound? (Lesson 6-2)
- **44. TEMPERATURE** The highest recorded temperature in the United States was 134°F, which is 214°F higher than the lowest recorded temperature. Write and solve an equation to find the lowest recorded temperature. (Lesson 3-2)

GET READY for the Next Lesson

PREREQUISITE SKILL Write each percent as a decimal. (Lesson 6-8)

45.
$$6.5\%$$
 46. $5\frac{1}{2}\%$ **47.** $8\frac{1}{4}\%$ **48.** $6\frac{3}{4}\%$



Sales Tax and Discount

Main IDEA

Solve problems involving sales tax and discount.

••••• Standard 6NS1.4 Calculate given percentages of quantities and solve problems involving discounts at sales, interest earned, and tips.

NEW Vocabulary

Sales Tax and Discount If both are represented as percents, sales tax is a percent of increase, and discount is a percent of decrease.

sales tax discount

GET READY for the Lesson

COMPUTERS Julie Ann plans to buy a new flat screen monitor that costs \$1,299. She lives in Florida where there is a 6% sales tax.

- 1. Calculate the sales tax by finding 6% of \$1,299.
- 2. What will be the total costs including the sales tax?
- **3**. Use a calculator to multiply 1.06 and 1,299. How does the result compare to your answer in Exercise 2?

Sales tax is an additional amount of money charged on items that people buy. The total cost of an item is the regular price plus the sales tax.

EXAMPLE Find the Total Cost

CALCULATORS A graphing calculator costs \$90, and the sales tax is 4.25%. What is the total cost of the calculator?

MEI	HOD 1	Add sales tax to the regular price	ce.
		First, find the sales tax.	
		4.25% of $90 = 0.0425 \cdot 90$	Write 4.5% as a decimal.
		≈ 3.83	The sales tax is \$3.83.
		Next, add the sales tax to th $3.83 + 90 = 93.83$	e regular price.
		Add the percent of tax to 100%	
MET	HOD 2	Add the percent of tax to 100%	
MET	HOD 2	100% + 4.25% = 104.25%	
MET	HOD 2	•	Add the percent of tax to 100%.

So, the total cost of the calculator is \$93.83.

CHOOSE Your Method

a. **CLOTHES** What is the total cost of a sweatshirt if the regular price is \$42 and the sales tax is $5\frac{1}{2}$ %?

Discount is the amount by which the regular price of an item is reduced. The sale price is the regular price minus the discount.

EXAMPLE Find the Sale Price

2) BOOGIE BOARDS A boogie board that has a regular price of \$69 is on sale at a 35% discount. What is the sale price of the boogie board?

METHOD 1 Subtract the discount from the regular price.

First, find the amount of the discount.

35% of $$69 = 0.35 \cdot 69 = \$24.15

Write 35% as a decimal. The discount is \$24.15.

Next, subtract the discount from the regular price. 69 - 24.15 = 44.85

Choosing Methods

In Example 2, both methods involve multiplication and subtraction. Method 2 is often preferred over Method 1 because the subtraction is easier in Method 2.

Percent Equation

Remember that, in the percent equation,

the percent must be written as a decimal. Since the sale price is

60% of the original price, use 0.6 to represent 60% in the

percent equation.

110

METHOD 2 Subtract the percent of discount from 100%.

100% - 35% = 65%Subtract the discount from 100%. The sale price is 65% of the regular price. 65% of $\$69 = 0.65 \cdot \69 Write 65% as a decimal. = 44.85Multiply.

So, the sale price of the boogie board is \$44.85.

CHOOSE Your Method

b. MUSIC A CD that has a regular price of \$15.50 is on sale at a 25% discount. What is the sale price of the CD?

EXAMPLE Find the Original Price

3 MUSIC An electric guitar is on sale at 40% off. If the sale price is \$179.94, what is the original price?

The sale price is 100% - 40% or 60% of the original price.

- Words \$179.94 is 60% of what price? Variable Let *p* represent the original price. Equation 179.94 = 0.6p 179.94 = 0.6pWrite the equation.
- $\frac{179.94}{2} = \frac{1}{2}$ 0.6p $\dot{0.0}$
 - Divide each side by 0.6.
- 299.90 = pSimplify.

0.6

The original price of the guitar is \$299.90.

CHECK Your Progress

- c. Find the original price if the sale price of the guitar is \$151.74.
- Personal Tutor at ca.gr6math.com



Find the total cost or sale price to the nearest cent.

Example 1 (p. 375)	1. \$2.95 notebook; 5% tax	2 . \$46 shoes; 2.9% tax
Example 2 (p. 376)	3 . \$1,575 computer; 15% discount	4 . \$119.50 skateboard; 20% off
Example 3 (p. 376)	5. IN-LINE SKATES A pair of in-line sk represents a 9% discount from the price to the nearest cent?	ates is on sale for \$90. If this price original price, what is the original

Exercises

HOMEWORKHELP		
For Exercises	See Examples	
6-13	1–2	
14–17	3	

- Find the total cost or sale price to the nearest cent.
- **6**. \$58 ski lift ticket; 20% discount
- 8. \$99 CD player; 5% tax
- **10**. \$4.30 makeup; 40% discount
- **12**. \$39.60 sweater; 33% discount
- 7. \$1,500 computer; 7% tax
- 9. \$12.25 pen set; 60% discount
- **11**. \$7.50 meal; 6.5% tax
- **13.** \$89.75 scooter; $7\frac{1}{4}$ % tax
- 14. **COSMETICS** A bottle of hand lotion is on sale for \$2.25. If this price represents a 50% discount from the original price, what is the original price to the nearest cent?
- **15. TICKETS** At a movie theater, the cost of admission to a matinee is \$5.25. If this price represents a 30% discount from the evening price, find the evening price to the nearest cent.

Find the original price to the nearest cent.

16 . calendar: discount, 75%	17 . telescope: discount, 30%
sale price, \$2.25	sale price, \$126

- **18. VIDEO GAMES** What is the sales tax of a \$178.90 video game system if the tax rate is 5.75%?
- **19. RESTAURANTS** A restaurant bill comes to \$28.35. Find the total cost if the tax is 6.25% and a 20% tip is left on the amount before tax.

BIKES For Exercises 20–22, use the information
below and the table shown.

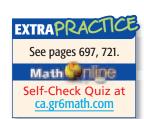
Jason lives in California and is buying a bike that normally costs \$575.

20. What is the total cost of the bike including tax?

State	2005 Sales Tax Rate
California	6.25%
Mississippi	7%
North Carolina	4.5%
Texas	6.25%

Source: www.taxadmin.org

- **21**. If the bike is on sale with a 25% discount, how much will Jason save on the bike?
- **22.** If Jason arrives at the store between 7 and 8 A.M. on the day of the sale, the bike will be discounted an additional 15% off the already discounted price. What will be the sale price if tax is calculated after both discounts?



H.O.T. Problems ... 23. CHALLENGE A gift store is having a sale in which all items are discounted 20%. Including tax, Colin paid \$21 for a picture frame. If the sales tax rate is 5%, what was the original price of the picture frame?
24. OPEN ENDED Give an example of the regular price of an item and the total cost including sales tax if the tax rate is 5.75%.
25. Which One Doesn't Belong? In each pair, the first value is the regular price of an item and the second value is the sale price. Identify the pair that does



not have the same percent of discount as the other three. Explain.

26. WRITING IN MATH Describe two methods for finding the sale price of an item that is discounted 30%. Which method do you prefer? Explain.

STANDARDS PRACTICE

27. A computer software store is having a sale. The table shows the regular price, *r*, and the sales price, *s*, of various items.

ltem	Regular Price (r)	Sale Price (s)
A	\$5.00	\$4.00
В	\$8.00	\$6.40
C	\$10.00	\$8.00
D	\$15.00	\$12.00

Which formula can be used to calculate the sale price?

A	s = r	$\times 0.2$	С	s =	$r \times$	0.8

B s = r - 0.2 **D** s = r - 0.8

28. A chair that costs \$210 was reduced by 40% for a one day sale. After the sale, the sale price was increased by 40%. What is the price of the chair?

F	\$176.40	Η	\$205.50
G	\$185.30	J	\$210.00

29. Juanita paid \$10.50 for a T-shirt at the mall. It was on sale for 30% off. What was the original price before the discount?

A	\$3.15	С	\$15.00
B	\$7.35	D	\$35.00



Find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an *increase* or *decrease*. (Lesson 7-6)

- **30**. 4 hours to 6 hours **31**
- **31**. \$500 to \$456
- **32**. 20.5 meters to 35.5 meters
- **33. TRAVEL** Out of a 511-mile trip, Mya drove about 68% on Monday. Determine a reasonable estimate for the number of miles she drove on Monday. (Lesson 7-5)

GET READY for the Next Lesson

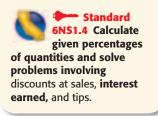
PREREQUISITE SKILL Multiply. Write in simplest form. (Lesson 5-5)34. $\frac{2}{7} \cdot \frac{4}{5}$ 35. $\frac{1}{8} \cdot \frac{4}{9}$ 36. $\frac{6}{11} \cdot \frac{9}{24}$



Simple Interest

Main IDEA

Solve problems involving simple interest.



NEW Vocabulary

Fractions of Years The amount of time, *t*, must be expressed in years in order to use the formula

I = prt. Since 9 months $= \frac{9}{12}$ or 0.75

0.75 for t.

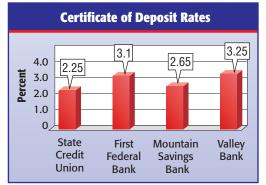
year, use either $\frac{9}{12}$ or

simple interest principal

GET READY for the Lesson

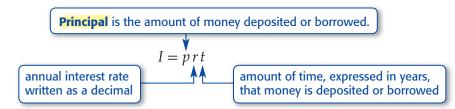
INVESTING Jin plans to invest \$1,000 in a certificate of deposit (CD). The graph shows CD rates for one year at various banks.

 Calculate 2.25% of \$1,000 to find the amount of money that Jin can earn in one year for a CD at State Credit Union.



2. Find the amount of money that she can earn in one year at the other three banks.

Simple interest is the amount paid or earned for the use of money. To find simple interest *I*, use the following formula.



EXAMPLES Find Interest Earned

SAVINGS Raini has \$750 in a savings account that pays 3% simple interest. How much interest will he earn in each amount of time?

1 4 years

I = prt	Formula for simple interest
$I = 750 \cdot 0.03 \cdot 4$	Replace p with \$750, r with 0.03, and t with 4.
I = 90	Simplify.

Raini will earn \$90 in interest in 4 years.

🔰 9 months

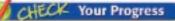
9 months = $\frac{9}{12}$ or 0.75 year	Write the time as years.
I = prt	Formula for simple interest
$I = 750 \cdot 0.03 \cdot 0.75$	p = \$750, $r = 0.03$, $t = 0.75$
$I \approx 16.88$	Simplify.

Raini will earn \$16.88 in interest in 9 months.



Real-World Link . .

A car loan on a \$22,000 car over 60 months at 4.79 percent annual interest and no down payment will cost an additional \$2,783 in interest payments alone. Source: carloanclues.com



SAVINGS Jenny has \$1,560 in a savings account that pays 2.5% simple interest. How much interest will she earn in each amount of time?

a. 3 years

b. 6 months

Dersonal Tutor at ca.gr6math.com

The formula I = prt can also be used to find the interest owed when you borrow money. In this case, p is the amount of money borrowed, and t is the amount of time the money is borrowed.

EXAMPLE Find Interest Paid on a Loan

[3] LOANS Rondell's parents borrow \$1,200 from the bank for a new car. The interest rate is 8% per year. How much simple interest will they pay if they take 2 years to repay the loan?

I = prt	Formula for simple interest
<i>I</i> = 1,200 · 0.08 · 2	Replace p with \$1,200, r with 0.08, and t with 2.
I = 192	Simplify.

Rondell's parents will pay \$192 in interest in 2 years.

CHECK Your Progress

c. LOANS Mrs. Hanover borrows \$1,400 at a rate of 5.5% per year. How much simple interest will she pay if it takes 8 months to repay the loan?

EXAMPLE Find Total Paid on a Credit Card

4 CREDIT CARDS Cory charged a \$600 TV on his credit card with an interest rate of 21%. If he has no other charges on the card, and does not pay off the balance at the end of the month how much money will he owe after one month?

I = prt $I = 600 \cdot 0.21 \cdot \frac{1}{12}$ Formula for simple interest

Replace p with \$600, r with 0.21, and t with $\frac{1}{12}$.

I = 10.5

Simplify.

The interest owed after one month is \$10.50. So, the total amount owed would be \$600 + \$10.50 or \$610.50.

CHECK Your Progress

d. **CREDIT CARDS** An office manager charged \$425 worth of office supplies on a charge card with an interest rate of 9.9%. How much money will he owe if he makes no other charges on the card and does not pay off the balance at the end of the month?



Fractions of Years Remember to express 1 month as $\frac{1}{12}$ year in the formula.



Examples 1, 2 (pp. 379–380)	Find the simple interest earned to the nearest cent for each principal, interest rate, and time.	
	1 . \$640, 3%, 2 years	2 . \$1,500, 4.25%, 4 years
	3 . \$580, 2%, 6 months	4 . \$1,200, 3.9%, 8 months
Example 3 (p. 380)	Find the simple interest paid to the a and time.	nearest cent for each loan, interest rate,
	5 . \$4,500, 9%, 3.5 years	6 . \$290, 12.5%, 6 months
Example 4	7. FINANCES The Masters family fina	anced a computer that costs \$1,200.

(p. 380)
 7. FINANCES The Masters family financed a computer that costs \$1,200.
 If the interest rate is 19%, how much will the family owe after one month if no payments are made?

Exercises

HOMEWORKHELP			
For Exercises	See Examples		
8–9	1		
10-11	2		
12-15	3		
16–17	4		

Find the simple interest earned to the nearest cent for each principal, interest rate, and time.

8 . \$1,050, 4.6%, 2 years	9 . \$250, 2.85%, 3 years
10 . \$500, 3.75%, 4 months	11 . \$3,000, 5.5%, 9 months

Find the simple interest paid to the nearest cent for each loan, interest rate, and time.

12 . \$1,000, 7%, 2 years	13 . \$725, 6.25%, 1 year
14. \$2,700, 8.2%, 3 months	15 . \$175.80, 12%, 8 months

- **16. CREDIT CARDS** Leon charged \$75 at an interest rate of 12.5%. How much will Leon have to pay after one month if he makes no payments?
- **17. TRAVEL** A family charged \$1,345 in travel expenses. If no payments are made, how much will they owe after one month if the interest rate is 7.25%?

BANKING For Exercises 18 and 19, use the table.

- **18**. What is the simple interest earned on \$900 for 9 months?
- **19**. Find the simple interest earned on \$2,500 for 18 months.

Home Savings and Loan		
Time	Rate	
6 months	2.4%	
9 months	2.9%	
12 months	3.0%	
18 months	3.1%	

EXTRAPRACTICE See pages 698, 721. Math Self-Check Quiz at ca.gr6math.com

INVESTING For Exercises 20 and 21, use the following information.

Manuel has \$1,800 from his summer job to invest.

- **20**. Suppose he invests the \$1,800 for 2 years and earns \$144. What was the rate of interest?
- **21**. Manuel would like to have \$2,340 altogether. If he invests his money at 5% interest, in how many years will he have \$2,340?



- **22. OPEN ENDED** Suppose you earn 3% on a \$1,200 deposit for 5 years. Explain how the simple interest is affected if the rate is increased by 1%. What happens if the time is increased by 1 year?
- **23. CHALLENGE** Mrs. Williams deposits \$600 in an account that pays 4.5% annually. At the end of the year, the interest earned is added to the principal. Find the total amount in her account each year for 3 years, if she does not withdraw any money in the 3 years.
- 24. **WRITING IN MATH** List the steps you would use to find the simple interest on a \$500 loan at 6% interest rate for 18 months. Then find the simple interest.

STANDARDS PRACTICE

- 25. Antonia opened a savings account that pays 6.5% simple interest. How much money will be in Antonia's account after 3 years if she deposited \$250 at the beginning and never made any withdrawals or more deposits?
 - **A** \$48.75
 - **B** \$248.75
 - **C** \$298.75
 - **D** \$300.00

- **26.** Mr. McMahon bought a \$562 freezer using a credit card that charges 18% annual interest. If he does not make any payments or any additional charges, how much will he owe after 1 month?
 - F \$553.57
 - **G** \$570.43
 - H \$578.86
 - J \$663.16



27. Find the total cost of a \$19.99 DVD if the tax rate is 7%. (Lesson 7-7)

Find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an increase or decrease. (Lesson 7-6)

28. 35 birds to 45 birds
 29. 60 inches to 38 inches
 30. \$2.75 to \$1.80

 Divide. Write in simplest form. (Lesson 5-7)

 31. $\frac{3}{5} \div \frac{1}{2}$

 32. $\frac{4}{7} \div \frac{5}{8}$

```
33. 2\frac{2}{3} \div 1\frac{1}{4}
```

34. ALGEBRA What is the next number in the sequence 23, 28, 33, ...? (Lesson 1-8)

Cross-Curricular Project

Math and Science

Lions, Tigers, and Bears, Oh My! It's time to complete your project. Use the information and data you have gathered about the animals you selected to prepare a video or poster. Be sure to include a spreadsheet and all the necessary graphs with your project.

Math Cross-Curricular Project at ca.gr6math.com

Extend 7-8

Main IDEA

Use a spreadsheet to calculate simple interest.

Standard 6NS1.4 Calculate given percentages of quantities and solve problems involving discounts at sales, interest earned, and tips. Standard 6MR2.5 Express the solution clearly and logically by using the appropriate mathematical notation and terms and clear language; support solutions with evidence in both verbal and symbolic work.

Spreadsheet Lab Simple Interest

A computer spreadsheet is a useful tool for quickly calculating simple interest for different values of principal, rate, and time.

ACTIVITY

Max plans on opening a "Young Savers" account at his bank. The current rate on the account is 4%. He wants to see how different starting balances, rates, and times will affect his account balance. To find the balance at the end of 2 years for different principal amounts, he enters the values B2 = 4 and C2 = 2 into the spreadsheet below.

Sim	nple Intere	st.xls				Ð (X
\diamond	Α	В	С	D	E		^
1	Principal (p)	Rate (r)	Time (t)	Interest (/)	New Balance		
2							
3	500	=B2/100	=C2	=A3*B3*C3	=A3+D3		
4	1000	=B2/100	=C2	=A4*B4*C4	=A4+D4		E
5	1500	=B2/100	=C2	=A5*B5*C5	=A5+D5		
6	2000	=B2/100	=C2	=A6*B6*C6	=A6+D6		
7	2500	=B2/100	=C2	=A7*B7*C7	=A7+D7		
 4 4	Sheet 1	Sheet 2 / Sh	eet 3				~
<	III					>	
		Ì					

For each principal given in column A, simple interest is calculated for any values of rate and time entered in B2 and C2, respectively. The spreadsheet adds simple interest to the principal.

ANALYZE THE RESULTS

- 1. Why is the rate in column B divided by 100?
- 2. What is the balance in Max's account after 2 years if the principal is \$1,500 and the simple interest rate is 4%?
- **3**. How much interest does Max earn in 2 years if his account has a principal of \$2,000 and a simple interest rate of 4%?
- **4**. Is the amount of principal proportional to the interest Max earns if his account earns 4% simple interest over 2 years? Explain.
- **5**. Is the amount of principal proportional to the balance in Max's account if it earns 4% simple interest over 2 years? Explain.
- **6**. What entries for cells B2 and C2 would you use to calculate the simple interest on a principal of \$1,500 at a rate of 7% for a 9-month period?
- **7**. What is the balance of this account at the end of the 9 months?

Study Guide and Review



Download Vocabulary Review from ca.gr6math.com

OLDABLES

CHAPTER

Be sure the following Key Concepts are noted in your Foldable.

7-1	7-2
7-3	7-4
7-5	7-6
7-7	7-8

GET READY to Study

Key Concepts

Percent of a Number (Lesson 7-1)

• To find the percent of a number, first write the percent as either a fraction or decimal and then multiply.

Percent Proportion (Lesson 7-2)

 $\frac{\text{part}}{\text{whole}} = \frac{n}{100}$ percent

Percent and Estimation (Lesson 7-3)

• One way to estimate the percent of a number is to use a fraction. The other way is to first find 10% of the number and then multiply.

Percent Equation (Lesson 7-5)

part = percent • whole

Percent of Change (Lesson 7-6)

• A percent of change is ratio that compares the change in quantity to the original amount.

percent of change = $\frac{\text{amount of change}}{\text{original amount}}$

Sales and Discount (Lesson 7-7)

- Sales tax is an additional amount of money charged on items. The total cost of an item is the regular price plus the sales tax.
- Discount is the amount by which the regular price of an item is reduced. The sale price is the regular price minus the discount.

Simple Interest (Lesson 7-8)

• Simple interest is the amount paid or earned for the use of money.

I = prt

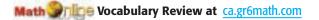
Key Vocabulary

discount (p. 375)	percent proportion (p. 350)
percent equation (p. 361)	principal (p. 379)
percent of change (p. 369)	sales tax (p. 375)
percent of decrease (p. 369)	simple interest (p. 379)
percent of increase (p. 369)	

Vocabulary Check

State whether each sentence is *true* or *false*. If *false*, replace the underlined word or number to make a true sentence.

- 1. The sale price of a discounted item is the regular price <u>minus</u> the discount.
- 2. A ratio that compares the change in quantity to the original amount is called the <u>percent of change</u>.
- **3.** A <u>percent proportion</u> compares part of a quantity to the whole quantity using a percent.
- **4**. The formula for simple interest is I = prt.
- 5. A method for estimating the percent of a number is to find <u>21%</u> of the number and then multiply.
- The equation part = percent whole is known as the <u>principal</u> equation.
- 7. The <u>principal</u> is the amount of money deposited or borrowed.
- 8. A <u>tax</u> is the amount by which the regular price of an item is reduced.
- **9**. To find a percent of increase, compare the amount of the increase to the <u>new</u> amount.
- **10**. If the new amount is greater than the original amount, then the percent of change is percent of <u>decrease</u>.



Lesson-by-Lesson Review

7-1

7-2

Percent of a Number (pp. 344–348)

Find each number. Round to the nearest tenth if necessary.

- 11. Find 78% of 50.
- **12.** 45.5% of 75 is what number?
- **13**. What is 225% of 60?
- 14. 0.75% of 80 is what number?

Example 1 Find	24% of 200.
24% of 200	
$= 24\% \times 200$	Write the expression.
$= 0.24 \times 200$	Write 24% as a decimal.
= 48	Multiply.
So, 24% of 200 is 4	8.

The Percent Proportion (pp. 350–354)

Find each number. Round to the nearest tenth if necessary.

- **15. SOCCER** A soccer team lost 30% of their games. If they played 20 games, how many did they win?
- **16.** 6 is what percent of 120?
- **17**. Find 0.8% of 35.
- **18**. What percent of 375 is 40?
- 19. PHONE SERVICE A family pays \$21.99 each month for their long distance phone service. This is 80% of the original price of the phone service. What is the original price of the phone service? Round to the nearest tenth if necessary.

Example 2 What percent of 90 is 18?

$\frac{18}{90} = \frac{n}{100}$	Write the proportion.
$18 \cdot 100 = 90 \cdot n$	Find the cross products.
1,800 = 90n	Simplify.
$\frac{1,800}{90} = \frac{90n}{90}$	Divide each side by 90.
20 = n	So, 18 is 20% of 90.

Example 3 52 is 65% of what number?

$\frac{52}{w} = \frac{65}{100}$	Write the proportion.
$52 \cdot 100 = w \cdot 65$	Find the cross products.
5,200 = 65w	Simplify.
$\frac{5,200}{65} = \frac{65w}{65}$	Divide each side by 65.
80 = w	So, 52 is 65% of 80.

7-3 Percent and Estimation (pp. 355–360)

Estimate.

20.	25% of 81	21.	33% of 122
22.	77% of 38	23.	19.5% of 96

Estimate by using 10%.

24. 12% of 77 **25.** 88% of 400

26. PETS About 12% of 291 households in a neighborhood have fish. Estimate how many households have fish.

Example 4 Estimate 52% of 495.

52% \approx 50% or $\frac{1}{2}$, and 495 \approx 500. 52% of 495 $\approx \frac{1}{2} \cdot$ 500 or 250 So, 52% of 495 is about 250.

Example 5 Estimate 68% of 80.

10% of $80 = 0.1 \cdot 80$ or 8 Find 10% of 80. 68% is about 70%.

 $7 \cdot 8 = 56$ 70% of 80 \approx 7 • (10% of 80) So, 68% of 80 is about 56.





7-5

Algebra: The Percent Equation (pp. 361–365)

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.

- **27**. 32 is what percent of 50?
- **28.** 65% of what number is 39?
- **29**. Find 42% of 300.
- **30**. 7% of 92 is what number?
- **31**. 12% of what number is 108?
- **32. SALONS** A local hair salon increased their sales of hair products by about 12.5% this week. If they sold 48 hair products, how many hair products did they sell last week?

Example 6 27 is what percent of 90?

27 is the part and 90 is the base. Let *n* represent the percent.

part = percent • base

27 = n	• 90	Write an equation.
$\frac{27}{90} = \frac{90n}{90}$		Divide each side by 90.
0.3 = n		The percent is 30%.

So, 27 is 30% of 90.

PSI: Determine Reasonable Answers (pp. 366–367)

Determine a reasonable answer for each problem.

- **33. CABLE TV** In a survey of 1,813 consumers, 18% said that they would be willing to pay more for cable if they got more channels. Is 3.3, 33, or 333 a reasonable estimate for the number of consumers willing to pay more for cable?
- **34. SCHOOL** There are 880 students at Medina Middle School. If 68% of the students are involved in sports, would the number of students involved in sports be about 510, 630, or 720?
- **35. VACATION** Suppose you are going on vacation for \$689 and the airfare accounts for 43.5% of the total cost. What is a reasonable cost of the airfare?

Example 7 Mr. Swanson harvested 1,860 pounds of apples from one orchard, 1,149 pounds from another, and 905 pounds from a third. The apples will be placed in crates that hold 42 pounds of oranges. Will Mr. Swanson need 100, 200, or 400 crates?

Since an exact answer is not needed, we can estimate the total of pounds.

1,860	\rightarrow	1,900
1,149	\rightarrow	1,100
+ 905	\rightarrow	+ 900
		3.900

Since $3,900 \div 40$ is about 100, it is reasonable that 100 crates need to be ordered.

7-6

Percent of Change (pp. 369–374)

Find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an *increase* or *decrease*.

- **36.** original: 172
 37. original: \$200

 new: 254
 new: \$386
- 38. original: 75 new: 60
 39. original: \$49.95 new: \$54.95
- **40. GAMES** A computer game that sold for \$24.95 last year is now priced at \$27.95. Find the percent of change.

Example 8 A magazine that originally cost \$2.75 is now \$3.55. Find the percent of change. Round to the nearest whole percent.

The new price is greater than the original price, so this is a percent of increase.

percent of increase = <u>amount of increase</u> original amount

 $= \frac{0.80}{2.75}$ Substitution

 ≈ 0.29 Simplify.

The percent of increase is about 29%.



Sales Tax and Discount (pp. 375–378)

Find the total cost or sale price to the nearest cent.

- 41. \$25 backpack; 7% tax
- **42**. \$210 bicycle; 15% discount
- **43.** \$8,000 car; $5\frac{1}{2}$ % tax
- 44. \$40 sweater; 33% discount

Find the percent of discount to the nearest percent.

- **45.** shirt: regular price: \$42 sale price: \$36
- **46**. boots: regular price, \$78 sale price: \$70
- **47. MONEY** A DVD that normally costs \$21.99 is on sale for 25% off. Tara buys the DVD and pays using a \$20 bill. Not including tax, how much change will she receive to the nearest cent?

Example 9 A new computer system is priced at \$2,499. Find the total cost if the sales tax is 6.5%.

First, find the sales tax. 6.5% of \$2,499 = 0.065 • 2,499 ≈ 162.44

Next, add the sales tax. The total cost is 162.44 + 2,499 or \$2,661.44.

Example 10 A pass at a water park is \$58. At the end of the season, the same pass costs \$46.40. What is the percent of discount?

58 - 46.40 = 11.60 Find the amount of discount.

Next, find what percent of 58 is 11.60.

 $11.60 = n \cdot 58$ Write an equation.0.2 = nDivide each side by 58.The percent of discount is 20%.





Simple Interest (pp. 379–382)

Find the interest earned to the nearest cent for each principal, interest rate, and time.

- **48**. \$475, 5%, 2 years
- **49**. \$5,000, 10%, 3 years
- **50.** \$2,500, 11%, $1\frac{1}{2}$ years
- **51. SAVINGS** Tonya deposited \$450 into a savings account earning 3.75% annual simple interest. How much interest will she earn in 6 years?

Find the interest paid to the nearest cent for each loan balance, interest rate, and time.

- **52**. \$3,200, 8%, 4 years
- **53**. \$1,980, 21%, 9 months
- **54. LOANS** Brian has a loan balance of \$1,000. If he pays off the balance in 2 years at an annual simple interest rate of 18%, how much total will he pay?

Example 11 Find the interest earned on \$400 at 9% for 3 years.

I = prt	Simple interest formula
$I = 400 \cdot 0.09 \cdot 3$	<i>p</i> = \$400, <i>r</i> = 0.09, <i>t</i> = 3
I = 108	Simplify.
The interest earned	is \$108.

Example 12 Elisa has a loan for \$1,300. The interest rate is 7%. If she pays it off in 6 months, how much interest will she pay?

I = prt	Simple interest formula
$I = 1,300 \cdot 0.07 \cdot 0.5$	<i>p</i> = \$1,300, <i>r</i> = 0.07, <i>t</i> = 0.5
I = 45.5	Simplify.

The interest she will pay after 6 months is \$45.50.

Practice Test

Find each number. Round to the nearest tenth if necessary.

1. Find 55% of 164.

CHAPTER

- **2**. What is 355% of 15?
- **3**. Find 25% of 80.

4. **STANDARDS PRACTICE** Of 365 students, 210 bought a hot lunch. About what percent of the students did *not* buy a hot lunch?

Α	35%	С	56%
B	42%	D	78%

Estimate.

5.	18% of 246	6.	145% of 81
7.	71% of 324	8.	56% of 65.4

 COMMUNICATION Theresa makes a long distance phone call and talks for 50 minutes. Of these minutes, 25% were spent talking to her brother. Would the time spent talking with her brother be about 8, 12, or 15 minutes? Explain your reasoning.

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.

- **10**. Find 14% of 65.
- **11**. What number is 36% of 294?
- **12**. 82% of what number is 73.8?
- **13**. 75 is what percent of 50?

Find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an *increase* or a *decrease*.

- **14.** \$60 to \$75
- **15.** 145 meters to 216 meters
- **16**. 48 minutes to 40 minutes

BOOKS For Exercises 17 and 18, use the table below. It shows the results of a survey in which 875 students at Haskell Middle School were asked to name their favorite types of fiction.

Type of Fiction	Percent
Historical Fiction	8%
Mystery	24%
Science Fiction	36%
Sports	32%

- **17.** How many of the 875 students chose science fiction as their favorite type of fiction?
- **18**. How many of the 875 students chose mystery as their favorite type of fiction?

Find the total cost or sale price to the nearest cent.

- **19.** \$2,200 computer, $6\frac{1}{2}$ % sales tax
- 20. \$16 hat, 55% discount
- 21. \$35.49 jeans, 33% discount

Find the simple interest earned to the nearest cent for each principal, interest rate, and time.

- 22. \$750, 3%, 4 years
- **23**. \$1,050, 4.6%, 2 years
- **24.** \$2,600, 4%, 3 months
- 25. **STANDARDS PRACTICE** Leah borrows \$2,200 to buy new furniture. Her loan has an annual simple interest rate of 16%. If she does not make any payments or additional charges, about how much will she owe after one month?
 - **F** \$2,229
 - **G** \$2,552
 - **H** \$2,750
 - J \$3,520

Math Chapter Test at ca.gr6math.com

CHAPTER

California Standards Practice Cumulative, Chapters 1–7



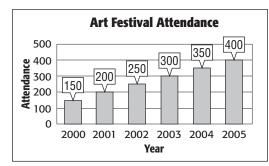
Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.

1 Sarah wants to buy pillows for her living room. Which store offers the best buy on pillows?

Store	Sale Price				
A	3 pillows for \$40				
В	4 pillows for \$50				
C	2 pillows for \$19				
D	1 pillow for \$11				
٨	C Clara C				

A Store A

- C Store C
- **B** Store B
- **D** Store D
- 2 The graph below shows the attendance at a summer art festival from 2000 to 2005. If the trend in attendance continues, which is the best prediction of the attendance at the art festival in 2008?



- **F** Fewer than 200
- G Between 500 and 600
- H Between 700 and 800
- I More than 800
- 3 At their annual car wash, the science club washes 30 cars in 45 minutes. At this rate, how many cars will they wash in 1 hour?

A	40	С	50
B	45	D	60

- The cost of Ken's haircut was \$23.95. If he wants to give his hair stylist a 15% tip, about how much of a tip should he leave?
 - **F** \$2.40
 - **G** \$3.60
 - **H** \$4.60
 - J \$4.80
- **5** At a pet store, 38% of the animals are dogs. If there are a total of 88 animals at the pet store, which equation can be used to find *x*, the number of dogs at the pet store?

A
$$\frac{x}{88} = \frac{100}{38}$$

B $\frac{38}{88} = \frac{100}{x}$
C $\frac{x}{88} = \frac{38}{100}$
D $\frac{100}{88} = \frac{x}{38}$

- 6 An architect made a model of an office building using a scale of 1 inch equals 3 meters. If the height of the model is 12.5 inches, which of the following represents the actual height of the building?
 - **F** 40.0 m
 - G 37.5 m
 - H 36.0 m
 - J 28.4 m
- 7 Mrs. Stewart painted the door to her deck. The door is a rectangle with length *x* feet and width *y* feet. In the middle of the door, there is a rectangular panel of glass that measures 5 feet by 2 feet. Which expression gives the painted area of the door in square feet?
 - **A** x + y 10**B** xy + 10**C** xy - 10**D** x + y + 10

California Standards Practice at ca.gr6math.com

More California Standards Practice For practice by standard, see pages CA1–CA39.

8 At a grocery store, half-gallons of milk are on sale 5 for \$4. Find the cost of 7 halfgallons of milk to the nearest cent.

F	\$2.86	Η	\$5.40
~		-	*• · · ·

G \$4.75	J	\$5.60
-----------------	---	--------

9 If point *B* is translated 3 units to the left and 2 units up, what will be point *B*'s new coordinates?

				- 1	y					
							В			
		-							-	
				0					X	
									_	
				1						
A	(-3, 2)				,	С	(4	1 , ·	-1)
B	(5,0)					D	(-	-1	, 4	F)

10 In Nadia's DVD collection, she has 8 action DVDs, 12 comedy DVDs, 7 romance DVDs, and 3 science fiction DVDs. What percent of Nadia's DVD collection are comedies?

F	25%	Η	35%
G	30%	J	40%

11 Cassandra bought 2 dozen juice boxes priced at 6 juice boxes for \$2.29 and 24 snack packages priced at 8 snack packages for \$6.32. What is the total amount, not including tax, she spent on juice boxes and snack packages?

A	\$34.44	C	\$28.12
B	\$32.15	D	\$25.83

- 12 The average cost of a 2-bedroom apartment in Grayson was \$625 last year. This year, the average cost is \$650. What is the percent of increase from last year to this year?
 - **F** 25%
 - **G** 4%
 - $H \hspace{0.1cm} 3.85\%$
 - **J** 0.04%
- 13 A necklace regularly sells for \$18.00. The store advertises a 15% discount. What is the sale price of the necklace?

A	\$3.00	С	\$15.30
В	\$14.40	D	\$20.70

TEST-TAKING TIP

Question 14 Remember to show all of your work. You may be able to get partial credit for your answers, even if they are not entirely correct.

Pre-AP

Record your answers on a sheet of paper. Show your work.

- 14. The Sybil family is working on its budget.
 - **a.** Their rent increased from \$750 to \$907.50 a month. What is the percent of increase?
 - b. Their landlord said that she would decrease the \$907.50 monthly rent payment by 6% if the family paid their rent by the 10th day of the month. If the Sybil family takes the landlord's offer, describe two ways to find how much rent they would pay.

NEED EXTRA HELP?														
If You Missed Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Go to Lesson	6-2	2-6	6-2	7-1	7-2	6-7	3-6	6-5	2-3	7-5	6-1	7-6	7-7	7-6
For Help with Standard	NS1.2	MR1.1	AF2.3	NS1.4	NS1.3	NS1.3	AF3.2	NS1.3	MR2.4	NS1.4	NS1.2	NS1.2	NS1.4	NS1.2

Chapter 7 California Standards Practice 391

Unit 4 Statistics, Data Analysis, and Probability

Focus

Calculate and use statistical measures to describe data, analyze data and sampling processes for possible bias, and calculate probabilities.

CHAPTER 8 Statistics: Analyzing Data

BIG Idea) Compute and analyze statistical measurements for data sets.

BIG Idea) Use measures of central tendency and range to describe a set of data.

BIG Idea) Use data samples of a population and describe the characteristics and limitations of the samples.

p.

CHAPTER 9 Probability

BIGIGED Determine theoretical and experimental probabilities and use these to make predictions about events.

Cross-Curricular Project

Math and Recreation

Step Right Up and Win A Prize What are my chances of winning? You may ask yourself that any time you play a game. You're about to embark on a gaming adventure. You'll investigate the mathematical probabilities of winning various carnival games. You'll also research and design a game of your own. So, come on and take a chance! Sharpen up that hand-eye coordination and grab your probability tool kit. This adventure is a win-win situation!

Math Control Log on to ca.gr6math.com to begin.





 Standard 6SDAP2.0
 Use data samples of a population and describe the characteristics and limitations of the samples.

Key Vocabulary

histogram (p. 416) measures of central tendency (p. 402) range (p. 397) scatter plot (p. 427)

Statistics: Analyzing Data

Real-World Link

Amusement Parks You can use a bar graph to display and then compare the speeds of various roller coasters.



Statistics: Analyzing Data Make this Foldable to help you organize your notes. Begin with nine sheets of notebook paper.

1 Fold 9 sheets of paper in half along the width.



Glue the 1" tab down. Write the lesson number and title on the front tab.



left edge through one thickness.

2 Cut a 1" tab along the



Repeat Steps 2 and 3 for the remaining sheets. Staple them together on the glued tabs to form a booklet.



GET READY for Chapter 8

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 2

Option 1

Math Take the Online Readiness Quiz at ca.gr6math.com.

Take the Quick Check below. Refer to the Quick Review for help.

QUICKCheck

Order from least to greatest. (Lesson 4-9)

- 1. 96.2, 96.02, 95.89
- **2**. 5.61, 5.062, 5.16
- **3**. 22.02, 22, 22.012
- 4. **JEANS** A store sells bootcut jeans for \$49.97, classic for \$49.79, and flared for \$47.99. Write these prices in order from least to greatest. (Lesson 4-9)

Order from greatest to least. (Lesson 4-9)

74.65, 74.67, 74.7
 1.26, 1.026, 10.26
 3.304, 3.04, 3.340

Evaluate each expression. (Lesson 1-4)

8.
$$\frac{23+44+37+45}{4}$$

9.
$$\frac{1.7 + 2.6 + 2.4 + 3.1 + 1.8}{5}$$

PIZZA Four friends ordered a large pizza for \$14.95, a salad for \$3.75, and two bottles of soda for \$2.25 each. If they split the cost evenly, how much does each person owe? (Lesson 1-4)

QUICKReview

Example 1

Order 47.7, 47.07, and 40.07 from least to greatest.

- 47.7
- 47.07 40.07 Line up the decimal points and compare place value.

The numbers in order from least to greatest are 40.07, 47.07, and 47.7.

Example 2

Order 2.08, 20.8, 0.28 from greatest to least.

The numbers in order from greatest to least are 20.8, 2.08, and 0.28.

Example 3

Evaluate
$$\frac{3.4 + 4.5 + 3.8}{3}$$
.
 $\frac{3.4 + 4.5 + 3.8}{3} = \frac{11.7}{3}$ Add 3.4, 4.5, and 3.8.
 $= 3.9$ Divide 11.7 by 3.

Line Plots

Main IDEA

Display and analyze data using a line plot.



Standard 6SDAP1.1 Compute the range,

mean, median, and mode of data sets. Standard 6SDAP1.2 Understand how additional data added to data sets may affect these computations of measures of central tendency.

NEW Vocabulary

statistics data line plot cluster outlier range analyze

GET READY for the Lesson

BUILDINGS The table shows the number of stories in 20 of the tallest buildings in Los Angeles.

- 1. Do any of the values seem much greater or much less than the other data values?
- 2. Do some of the buildings have the same height? Is this easy to see? Explain.

Los Angeles' Tallest Buildings Number of Stories								
73	48	55	52	44				
62	52	40	54	39				
52	45	52	42	53				
39	42	44	52	42				

Source: emporis.com

Statistics deals with collecting, organizing, and interpreting data. **Data** are pieces of information, which are often numerical. One way to show how data are spread out is to use a line plot. A **line plot** is a diagram that shows the data on a number line.

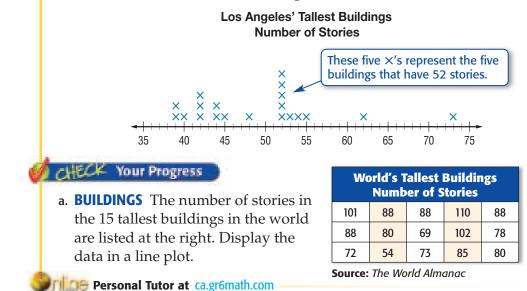
EXAMPLE Display Data Using a Line Plot

BUILDINGS Make a line plot of the data shown above.

Step 1 Draw a number line. The shortest building in the table has 39 stories, and the tallest has 73. You can use a scale of 35 to 75 and an interval of 5. Other scales and intervals could also be used.

	+++++	+++++	+++++	+++++	+++++	+++++	+++++	+++►
35	40	45	50	55	60	65	70	75

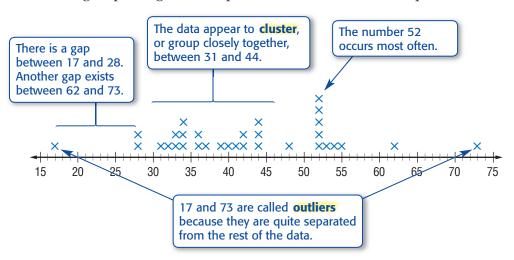
Step 2 Put an × above the number that represents the number of stories in each building. Include a title.



READING in the Content Area

For strategies in reading this lesson, visit ca.gr6math.com.

You can make some observations about the *distribution* of data, or how data are grouped together or spread out. Consider the line plot below.

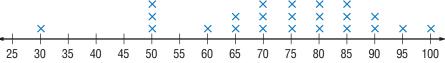


•In a line plot, you can easily find the **range**, or spread, of the data, which is the difference between the greatest and least numbers. When you **analyze** data, you use these observations to describe and compare data.

EXAMPLES Use a Plot to Analyze Data

SHOES The line plot below shows the prices for different basketball shoes. Identify any clusters, gaps, and outliers and find the range.

Prices (\$) of Basketball Shoes × × × × × X



Many of the data cluster between \$70 and \$85.

There is a gap between \$30 and \$50.

Since \$30 is apart from the rest of the data, it is an outlier.

The greatest price is \$100, and the least price is \$30. So, the range of the prices is \$100 - \$30 or \$70.

Describe how the range would change if the data value \$130 was added to the data set in Example 2.

The greatest price would change to \$130, and the least price would remain the same at \$30. So, the range of the prices would change from \$70 to \$130 - \$30 or \$100.

CHECK Your Progress Refer to Example 1.

- **b**. Identify any clusters, gaps, and outliers and find the range.
- c. Describe how the range would change if the data value 50 was added to the data set.



Everyday Meaning in music, all the notes between

the high and low notes, as in a singer with a wide range.

Math Use the difference between the greatest number and least number in a set of data.



Clusters

You can describe a cluster by stating a range of values or by giving a single value around which the data appear to be grouped.

Your Understanding



Display each set of data in a line plot.

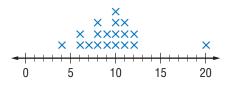
1.

·	Costs of Video Games (\$)									
	20	29	40	50						
	45	20	50	50						
	20	25	50	40						

2.	Siz	Sizes of Tennis Shoes									
	8	10	9	8	7	6					
	9	10	9	6	5	7					
	7	8	11	6	8	7					

MUSIC For Exercises 3 and 4, analyze the line plot below.

Number of Music CDs Owned



Example 2 (p. 397)

3. Identify any clusters, gaps, and outliers and find the range of the data.

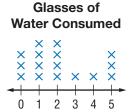
Example 3 (p. 397)

4. Describe how the range would change if the data value 3 was added to the data set.

SURVEYS For Exercises 5–8, analyze the line plot at the right and use the information below.

Jamie asked her classmates how many glasses of water they drink on a typical day. The results are shown.

5. What was the most frequent response?



Example 2

(p. 397)

- 6. What was the least frequent response? 7. What is the range?
- Example 3 8. Describe how the range would change if an additional data value of 4 was (p. 397) added to the data set.

1

Exercises

HOMEWORKHELP						
For Exercises	See Examples					
9–12	1					
13–20	2–3					

Display each set of data in a line plot.

9.	Heights of Desert Cacti (ft)									
	30	10	1	15	10					
	10	10	10	2	10					
	20	3	2	15	5					

11.	
-----	--

1	Basketball Scores (pts)								
	101	101 105 99 130		120					
	100	108	126	135	98				
	120	122	115	129	97				

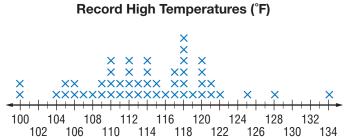
0.	Test Scores (%)									
	98	90	97	85	86	92				
	92	93	95	79	91	92				
	91	94	88	90	93	92				

12.	Ages of Students (y)									
	12	13	13	13	12	14				
	13	12	13	13	12	12				
	13	14	12	13	12	12				



Real-World Link ••••

Death Valley National Park is the site of the highest temperature ever recorded in the United States, 134°F. **Source:** Death Valley Chamber of Commerce •WEATHER For Exercises 13–16, analyze the line plot that shows the record high temperatures recorded by weather stations in each of the fifty states.

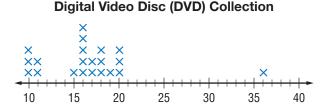


- **13**. What is the range of the data?
- 14. What temperature occurred most often?

Source: The World Almanac

- **15**. Identify any clusters, gaps, or outliers.
- **16**. Describe how the range of the data would change if 134°F were not part of the data set.

MOVIES For Exercises 17–20, analyze the line plot below that shows the number of digital video discs various students have in their DVD collection.



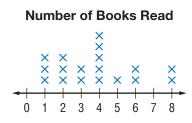
- **17.** Find the range of the data.
- 18. What number of DVDs occurred most often?
- 19. How many students have more than 15 DVDs in their collection?
- **20**. Describe how the range would change if the data value 38 was added to the data set.

Determine whether each statement is *sometimes, always,* or *never* true. Explain your reasoning.

- **21**. If a new piece of data is added to a data set, the range will change.
- **22**. If there is a cluster, it will appear in the center of the line plot.

BOOKS For Exercises 23–25, analyze the line plot at the right.

- **23.** How many students read 4 or more books?
- **24.** How many more students read 1–2 books than 5–6 books?
- 25. About what percent of the students read less than 5 books?

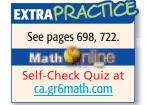


Average Life Spans								
Animal	Span (yr)	Animal	Span (yr)	Animal	Span (yr)			
black bear	18	giraffe	10	lion	15			
camel	12	gorilla	20	pig	10			
cat	12	grizzly bear	25	polar bear	20			
chipmunk	6	horse	20	rhesus monkey	15			
dog	12	kangaroo	7	squirrel	10			
elephant	40	leopard	12	white rhinoceros	20			

ANIMALS For Exercises 26–28, refer to the table.

Source: The World Almanac for Kids

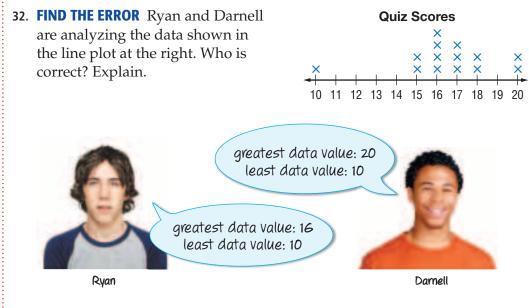
- **26**. Display the data in a line plot.
- 27. Find the range and determine any clusters or outliers.
- 28. Use the line plot to summarize the data in a sentence or two.
- **29**. The *maximum* life spans, in order, of the animals in the table above are 36, 50, 28, 10, 20, 77, 36, 54, 50, 50, 24, 23, 30, 27, 45, 37, 24, and 50, respectively. Display this data in a line plot. Compare this line plot to the line plot you made in Exercise 26. Include a discussion about clusters, outliers, range, and gaps in data.



H.O.T. Problems

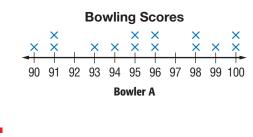
30. COLLECT THE DATA Conduct a survey of your classmates to determine how many hours of television they watch on a typical school night. Then display and analyze the data in a line plot. Use your analysis of the data to write a convincing argument about television viewing on a school night.

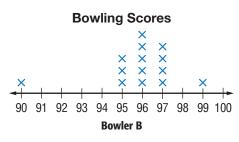
31. REASONING Explain how the inclusion or exclusion of outliers affects the computation of the range of a data set.



33. CHALLENGE Compare and contrast line plots and frequency tables. Include a discussion about what they show and when it is better to use each one.

34. WRITING IN MATH The last 14 bowling scores of two people are shown. Describe which person is more consistent and explain how you know.

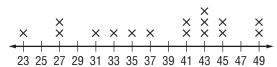




STANDARDS PRACTICE

35. The graph shows the weight of the emperor penguins at a zoo.

Emperor Penguins Weight (kg)



Which statement is not valid?

- A More than half of these penguins weigh at least 41 kilograms.
- **B** There are 16 emperor penguins at the zoo.
- **C** Of these penguins, 30% weigh between 30 and 38 kilograms.
- **D** The range of the emperor penguins' weight is 49 23 or 26 kilograms.

36. The table shows the math scores for 24 students in Mr. Baker's class.

Math Test Scores								
90	86	96	89	85	91	82	89	
100	65	73	85	85	93	77	93	
71	70	75	80	82	99	84	75	

How would the range of the test scores change if a score of 83 was added?

- **F** The range would remain unchanged at 45.
- **G** The range would remain unchanged at 35.
- H The range would change from 45 to 83.
- J The range would change from 35 to 17.

Spiral Review

Find the interest earned to the nearest cent for each principal, interest rate, and time. (Lesson 7-8)

37. \$300, 10%, 2 years

38. \$900, 5.5%, 4.5 years

- **39. BASEBALL CARDS** What is the total cost of a package of baseball cards if the regular price is \$4.19 and the sales tax is 6.5%? (Lesson 7-7)
- **40**. Solve m + 18 = 33 mentally. (Lesson 1-7)

GET READY for the Next Lesson

PREREQUISITE SKILL Add or divide. Round to the nearest tenth if necessary.

41. 16 + 14 + 17 **42.** 4.6 + 2.5 + 9 **43.** $\frac{202}{16}$ **44.** $\frac{253}{7}$

Measures of Central Tendency and Range

Main IDEA

Describe a set of data using mean, median, mode, and range.



Standard 6SDAP1.1 Compute the range, mean, median, and

mode of data sets. Standard 6SDAP1.2 Understand how additional data added to data sets may affect these computations of measures of central tendency.

Standard 6SDAP1.4 Know why a specific measure of central tendency (mean, median, mode) provides the most useful information in a given context.

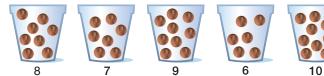
NEW Vocabulary

measures of central tendency mean median mode

MINI Lab

The table shows scores for five quizzes.

• Place pennies in each cup to represent each score.



Quiz	Score
1	8
2	7
3	9
4	6
5	10

Mean

- Move the pennies among the cups so that each cup has the same number of pennies.
- 1. What was the average score for the five quizzes?
- **2**. If the quiz score of 14 points is added to the data, how many pennies would be in each cup?

A number used to describe the *center* of a set of data is a **measure of central tendency**. The most common of these measures is the mean.

KEY CONCEPT

Words	The mean of a set of data is the sum of the data divided by the number of items in the data set. The mean is also referred to as <i>average</i> .
Examples	data set: 1 cm, 1 cm, 5 cm, 2 cm, 2 cm, 4 cm, 2 cm, 5 cm
	mean: $\frac{1+1+5+2+2+4+2+5}{8}$ or 2.75 cm

EXAMPLE Find the Mean

NUTRITION The table shows the grams of sugar in 20 different breakfast bars.

Find the mean.

mean = $\frac{14 + 11 + ... + 12}{20}$ \leftarrow sum of data = $\frac{253}{20}$ or 12.65 grams



Grams of Sugar in

Breakfast Bars

7 14 15

18 21

12

18

10

9 11

8 12

14 11

22

10 10 11

11 9

CHECK Your Progress

a. **MONEY** Adam earned \$14, \$10, \$12, \$15, and \$13 by doing chores around the house. What is the mean amount Adam earned doing these chores?

Two other common measures of central tendency are median and mode.



Everyday Use the middle paved or planted section of a highway, as in median strip.

Math Use the middle number of the ordered data.

KEY C	ONCEPT Median
Words	In a data set that has been ordered from least to greatest, the median is the middle number if there is an odd number of data items. If there is an even number of data items, the median is the mean of the two numbers closer to the middle.
Example	data set: 7 yd, 11 yd, <u>15 yd, 17 yd</u> , 20 yd, 20 yd
	median: $\frac{15+17}{2}$ or 16 yd The median divides the data in half.
	Mode
Words	The mode of a set of data is the number that occurs most often. If there are two or more numbers that occur most often, all of them are modes.
Example	data set: 50 mi, 45 mi, 45 mi, 52 mi, 49 mi, 56 mi, 56 mi) modes: 45 mi and 56 mi

EXAMPLE Find the Mean, Median, and Mode

2) MOVIE RENTALS The number of DVDs rented during one week at Star Struck Movie Rental is shown in the table. What are the mean, median, and mode of the data?

Star Struck Movie Rental Daily DVD Rentals								
S M T W TH F S								
55 34 35 34 57 78 106								

 $\frac{55+34+35+34+57+78+106}{7} = \frac{399}{7} \text{ or } 57$ mean: 34, 34, 35, 55, 57, 78, 106 median: First, write the data in order. median mode: 34 It is the only value that occurs more than once.

The mean is 57 DVDs, the median is 55 DVDs, and the mode is 34 DVDs.

CHECK Your Progress

b. BICYCLES The sizes of the bicycles owned by the students in Ms. Garcia's class are listed in the table. What are the mean, median, and mode of the data?

Students' Bicycle Sizes (in.)						
20	24	20	26			
24	24	24	26			
24	29	26	24			

c. FOOTBALL The points scored in each game by Darby Middle School's football team for 9 games are 21, 35, 14, 17, 28, 14, 7, 21, and 14. Find the mean, median, and mode.

Math Time Extra Examples at ca.gr6math.com

STANDARDS EXAMPLE

3) The maximum length in feet of several whales is listed below.

46, 53, 33, 53, 79

If the maximum length of the Blue Whale, 98 feet, is added to this list, which of the following statements would be true?

- **A** The mode would decrease.
- **C** The mean would increase.
- **B** The median would decrease. **D** T
- **D** The mean would decrease.

Read the Item

You are asked to identify which statement would be true if the data value 98 was added to the data set.

Solve the Item

Use number sense to eliminate possibilities. The mode, 53, will remain unchanged since the new data value occurs only once. So, eliminate answer choice A.

Since the new data value is greater than each value in the data set, the median will not decrease. So, eliminate answer choice B.

The remaining two answer choices refer to the mean. Since 98 is greater than each value in the data set, the mean will increase, not decrease. So, the answer is C.

CHECK Your Progress

- **d**. If the maximum length of the Orca Whale, 30 feet, is added to the list in Example 3, which of the following statements would be true?
 - **F** The mode would decrease. **H** The r
 - H The mean would increase.
 - **G** The median would decrease. **J** The mean would decrease.

Personal Tutor at ca.gr6math.com

In addition to the mean, median, and mode, you can also use the range to describe a set of data. Below are some guidelines for using these measures.

CONCEP	Summary Mean, Median, Mode, and Range			
Measure	Most Useful When			
Mean	 data set has no outliers 			
Median	 data set has outliers there are no big gaps in the middle of the data			
Mode	 data set has many identical numbers 			
Range	describing the spread of the data			

Comparing Measures Another way to solve Example 3 is to find

Test-Taking Tip

the measures *before* 98 is added to the data set. Then find the measures *after* 98 is added to the data set. Then compare.



Median

When there is an odd number of data, the median is the middle number of the ordered set. When there is an even number of data, the median is the mean of the two middle numbers.

EXAMPLE Choose Mean, Median, Mode, or Range

4 TESTS The line plot shows the test scores of the students in Mrs. Hiroshi's math class. Would the mean, median, mode, or range best represent the test scores?

× 76 78 80 82 84 86 88 90 92 94 96

Test Scores

 $76 + 76 + 76 + \dots + 92$ or 83 mean: median mode:

92 - 76 or 16 range:

The mode of 89 misrepresents the scores. Either the mean of 83 or the median of 81.5 best represents the scores.

CHECK Your Progress

e. **GAMES** The table shows the cost of various board games. Would the mean, median, mode, or range best represent the costs? Explain.

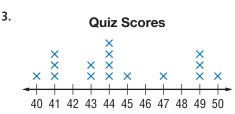
Board Game Costs (\$)						
12	15	40	22			
14	40	15	17			
20	18	40	19			
16	21	19	16			

Your Understanding

Find the mean, median, and mode for each set of data. Round to the nearest Examples 1, 2 (pp. 402-403) tenth if necessary.

1. Miles traveled on the weekend: 29, 14, 80, 59, 78, 30, 59, 69, 55, 50

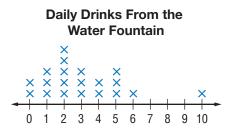
2.	Team	Number of Wins
	Eagles	10
	Hawks	8
	Zipps	9
	Falcons	11



Example 3 (p. 404)

STANDARDS PRACTICE During the week, the daily low temperatures were 52°F, 45°F, 51°F, 45°F, and 48°F. If Saturday's low temperature of 51°F is added, which statement about the data set would be true?

- The mean would decrease. Δ
- The median would decrease. B
- Example 4 5. **SCHOOL** The line plot shows the (p. 405) number of times per day that students drink from the water fountain at school. Which measure best describes the data: mean, median, mode, or range? Explain.
- **C** The mode would increase.
- **D** The mode would decrease.



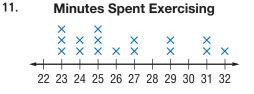
Exercises

HOMEWORKHELP						
For Exercises	See Examples					
6-11	1,2					
30–32	3					
12-13	4					

Find the mean, median, and mode for each set of data. Round to the nearest tenth if necessary.

- 6. Number of dogs groomed each week: 65, 56, 57, 75, 76, 66, 64
- 7. Daily number of boats in a harbor: 93, 84, 80, 91, 94, 90, 78, 93, 80
- 8. Scores earned on a math test: 95, 90, 92, 94, 91, 90, 98, 88, 89, 100
- 9. Prices of books: \$10, \$18, \$11, \$6, \$6, \$5, \$10, \$11, \$46, \$7, \$6, \$8

10.	Cost	Number of Coats	
	\$75	8	
	\$80	3	
	\$85	6	



12. MUSIC The line plot shows the number of weeks that songs have been on the Top 20 Country Songs list. Would the mean, median, mode, or range best represent the data? Explain.



Real-World Link ••••

The International Space Station measures 356 feet by 290 feet, and contains almost an acre of solar panels. **Source:** The World Almanac

Country Songs Number of Weeks in Top 20

 X
 X
 X
 X
 X
 X

 4
 X
 X
 X
 X
 X
 X

 6
 8
 10
 12
 14
 16
 18
 20
 22
 24
 26
 28
 30
 32
 34
 36
 38
 40
 42
 44

•13. **SPACE** Twenty-seven countries have sent people into space. The table shows the number of individuals from each country. Which measure best describes the data: mean, median, mode, or range? Explain.

People in Space								
267	1	9	8	1	1	1	1	1
97	1	1	1	3	1	1	2	1
11	2	1	1	5	1	1	1	1

Source: The World Almanac

Find the mean, median, and mode for each set of data. Round to the nearest tenth if necessary.

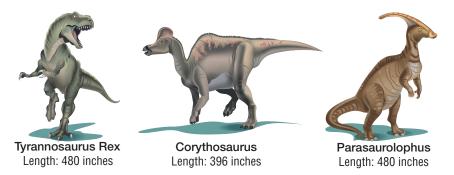
- 14. Weight in ounces of various insects: 6.1, 5.2, 7.2, 7.2, 3.6, 9.0, 6.5, 7.4, 5.4
- **15.** Prices of magazines: \$3.50, \$3.75, \$3.50, \$4.00, \$3.00, \$3.50, \$3.25
- **16.** Daily low temperatures: $-2^{\circ}F$, $-8^{\circ}F$, $-2^{\circ}F$, $0^{\circ}F$, $-1^{\circ}F$, $1^{\circ}F$, $-2^{\circ}F$, $-1^{\circ}F$

REASONING Determine whether each statement is *always, sometimes,* or *never* true about the data set {8, 12, 15, 23}. Explain your reasoning.

17. If a value greater than 23 is added, the mean will increase.

- **18**. If a value less than or equal to 8 is added, the mean will decrease.
- **19**. If a value between 8 and 23 is added, the mean will remain unchanged.

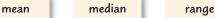
DINOSAURS For Exercises 20–22, use the lengths of the dinosaurs shown below.



- **20**. What is the mean length of the dinosaurs?
- **21**. One of the largest dinosaurs ever is the Brachiosaurus. Its length was 960 inches. If this data value is added to the lengths of the dinosaurs above, how will it affect the mean? Explain your reasoning.
- **22**. Which measure best describes the data if the length of the Brachiosaurus is included: mean, median, mode, or range? If the length of the Brachiosaurus is *not* included? Explain any similarities or differences.
- 23. **SPORTS** The table shows the points scored by a lacrosse team so far this season. The team will play 14 games this season. How many points need to be scored during the last game so that the average number of points scored this season is 12? Explain.

	Hawks Lacrosse Team Points Scored								
11	11 15 12 10 10 10 13								
14									

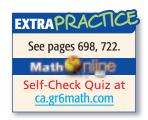
- 24. **FIND THE DATA** Refer to the California Data File on pages 16–19. Choose some data and then describe it using the mean, median, mode, and range.
- **25. OPEN ENDED** Give an example of a set of data in which the mean is not the best representation of the data set. Explain why not.
- **26**. **Which One Doesn't Belong?** Identify the term that does not have the same characteristic as the other three. Explain your reasoning.



- range mode
- **27. REASONING** Determine whether the median is *sometimes, always,* or *never* part of the data set. Explain your reasoning.
- **28. CHALLENGE** Without calculating, would the mean, median, or mode be most affected by eliminating 1,000 from the data shown? Which would be the least affected? Explain your reasoning.

50, 100, 75, 60, 75, 1,000, 90, 100

29. WRITING IN MATH According to the U.S. Census Bureau, the typical number of family members per household is 2.59. State whether this measure is a mean or mode. Explain how you know.



H.O.T. Problems ...

STANDARDS PRACTICE

30. The table below shows the number of soup labels collected in one week by each homeroom in grade 7.

Classroom	Number of Soup Labels
Mr. Martin	138
Ms. Davis	125
Mr. Cardona	89
Mrs. Turner	110
Mr. Wilhelm	130
Mrs. LaBash	?

Which number could be added to the set of data in order for the mode and median of the set to be equal?

Α	89	C	125
В	110	D	130

31. An antique dealer purchased 5 antiques for a total of \$850.00. He later bought another antique for \$758.00. What is the mean cost of all the antiques?

F \$151.60 **H** \$268.00

G \$170.00 **J** \$321.60

32. Gina found the mean and median of the following list of numbers.

5,7,7

If the number 11 was added to this list, which of the following statements would be true?

A The mean would increase.

- **B** The mean would decrease.
- C The median would increase.
- **D** The median would decrease.



33. NUTRITION The table shows the grams of fiber in one serving of 15 different cereals. Make a line plot of the data. (Lesson 8-1)

Find the interest earned to the nearest cent for each principal, interest rate, and time. (Lesson 7-8)

- **34**. \$1,250, 3.5%, 2 years
- **35**. \$569, 5.5%, 4 months
- **36. FOOD** The United States produced almost 11 billion pounds of apples in a recent year. Use the information in the graph to find how many pounds of apples were used to make juice and cider. (Lesson 7-1)
- **37.** Name the property shown by the statement $4 \times 6 = 6 \times 4$. (Lesson 1-8)

GET READY for the Next Lesson

PREREQUISITE SKILL Name the place value of the underlined digit. (p. 669)

•			
38. <u>5</u> 81 39.	6,29 <u>5</u> 40	0. <u>4</u> ,369	41 . 2. <u>8</u> 4

5 5 4 3 3 3 1 1 1 2 1 1 1 1 0

Fiber in Cereal (g)

Uses of Apples in the United States



Extend 8-2

Graphing Calculator Lab Mean and Median

Main IDEA

Use technology to calculate the mean and median of a set of data.



Standard 6SDAP2.5 Identify

claims based on statistical data, and in simple cases, evaluate the validity of the claims.

Standard 6MR2.5 Express the solution clearly and logically by using the appropriate mathematical notation and terms and clear language; support solutions with evidence in both verbal and symbolic work.



Median The median, 2 times, means that half of the students waited more than 2 times to use a computer and half waited fewer than 2 times. You can more efficiently calculate the mean and median of a large set of data using a graphing calculator.

ACTIVITY

COMPUTERS Kendrick surveys thirty seventh graders and asks them how many times they had to wait longer than 5 minutes during the previous week to use a computer in the school library. The results are shown below.

Number of Times a Student Had to Wait to Use the Library Computer										
5	2	9	1	1	2	1	2	5	2	
3	4	2	1	4	0	4	2	2	5	
4	2	2	3	2	1	3	9	5	2	

Find the mean and median of the data.

STEP3 Display a list of statistics

STEPD Clear list L1 by pressing STAT ENTER 🔺 CLEAR ENTER

Enter the number of times students had to wait in L1. Press 5 ENTER 2 ENTER ... 2 ENTER.

for the data by pressing STAT IN ENTER 2nd 1 ENTER.



The first value, *x*, is the mean.

Use the down arrow key to locate **Med**. The mean number of times a student waited was 3 and the median number of times was 2.

ANALYZE THE RESULTS

- 1. **WRITING IN MATH** Kendrick claims that, on average, students had to wait more than 5 minutes about 3 times last week. Based on your own analysis of the data, write a convincing argument to dispute his claim. (*Hint*: Create and use a line plot of the data to support your argument.)
- 2. **COLLECT THE DATA** Collect some numerical data from your classmates. Then use a graphing calculator to calculate the mean and median of the data. After analyzing the data, write a convincing argument to support a claim you can make about your data.



Stem-and-Leaf Plots

Main IDEA

Display and analyze data in a stem-and-leaf plot.



Standard 6SDAP1.3 Understand how

the inclusion or exclusion of outliers affects measures of central tendency.

Standard 6SDAP1.1

Compute the range, mean, median, and mode of data sets.

NEW Vocabulary

stem-and-leaf plot leaf stem

GET READY for the Lesson

BIRDS The table shows the average chick weight in grams of sixteen different species of birds.

- 1. Which chick weight is the lightest?
- 2. How many of the weights are less than 10 grams?

Chick Weight (g)								
19	6	7	10					
11	13	18	25					
21	12	5	12					
20	21	11	12					
Sourc	:e: up	atsix.c	om					

In a **stem-and-leaf plot**, the data are organized from least to greatest. The digits of the least place value usually form the **leaves**, and the next place value digits form the **stems**.

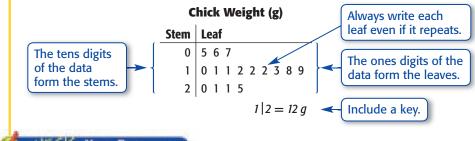
EXAMPLE Display Data in a Stem-and-Leaf Plot

BIRDS Display the data in the table above in a stem-and-leaf plot.

- **Step 1** Choose the stems using digits in the tens place, 0, 1, and 2. The least value, 5, has 0 in the tens place. The greatest value, 25, has 2 in the tens place.
- **Step 2** List the stems from least to greatest <u>ste</u> in the *Stem* column. Write the leaves, the ones digits to the right of the corresponding stems.

tem									
0	6	7	5						
1	9	0	1	3	8	2	2	1	2
2	5	1	0	1					

Step 3 Order the leaves and write a *key* that explains how to read the stems and leaves. Include a title.



CHECK Your Progress

a. **HOMEWORK** The number of minutes the students in Mr. Blackwell's class spent doing their homework one night is shown. Display the data in a stem-and-leaf plot.

Homework Time (min)									
42	5	75	30	45					
47	0	24	45	51					
56	23	39	30	49					
58	55	75	45	35					

Personal Tutor at ca.gr6math.com

Stem-and-leaf plots are useful in analyzing data because you can see all the data values, including the greatest, least, mode, and median value.

EXAMPLE Describe Data

2 **CHESS** The stem-and-leaf plot shows the number of chess matches won by members of the Avery Middle School Chess Team. Find the range, median, and mode of the data.

range: greatest wins - least wins = 61 - 8 or 53median: middle value, or 35 wins mode: most frequent value, 40

Chess Matches Won											
Stem	Le	eaf									
0	8	8	9								
1	9										
2	0	0	2	4	4	8	9				
3	1	1	2	4	5	5	6	6	7	7	8
4	0	0	0	3	8	9					
5	2	4									
6	1										
	9 0 0 2 4 4 8 9 1 1 2 4 5 5 6 6 7 7 8 0 0 0 3 8 9 2 4 1 3 2 = 32 wins										

CHECK Your Progress

b. BIRDS Find the range, median, and mode of the data in Example 1.



Real-World Career . . . How Does a

Nutritionist Use Math?

Nutritionists use statistical graphs to summarize and compare the nutritional values of various foods.

Math Colore For more information, go to ca.gr6math.com.

EXAMPLE Effect of Outliers

NUTRITION The average amount of pasta consumed in different countries each year is shown in the stem-and-leaf plot. Which measure of central tendency is most affected by the inclusion of the outlier?

The mode, 15, is not affected by the inclusion of the outlier, 59.

Amount of Pasta Consumed (Ib) Stem Leaf

tem	Le	ear							
0	3	4	5	8	8	9	9		
1	3 0	1	4	5	5	5	5	5	9
2 3		0							
3									
4									
4 5	9								2 8 = 28 lb

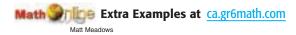
Calculate the mean and median each without the outlier, 59. Then calculate them including the outlier and compare.

without the outlierincluding the outliermean: $\frac{3+4+...+28}{19} \approx 12.79$ $\frac{3+4+...+28+58}{20} = 15.1$ median:1414.5

The mean increased by 15.1 - 12.79, or 2.31, while the median increased by 14.5 - 14, or 0.5. Since 2.31 > 0.5, the mean is most affected.

CHECK Your Progress

c. CHESS Refer to Example 2. If an additional student had 84 wins, which measure of central tendency would be most affected?



Your Understanding



Display each set of data in a stem-and-leaf plot.

1.

Height of Trees (ft)								
15	25	8	12	20				
10	16	15	8	18				

2.	Cost of Shoes (\$)									
	42	47	19	16	21					
	23	25	25	29	31					
	33	34	35	39	48					

Stem Leaf 0 9 9 9

Ages of Students

1 0 1 1 1 1 2 2 3 3 4

 $1 \mid 0 = 10 \ vr$

CAMP The stem-and-leaf plot at the right shows Examples 2, 3 (p. 411) the ages of students in a pottery class.

- **3**. What is the range of the ages of the students?
- 4. Find the median and mode of the data.
- 5. If an additional student was 6 years old, which measure of central tendency would be most affected?

Exercises

HOI

12, 15, 19

HOMEWO	RKHELP	Dis	play ea	1
For	See	6.		1
Exercises	Examples		70	
6-9	I		80	
10, 11, 13, 14, 16–18	2		76	

3

ay each set of data in a stem-and-leaf plot.

Quiz Scores (%)									
70	96	72	91						
80	80	79	93						
76	95	73	93						
90	93	77	91						

8.	Floa	ts at An	nual Pa	rade
	151	158	139	103
	111	134	133	154
	157	142	149	159

CYCLING The number of Tour de France titles won by eleven countries as of 2005 is shown.

- **10**. Find the range of titles won.
- 11. Find the median and mode of the data.
- 12. Which measure of central tendency is most affected by the outlier?

ELECTRONICS For Exercises 13–15, use the stem-and-leaf plot that shows the costs of various DVD players at an electronics store.

- **13**. What is the range of the prices?
- 14. Find the median and mode of the data.
- 15. If an additional DVD player cost \$153, which measure of central tendency would be most affected?

7.	Lo	w Tem	perat	ures (° F)
	15	13	28	32	38
	30	31	13	36	35
	38	32	38	24	20

9.	Scho	ol Play	Attend	ance
	225	227	230	229
	246	243	269	269
	267	278	278	278

Tour de France Titles Won by Eleven Countries

Stem								
0	1 0 6	1	1	2	2	4	8	9
1	0	8						
2								
3	6				0	4	=	4 titles

Costs of DVD Players

Stem	Leaf						
8	2	5	5				
9	9	9					
8 9 10 11 12	0	0	2	5	6	8	
11	0	0	5	5	5	9	9
12	5	7	7				
							5 = \$115



Real-World Link The saltwater crocodile is the largest living reptile. Some measuring 27–30 feet in length have been recorded in the wild. Source: pbs.org

EXTRAPRACTICE
See pages 699, 722.
Math
Self-Check Quiz at <u>ca.gr6math.com</u>

H.O.T. Problems

HISTORY For Exercises 16–19, refer to the stem-and-leaf plot below.

Ages of Signers of Declaration of Independence

```
      Stem
      Leaf

      2
      6
      6
      9

      3
      0
      1
      3
      3
      4
      4
      5
      5
      5
      7
      7
      8
      8
      9

      4
      0
      1
      1
      2
      2
      2
      4
      5
      5
      5
      5
      6
      6
      6
      7
      8
      9

      5
      0
      0
      0
      2
      2
      3
      5
      7
      7
      8
      8
      9
      9

      5
      0
      0
      0
      2
      2
      3
      5
      7
      7
      8
      8
      9
      9

      6
      0
      0
      2
      2
      3
      5
      7
      7
      8
      8
      9
      9

      6
      0
      0
      2
      2
      3
      5
      7
      7
      8
      9
      1
      1
      1
      1
      1
      1
      1
      1
      1
      1
      1
      1
      1
      1
      1
      1
      1
      1
      1
      1
```

- 16. How many people signed the Declaration of Independence?
- 17. What was the age of the youngest signer?
- **18**. What is the range of the ages of the signers?
- **19**. Based on the data, can you conclude that the majority of the signers were 30–49 years old? Explain your reasoning.
- **20. GYMNASTICS** The scores for 10 girls in a gymnastics event are 9.3, 10.0, 9.9, 8.9, 8.7, 9.0, 8.7, 8.5, 8.8, 9.3. Analyze a stem-and-leaf plot of the data to draw two conclusions about the scores.
- •21. **REPTILES** The average lengths of certain species of crocodiles are given in the table. Analyze a stem-and-leaf plot of this data to write a convincing argument about a reasonable length for a crocodile.

Crocodile Average Lengths (ft)							
8.1	16.3	16.3	9.8				
16.3	16.3	11.4	6.3				
13.6	9.8	19.5	16.0				

Source: Crocodilian Species List

- 22. **FIND THE DATA** Refer to the California Data File on pages 16–19. Choose some data that can be presented in a stem-and-leaf plot. Then analyze the stem-and-leaf plot to draw two conclusions about the data.
- 23. FIND THE ERROR Selena and Diana are analyzing the data in the stem-and-leaf plot at the right. Diana says half of the pieces of ribbon are between 20 and 30 inches in length. Selena says there are no pieces of ribbon more than 50 inches in length. Who is correct? Explain.

Cut Ribbon Length						
Stem						
2	6 6 9 6 3 6					
3						
4	6					
5	3 6					
	2 6 = 26 in.					

- **24. CHALLENGE** Create a stem-and-leaf plot in which the median of the data is 25.
- 25. **WRITING IN** MATH Present the data shown at the right in a frequency table, a line plot, and a stem-and-leaf plot. Describe the similarities and differences among the representations. Which representation do you prefer to use? Explain your reasoning.

Price of Jeans (\$)								
40	45	38	30					
35	32	33	24					
26	36	56	36					
26	38	49	34					
28	40	40	35					

26. COLLECT THE DATA Collect a set of data that represents the heights in inches of the people in your math class. Then write a question that can be solved by analyzing a stem-and-leaf plot of the data. Be sure to explain how the stem-and-leaf plot would be used to solve your problem.

STANDARDS PRACTICE

27. Denzell's science quiz scores are 11, 12, 13, 21, and 35. Which stem-and-leaf plot best represents this data?

Α	Stem	Leaf	
	1	1	
	2 3	1 5	
	3	5	3 5 = 35
В	Stem	Leaf	
	1	3	
	2	1	
	3	5	3 5 = 35
С	Stem	Leaf	
C	1	123	
C	1	123	
C	-	123	3 5 = 35
C	1	123	3 5 = 35
C D	1	123	3 5 = 35
_	1 2 3 Stem 1	1 2 3 1 5 Leaf 1	3 5 = 35
_	1 2 3 Stem 1	1 2 3 1 5 Leaf 1	3 5 = 35
_	1 2 3 Stem	1 2 3 1 5 Leaf 1	3 5 = 35 3 5 = 35

28. The stem-and-leaf plot shows the points scored by the Harding Middle School basketball team.

Points Scored							
Stem	Le	Leaf					
4	7 0 1 4	8	8	8			
5	0	0	2	3	7	9	
6	1	6					
7							
8	4						
							70

Which one of the following statements is true concerning how the measures of central tendency are affected by the inclusion of the outlier?

- **F** The mode is most affected.
- **G** The median is not affected.
- H The mean is most affected.
- J None of the measures of central tendency are affected.



Find the mean, median, and mode for each set of data. Round to the nearest tenth if necessary. (Lesson 8-2)

- **29**. 80, 23, 55, 58, 45, 32, 40, 55, 50
- **30**. 3.6, 2.4, 3.0, 7.9, 7.8, 2.4, 3.6, 3.9
- 31. Make a line plot of the test scores shown. (Lesson 8-1)
- **32. SCHOOL** The ratio of boys to girls in the sixth grade is 7 to 8. How many girls are in the sixth grade if there are 56 boys? (Lesson 6-1)

Test Scores				
83	94	78	78	85
86	88	83	82	92
90	77	83	81	89
90	88	87	88	85
84	81	83	85	91

33. Write $\frac{9}{24}$ in simplest form. (Lesson 4-4)

GET READY for the Next Lesson

PREREQUISITE SKILL Choose an appropriate interval and scale for each set of data. (Lesson 8-1)

34. 9, 0, 18, 19, 2, 9, 8, 13, 4

35. 30, 20, 60, 80, 90, 120, 40



Bar Graphs and Histograms

Main IDEA

Display and analyze data using bar graphs and histograms.



Standard 6SDAP2.3 Analyze data displays and

explain why the way in which the question was asked might have influenced the results obtained and why the way in which the results were displayed might have influenced the conclusions reached.

NEW Vocabulary

bar graph histogram



Bar Graphs The bars should be of equal width with equal spacing between them.

GET READY for the Lesson

ANIMALS The cheetah is the fastest known land animal. The table shows its fastest speed and the top speeds of four other land animals.

- 1. What are the fastest and slowest speeds in the table?
- **2**. How can you create a visual representation to summarize the data?
- Animal
 Speed (mph)

 cheetah
 70

 wildebeest
 50

 lion
 50

 elk
 45

 zebra
 40

Source: The World Almanac

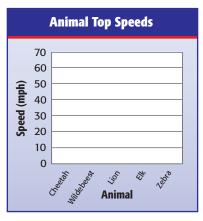
3. Do any of these representations show both the animal name and its speed?

A **bar graph** is a method of comparing data by using solid bars to represent quantities.

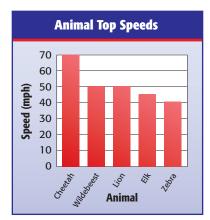
EXAMPLE Display Data Using a Bar Graph

Display the data in the table above in a bar graph.

Step 1 Draw a horizontal axis and a vertical axis. Label the axes as shown. In this case, the scale on the vertical axis is chosen so that it includes all the speeds. Add a title.



Step 2 Draw a bar to represent each category. In this case, a bar is used to represent the speed of each animal.



CHECK Your Progress

a. FLOWERS The table shows the diameters of the world's largest flowers. Display the data in a bar graph.

Flower	Maximum Size (in.)	
Rafflesia	36	
Sunflower	19	
Giant Water Lily	18	
Brazilian Dutchman	14	
Magnolia	10	
Source: Book of World Records		

READING Math

Frequency

Frequency refers to the number of data items in a particular interval. In Example 2, the frequency of 10 in the third row means that there are 10 animals whose maximum speed is 31–40 mph.



Histograms

Because the intervals are equal, all of the bars have the same width, with no space between them. The space at 51-60 indicates that there are no data values on that interval.

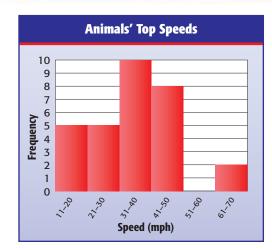
A special kind of bar graph, called a **histogram**, uses bars to represent the frequency of numerical data that have been organized in intervals.

EXAMPLE **Display Data Using a Histogram**

2 ANIMALS The top speeds of thirty different land animals have been organized into a frequency table. Display the data in a histogram.

Maximum Speed (mph)	Number of Animals	
11–20	5	
21-30	5	
31–40	10	
41-50	8	
51-60	0	1.1.1
61-70	2	Contraction of the state of the state
Source: The Wo	orld Almanac	And a second sec

- Step 1 Draw and label horizontal and vertical axes. Add a title.
- Step 2 Draw a bar to represent the frequency of each interval.



The two highest bars represent a majority of the data. From the graph, you can easily see that most of the animals have a top speed of 31–50 miles per hour.



b. EARTHQUAKES The magnitudes of the largest U.S. earthquakes are organized into the frequency table shown. Display the data in a histogram.

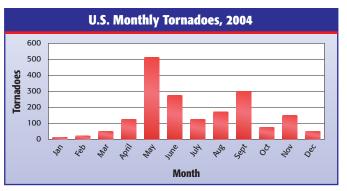
4
Τ.
14
5
2
1

Source: National Earthquake Information Center



EXAMPLES Analyze Data to Make Inferences

WEATHER The bar graph shows the monthly number of tornadoes that occurred in the U.S. in 2004.



Source: NOAA National Weather Service

3 Which season had the least number of tornadoes? Justify your answer.

Look for the months with the least number of tornadoes. The graph shows that close to 0 tornadoes occurred in January and February. So, the least number of tornadoes occurred in winter.

4 Compare the number of tornadoes that occurred in May and June.

About 500 tornadoes occurred in May. About 275 tornadoes occurred in June. So, there were almost twice as many tornadoes in May than in June.

CHECK Your Progress

MALLS The histogram shows the number of stores in the largest malls in the U.S.

- c. How many malls are represented in the histogram? Explain your reasoning.
- d. Compare the number of malls with 275–349 stores to the malls with 425–499 stores.



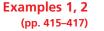
Source: Directory of Major Malls



Inferences An inference is a conclusion that can be supported by data.

CHECK Your Understanding

1



2 Select the appropriate graph to display each set of data: bar graph or
⁷⁾ histogram. Then display the data in the appropriate graph.

·	State Sales Tax Rates		
	Percent	States	
	2.0-2.9	1	
	3.0-3.9	0	
	4.0-4.9	12	
	5.0-5.9	12	
	6.0-6.9	16	
	7.0–7.9	4	

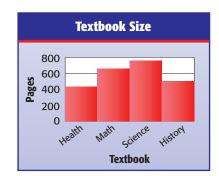
Source: www.taxadmin.org

2.	Men's Grand Slam Titles		
	Player	Titles	
	Pete Sampras	14	
	Roy Emerson	12	
	Bjorn Borg	11	
	Rod Laver	11	
	Andre Agassi	8	

Source: Book of World Records

Examples 3, 4 (p. 417) TEXTBOOKS For Exercises 3 and 4, use the bar graph that shows the average number of pages in various textbooks.

- **3**. On average, which textbook has the least number of pages?
- 4. Is it reasonable to say that on average, a health textbook has half as many pages as a science textbook? Explain.



Exercises

HOMEWORK HELP		
For Exercises	See Examples	
5–8	1, 2	
9–15	3	

Select the appropriate graph to display each set of data: bar graph or histogram. Then display the data in the appropriate graph.

5.	Most Threatened Reptiles		
	Country	Number of Species	
	Australia	38	
	China	31	
	Indonesia	28	
	U.S.	27	
	India	25	

Source: Top 10 of Everything, 2005

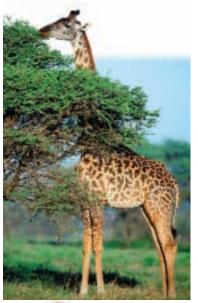
7.	Major U.S. Rivers			
	Length (mi)	Frequency		
	600–999	15		
	1,000–1,399	5		
	1,400–1,799	3		
	1,800–2,199	3		
	2,200–2,599	2		

Source: The World Almanac

6.	Home Run Leaders, 1985–2004		
	Home Runs	Frequency	
	31–36	1	
	37–42	4	
	43–48	7	
	49–54	5	
	55-60	3	
	Source: The Wor	ld Almanac	

8.	City Skyscrapers			
	City	Skyscrapers		
	New York	176		
	Hong Kong	163		
	Chicago	81		
	Shanghai	49		
	Токуо	44		

Source: Book of World Records



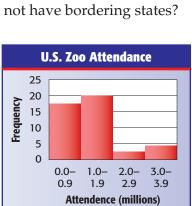
Real-World Link Giraffes live for 10-15 years in the wild, but average 25 years at ZOOS. Source: zoo.org

GEOGRAPHY For Exercises 9–12. use the graph that shows the number of bordering states for each of the fifty states.

- 9. What is the most frequent number of states that borders another state?
- 10. How many states are bordered by 6 states?
- **11.** How many states do not have any bordering states? Justify your answer.
- 12. **RESEARCH** Use the Internet or another source to find which states do not have any bordering states. Why do these states not have bordering states?

•• **ZOOS** For Exercises 13–15, use the histogram that shows the attendance at the major U.S. zoos in a recent year.

- **13**. About how many zoos does the graph represent?
- 14. What is the range of attendance for most of the zoos?
- 15. Compare the number of zoos with 0.0–0.9 million visitors to the number of zoos with 3.0–3.9 million visitors.



3 4 5 6 7

Number of Bordering States

8

The State's Neighbors

2

10

6 4

2

0

0 1

Frequency 8

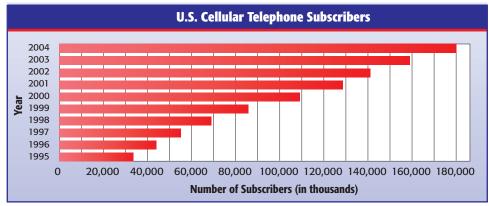
Source: The World Almanac

Match each characteristic to the appropriate graph(s).

- **16**. data display based upon place value
- 17. shows the frequency of data on a number line
- **18**. compares data using solid bars
- **19**. data is organized using intervals

- a. line plot
- **b**. histogram
- **c**. stem-and-leaf plot
- d. bar graph

CELL PHONES For Exercises 20 and 21, use the bar graph shown below.

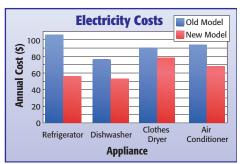


Source: The World Almanac

- 20. Describe how the number of cell phone subscribers has grown over the 10-year period.
- **21**. Use the graph to predict the number of cell phone subscribers in 2010.

ELECTRICITY For Exercises 22 and 23, use the multiple bar graph that compares the annual costs of using old model appliances and using equivalent new model appliances.

- **22**. For which appliance is the difference in electricity costs between the old and new model the greatest? Explain.
- 23. Describe an advantage of using a multiple-bar graph rather than two separate graphs to compare data.



Source: Association of Home Appliance Manufacturers

EXERCISE For Exercises 24–27, refer to the graph below. **Favorite Sports to Play** Girls 60 Boys 50 40 Percent 30 20 10 0 Societ

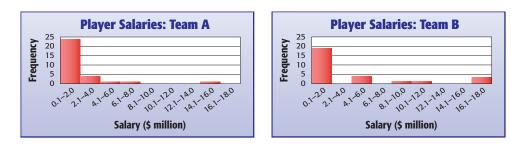
EXTRAPRACTICE	
See pages 699, 722.	
Math	
Self-Check Quiz at <u>ca.gr6math.com</u>	

H.O.T. Problems

- 24. Which sport did the girls surveyed prefer the most?
- **25**. Which sport is the least favorite for the boys?
- **26**. Based on this survey, boys prefer football 4 times more than what sport?

Sports

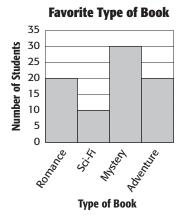
- **27**. Write a convincing argument telling why you think that approximately the same number of boys and girls like to play kickball.
- **28. CHALLENGE** The histograms show players' salaries for two major league baseball teams. Compare the salary distributions of the two teams.



- 29. DATA SENSE Describe how to determine the number of values in a data set that is represented by a histogram.
- 30. **WRITING IN MATH** Can any data set be displayed using a histogram? If yes, explain why. If no, give a counterexample and explain why not.

STANDARDS PRACTICE

31. The results of a survey are displayed in the graph.



Which statement is valid about the survey?

- **A** Twice as many students enjoy reading mysteries than romance.
- **B** Most students enjoy reading adventure books.
- **C** Twice as many students enjoy reading romance books than science fiction.
- **D** Half as many students enjoy reading mysteries than romance.

Spiral Review

SPORTS For Exercises 33 and 34, refer to the data that lists the number of games won by each team in a baseball league.

- 33. Make a stem-and-leaf plot of the data. (Lesson 8-3)
- 34. What is the mean, median, and mode of the data? (Lesson 8-2)
- **35. SELECT A TECHNIQUE** The video game that Neil wants to buy costs \$50. He has saved $\frac{1}{5}$ of the amount he needs. Which of

the following techniques might Neil use to find how much more money he will need to buy the game? Justify your selection(s). Then use the technique(s) to solve the problem. (Lesson 5-5)

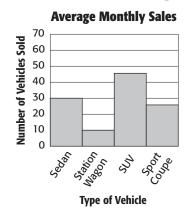
mental math	number sense	

estimation

GET READY for the Next Lesson

36. WEATHER At 5:00 P.M., the outside temperature was 81°F. At 6:00 P.M., it was 80°F. At 7:00 P.M., it was 79°F. Use the *look for a pattern* strategy to predict the outside temperature at 8:00 P.M. (Lesson 2-6)

32. The graph shows the average car sales per month at a car dealership.



What is the best prediction for the number of station wagons the dealer sells in a year?

- **F** 10
- **G** 60
- **H** 120
- J 500

Number of Wins						
25	36	46	15	30	53	
40	32	17	45	41	31	
56	50	52	47	26	40	
43	56	51	50	55	50	
44	47	53	23	19		

Spreadsheet Lab Circle Graphs

Main IDEA

Use technology to create circle graphs.

Extend

8-4

Standard 6SDAP2.3 Analyze data displays and

explain why the way in which the question was asked might have influenced the results obtained and why the way in which the results were displayed might have influenced the conclusions reached.

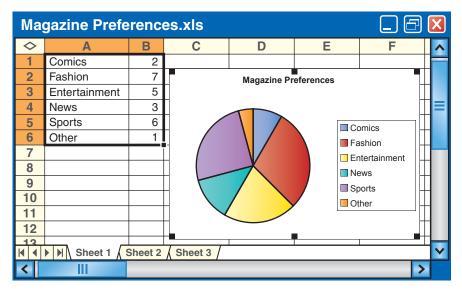
Standard 6MR1.2 Formulate and justify mathematical conjectures based on a general description of the mathematical question or problem posed. Another type of display used to compare categories of data is a *circle graph*. Circle graphs are useful when comparing parts of a whole.

ACTIVITY

MAGAZINES The table shows the results of a survey in which students were asked to indicate their favorite type of magazine. Use a spreadsheet to make a circle graph of these data.

STEP1) Enter the data in a spreadsheet as shown.

Magazine Preferences				
Туре	Frequency			
Comics	2			
Fashion	7			
Entertainment	5			
News	3			
Sports	6			
Other	1			



Select the information in cells A1 to B6. Click on the Chart Wizard icon. Choose the Pie chart type. Click Next twice. Enter the title Magazine Preferences. Then click Next and Finish.

ANALYZE THE RESULTS

- 1. MAKE A CONJECTURE Use the graph to determine which types of magazines were preferred by about $\frac{1}{3}$ and 25% of the students surveyed. Explain your reasoning. Then check your answers.
- 2. **COLLECT THE DATA** Collect some data that can be displayed in either a circle or bar graph. Record the data in a spreadsheet. Then use the spreadsheet to make both types of displays. Which display is more appropriate? Justify your selection.

STUDY TIP

Bar Graphs

To create a bar graph using a spreadsheet, follow the same steps used to create a circle graph, except choose Bar for the chart type.

CHAPTER

Mid-Chapter Quiz

Lessons 8-1 through 8-4

STANDARDS PRACTICE The table shows quiz scores of a math class. What is the range of test scores? (Lesson 8-1)

			Math Scores					
		89	92	67	75	95	89	82
		92	88	89	80	91	79	90
A	89				C	67		
В	82				D	28		

For Exercises 2–4, use the data below. (Lesson 8-1)

Age Upon Receiving Driver's License									
16	17	16	16	18	21	16	16	18	18
17	25	16	17	17	17	17	16	20	16

- 2. Make a line plot of the data.
- 3. Identify any clusters, gaps, or outliers.
- 4. Describe how the range of data would change if 25 was not part of the data set.
- 5. **STANDARDS PRACTICE** The table shows the average April rainfall for 12 cities. If the value 4.2 is added to this list, which of the following would be true? (Lesson 8-2)

Average Rain (in.)						
0.5	0.6	1.0	1.0	2.5	3.7	
2.6	3.3	2.0	1.4	0.7	0.4	

- **F** The mode would increase.
- **G** The mean would increase.
- H The mean would decrease.
- J The median would decrease.
- 6. **TREES** The heights, in meters, of several trees are 7.6, 6.8, 6.5, 7.0, 7.9, and 6.8. Find the mean, median, and mode. Round to the nearest tenth if necessary. (Lesson 8-2)

 SPEED Display the data shown in a stemand-leaf plot and write one conclusion based on the data. (Lesson 8-3)

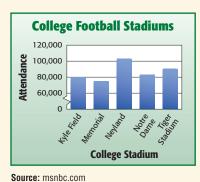
Car Highway Speeds								
65	72	76	68	65				
59	70	69	71	74				
68	65	71	74	69				

MAMMALS For Exercises 8–10, refer to the stemand-leaf plot that shows the maximum weight in kilograms of several rabbits.

Maximum Weight of Rabbits (kg)						
Stem	Leaf					
0	8 9 0 2 4 6 8 7					
1	02468					
2	7					
2 3 4 5						
4						
5	4					
	$0 8 = 0.8 \ kg$					

- 8. Find the range of weights.
- 9. Find the median and mode of the data.
- **10**. Which measure of central tendency is most affected by the inclusion of the outlier? Explain.

ATTENDANCE For Exercises 11 and 12, refer to the graph. (Lesson 8-4)



- **11.** About how many people does the graph represent?
- **12**. Which two stadiums house about the same number of people?

Problem-Solving Investigation

MAIN IDEA: Solve problems by using a graph.

Standard 6MR2.3 Estimate unknown quantities graphically and solve for them by using logical reasoning and arithmetic and algebraic techniques. **Standard 6SDAP2.3 Analyze data displays** and explain why the way ... might have influenced the results obtained and why the way ... influenced the conclusions reached.

P.S.I. TERM 🕂

e-Mail: USE A GRAPH

YOUR MISSION: Use a graph to solve the problem.

THE PROBLEM: The table shows the study times and test scores of 13 students in Mrs. Collins' English class?

Yolanda: Based on this data, what would be the test score of a student who studied for 80 minutes?

Study Time and Test Scores												
	Study Time (min)	120	30	60	95	70	55	90	45	75	60	10
	Test Score (%)	98	77	91	93	77	78	95	74	87	83	65

	EXPLORE	You know the number of minutes stue	died. You need to predict the test score.
	PLAN	Organize the data in a graph so you can easily see any trends.	Study Time and Test Scores
	SOLVE	The graph shows that as the study times progress, the test scores increase. You can predict that the test score of a student who studied for 80 minutes is about 88%.	95 95 85 75 75
1111111111111	CHECK	Draw a line that is close to as many of the points as possible, as shown. The estimate is close to the line so the prediction is reasonable.	65 0 20 40 60 80 100 x Study Time (min)
			11

Analyze The Strategy

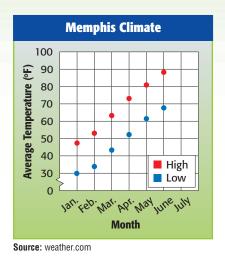
- 1. Explain why analyzing a graph is a useful way to quickly make conclusions about a set of data.
- 2. **WRITING IN MATH** Write a problem in which using a graph would be a useful way to check a solution.



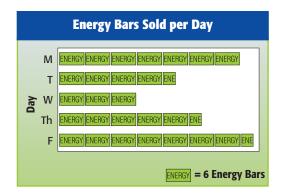
Mixed Problem Soluing

For Exercises 3 and 4, solve by using a graph.

3. SCIENCE Refer to the graph. Suppose the trends continue. Predict the average high temperature for the month of July.



4. **SCHOOL** The graph shows the number of energy bars sold in the cafeteria. On which day did the cafeteria sell about half as many bars as it did on Friday?

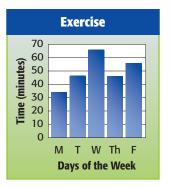


Use any strategy to solve Exercises 5–8. Some strategies are shown below.

PROBLEM-SOLVING STRATEGIES • Guess and check. • Look for a pattern.	
·Use a graph.	-

5. **ALGEBRA** What are the next two numbers in the pattern 8, 18, 38, 78, ...?

- 6. **READING** Maya read 10 pages of a 150-page book on Monday and plans to read twice as many pages each day than she did the previous day. On what day will she finish the book?
- 7. EXERCISE The graph shows the number of minutes Jacob exercised during one week. According to the graph, which two days did he exercise about the same amount of time?



8. **ALGEBRA** Find two numbers with a sum of 56 and with a product of 783.

Select the Operation

For Exercises 9 and 10, select the appropriate operation(s) to solve the problem. Justify your selection(s) and solve the problem.

- **9. SAFETY** An elevator sign reads *Do not exceed* 2,500 *pounds*. How many people, each weighing about 150 pounds, can be in the elevator at the same time?
- 10. BOWLING Tariq and three of his friends are going bowling, and they have a total of \$70 to spend. Suppose they buy a large pizza, four beverages, and each rent bowling shoes. How many games can they bowl if they all bowl the same number of games?

Bowling	Costs
Item	Price
large pizza	\$15.75
beverage	\$1.50
shoe rental	\$3.50
game	\$4.00

Using Graphs to Predict

Main IDEA

Analyze line graphs and scatter plots to make predictions and conclusions.



Standard 6MR2.3 Estimate unknown quantities

graphically and solve
for them by using logical
reasoning and arithmetic
and algebraic techniques.
Standard 6SDAP2.5
Identify claims based on
statistical data, and in simple
cases, evaluate the validity of
the claims.

NEW Vocabulary

line graph scatter plot

MINI Lab

- Pour 1 cup of water into the drinking glass.
- Measure the height of the water, and record it in a table like the one shown.
- Place 5 marbles in the glass. Measure the height of the water. Record.
- Continue adding marbles, 5 at a time, until there are 20 marbles in the glass. After each time, measure and record the height of the water.

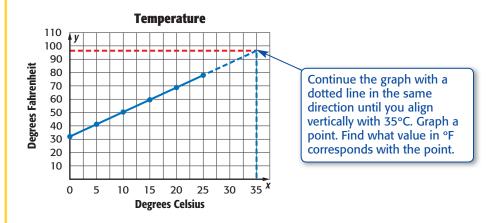
Height of Water (cm)

- 1. By how much did the water's height change after each addition of marbles?
- **2**. Predict the height of the water when 30 marbles are in the drinking glass. Explain how you made your prediction.
- **3**. Test your prediction by placing 10 more marbles in the glass.
- 4. Draw a graph of the data that you recorded in the table.

You created a line graph in the Mini Lab. Line graphs can be useful in predicting future events because they show relationships or trends over time.

EXAMPLES Use a Line Graph to Predict

TEMPERATURE The relationship between temperature readings in °C and °F is shown below. Use the line graph to predict the temperature reading 35°C in °F.



The temperature reading 35°C is equivalent to 95°F.

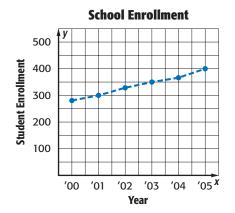


Broken Lines In Example 2, there are no data points between the points that represent enrollment. So, a broken line was used to help you easily see trends in the data.

STUDY TIP

Scatter Plots

In a positive relationship, as the value of *x* increases, so does the value of *y*. In a negative relationship, as the value of *x* increases, the value of *y* decreases. **SCHOOL** The graph shows the student enrollment at McDaniel Middle School for the past several years. If the trend continues, what will be the enrollment in 2010?



If the trend continues, the enrollment in 2010 will be about 525 students.

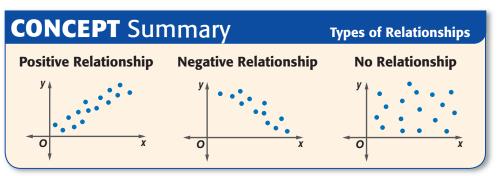
CHECK Your Progress

- a. **READING** Kerry is reading *The Game of Sunken Places* over summer break. The graph shows the time it has taken her to read the book so far. Predict the time it will take her to read 150 pages.
- b. JUICE BOXES The table shows the number of juice boxes a cafeteria sold in a five-week period. Display the data in a line graph. If the trend continues, how many juice boxes will be sold in week 8?

	The Game of Sunken Places								
	140	A V	1						
	120	Ľ –	-	-					
ad	100		-				-		
2	80		-			4	-		
Pages Read	60		-		4	_	-		
Pa	40	\vdash			-		+		
	20		1		_	_	-		
	0							-	
		1	2 3	54	- 5	6	78	3 x	
		Days							

Juice Box Sales					
Week	Number Sold				
1	50				
2	52				
3	56				
4	60				
5	62				

A **scatter plot** displays two sets of data on the same graph. Like line graphs, scatter plots are useful for making predictions because they show trends in data. If the points on a scatter plot come close to lying on a straight line, the two sets of data are related.



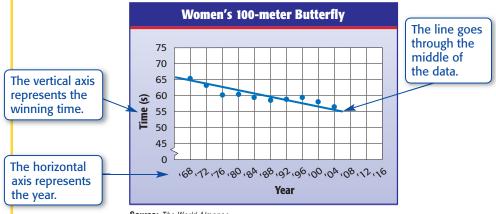


READING Math

Scatter Plots Another name for scatter plot is *scattergram*.



3 SWIMMING The scatter plot shows the winning times for the women's 100-meter butterfly event at the Summer Olympics from 1968 to 2004. Predict a winning time for this event at the 2012 Olympics.



Source: The World Almanac

By looking at the pattern, we can predict that the winning time at the 2012 Olympics will be about 54 seconds.

CHECK Your Progress

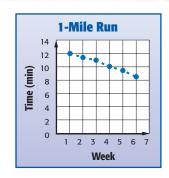
c. **SWIMMING** Use the scatter plot above to predict a winning time for the Women's 100-meter Butterfly event at the 2016 Olympics.

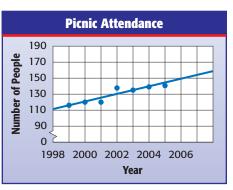
Personal Tutor at <u>ca.gr6math.com</u>

CHECK Your Understanding

Examples 1, 2 (pp. 426–427) **TRACK** Sierra is training for cross-country try-outs. To make the team, she needs to be able to run 1 mile in under 8 minutes. The graph charts her progress.

- 1. Describe the relationship between the two sets of data.
- 2. If the trend continues, will Sierra make the team? Explain.
- Example 3 (p. 428)
- 3. **PICNICS** The scatter plot shows the number of people who attended a neighborhood picnic each year. How many people should be expected to attend the picnic in 2007?



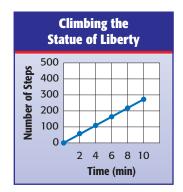


Exercises

HOMEWORKHELP		
For Exercises	See Examples	
4–5	1, 2	
6–7	3	

MONUMENTS For Exercises 4 and 5, use the graph that shows the time it takes Ciro to climb the Statue of Liberty.

- 4. Predict the time it will take Ciro to climb 354 steps to reach the top.
- **5.** How many steps will he have climbed after 14 minutes?



SCHOOL For Exercises 6 and 7, use the graph that shows the time students spent studying for a test and their test score.

- 6. What score should a student who studies for 1 hour be expected to earn?
- 7. If a student scored 90 on the test, about how much time can you assume the student spent studying?

SAFETY For Exercises 8–10, use the table that shows the relationship between the speed of a vehicle and the distance required to stop.

- 8. Make a scatter plot of the data. Use the speed on the horizontal axis and the stopping distance on the vertical axis.
- **9**. Describe the relationship, if any, between the two sets of data.
- Speed (mph)
 Stopping Distance (ft)

 55
 273

 60
 312

 65
 355

 70
 400

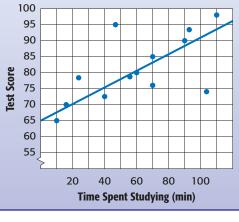
 75
 447
- **10**. Predict the stopping distance for a car traveling 45 miles per hour.

OLYMPICS For Exercises 11–13, use the table that shows the number of nations that participated in the Summer Olympics from 1936 to 2004.

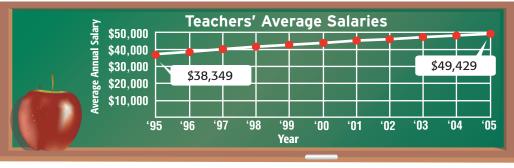
- 11. Display the data in a scatter plot.
- Predict the number of nations that will participate in the 2012 Summer Olympics.
- **13**. Describe the trend in the data.

Year	Number of Nations	Year	Number of Nations
1936	49	1976	92
1948	59	1980	80
1952	69	1984	140
1956	72	1988	159
1960	83	1992	169
1964	93	1996	197
1968	112	2000	199
1972	121	2004	201

Study Time and Test Scores

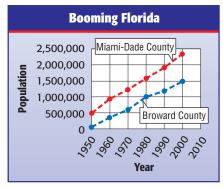


SCHOOLS For Exercises 14 and 15, use the graphic that shows public school teachers' average salaries for the past few years.



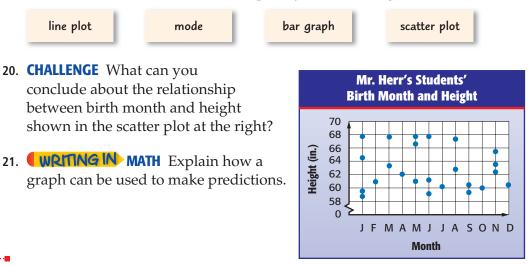
Source: nea.org

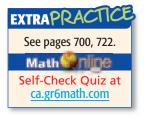
- 14. Describe the relationship, if any, between the two sets of data.
- 15. If the trend continues, what will be the average annual salary in 2009?
- **16. RESEARCH** Use the Internet or another source to find a real-world example of a scatter plot. Write a description of what the graph displays and extend the graph to show where the data will be in the future.
- **17. POPULATION** The *multiple line graph* at the right shows the population of Miami-Dade and Broward Counties in Florida from 1950 to 2000. Do you think that the population of Broward County will catch up to the population of Miami-Dade County in the next census in 2010? Write a convincing argument as to why or why not.





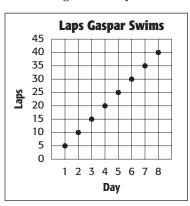
- **H.O.T.** Problems 18. OPEN ENDED Name two sets of data that can be graphed on a scatter plot.
 - **19.** Which One Doesn't Belong? Identify the term that does not have the same characteristic as the other three. Explain your reasoning.





STANDARDS PRACTICE

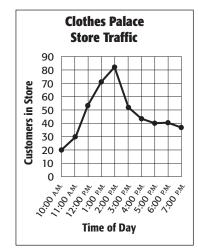
22. The number of laps Gaspar has been swimming each day is shown.



If the trend shown in the graph continues, what is the best prediction for the number of laps he will swim on day 10?

- **A** 50
- **B** 65
- **C** 75
- **D** 100

23. The number of customers at Clothes Palace at different times during the day is shown.



If extra workers are needed when the number of customers exceeds 50, between which hours is extra help needed?

- F 12:00 P.M.-3:00 P.M.
- **G** 11:00 A.M.-4:00 P.M.
- **Н** 1:00 р.м.-4:00 р.м.
- J 1:00 р.м.-3:00 р.м.



- 24. **SKATING** Use the *use a graph* strategy to compare the number of people who skate in California to the number of people who skate in Texas. (Lesson 8-5)
- **25. COLORS** Of 57 students, 13 prefer the color red, 16 prefer blue, 20 prefer green, and 8 prefer yellow. Display this data in a bar graph. (Lesson 8-4)



Source: National Sporting Goods Association

GET READY for the Next Lesson

 PREREQUISITE SKILL
 Find the mean and median for each set of data. (Lesson 8-2)

 26. 89 ft, 90 ft, 74 ft, 81 ft, 68 ft
 27. 76°, 90°, 88°, 84°, 82°, 78°

Spreadsheet Lab Multiple-Line and -Bar Graphs

Main IDEA

Use a spreadsheet to make a multiple-line graph and a multiple-bar graph.

Extend

8-6



SDAP2.3 Analyze data displays and

explain why the way in which the question was asked might have influenced the results obtained and why the way in which the results were displayed might have influenced the conclusions reached.

Standard 6MR2.4 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.

In Lessons 8-4 and 8-6, you interpreted data in a multiple-bar graph and in a multiple-line graph, respectively. You can use a spreadsheet to make these two types of graphs.

ACTIVITY

The stopping distances for a car on dry pavement and on wet pavement are shown in the table at the right.

Speed	Stopping Distance (ft)		
Speed (mph)	Dry Pavement	Wet Pavement	
50	200	250	
60	271	333	
70	342	430	
80	422	532	

Source: Continental Teves

Set up a spreadsheet like the one shown below.

	Sto	ppir	ng Dista	ance.xls			X		
	\diamond		Α	В	С		~		
	1			Stopping Dista	ance (ft)				
	2	Spee	ed (mph)	Dry Pavement	Wet Pavement				
	3		50	200	250				In columns B
In column	A ont	or	60	271	333				and C, enter
the driving			70	342	430				the stopping
	spee		80	422	532				distances on
	7 	× N	Sheet 1	Sheet 2 / Sheet	3	>	~	7	dry and wet pavement, respectively.

The next step is to "tell" the spreadsheet to make a double-line graph for the data.

- 1. Highlight the data in columns B and C, from B2 through C6.
- Click on the Chart Wizard icon.
- **3**. Choose the line graph and click Next.
- 4. To set the *x*-axis, choose the Series tab and press the icon next to the Category (X) axis labels.

This tells the spreadsheet to read the data in columns B and C.

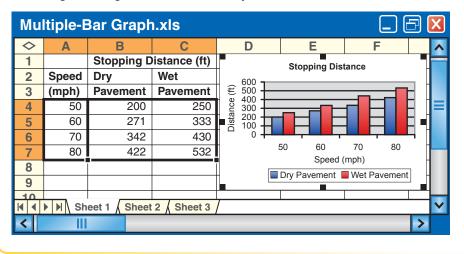
- 5. On the spreadsheet, highlight the data in column A, from A3 through A6.
- 6. Press the icon on the bottom of the Chart Wizard box to automatically paste the information.
- 7. Click Next and enter the chart title and labels for the *x* and *y*-axes.
- 8. Click Next and then Finish.

\diamond	Α	В	С	D	E	F	
1		Stopping D	istance (ft)				
2	Speed	Dry	Wet	600 -	Stopping Distar	ice	
3	(mph)	Pavement	Pavement	500		<u> </u>	
4	50	200	250	000 (ff) 0100 (ff) 0100 (ff)	X	<u></u>	
5	60	271	333	100 500 -		_	
6	70	342	430				
7	80	422	532		50 60 70	80	
8					Speed (mph)		
9				Dry I	Pavement	- Wet Pavement	
10							
11				/			
• •	M Sh	eet 1 / Sheet	2 / Sheet 3	/			

ACTIVITY

2) Use the same data to make a multiple-bar graph.

- Highlight the data in columns B and C, from B2 through C6.
- Click on the Chart Wizard icon.
- Click on Column and Next to choose the vertical bar graph.
- Complete steps 4–8 from Activity 1.



ANALYZE THE RESULTS

- 1. Explain the steps you would take to make a multiple-line graph of the stopping distances that include the speeds 55, 65, and 75.
- 2. **COLLECT THE DATA** Collect two sets of data that represent the number of boys and the number of girls in your class born in the spring, summer, fall, and winter. Use a spreadsheet to make a multiple-line or -bar graph of the data. Justify your selection.

Using Data to Predict

Main IDEA

Predict actions of a larger group by using a sample.



Preparation for 6SDAP2.2

Identify different ways of selecting a sample (e.g., convenience sampling, responses to a survey, random sampling) and which method makes a sample more representative for a population.

Standard 6SDAP2.5 Identify claims based on statistical data, and in simple cases, evaluate the validity of the claims.

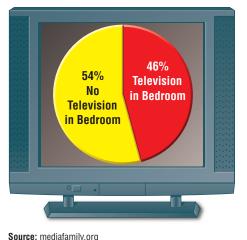
NEW Vocabulary

survey population

GET READY for the Lesson

TELEPHONE The circle graph shows the results of a survey in which children ages 8 to 12 were asked whether they have a television in their bedroom.

- 1. Can you tell how many were surveyed? Explain.
- 2. Describe how you could use the graph to predict how many students in your school have television in their bedroom.



A **survey** is designed to collect data about a specific group of people, called the **population**. If a survey is conducted at random, or without preference, you can assume that the survey represents the population. In this lesson, you will use the results of randomly conducted surveys to make predictions about the population.

Real-World EXAMPLE

TELEVISION Refer to the graphic above. Predict how many out of 1,250 students would not have a television in their bedroom.

You can use the percent proportion and the survey results to predict what part p of the 1,250 students have no TV in their bedroom.

part of the population	$\frac{p}{1,250} = \frac{54}{100} $ Survey	
whole	$p \cdot 100 = 1,250 \cdot 54$	Find the cross products.
population	100p = 67,500	Simplify.
	$\frac{100p}{100} = \frac{67,500}{100}$	Divide each side by 100.
	p = 675	Simplify.

About 675 students do not have a television in their bedroom.

CHECK Your Progress

a. **TELEVISION** Refer to the same graphic. Predict how many out of 1,370 students have a television in their bedrooms.

READING in the Content Area

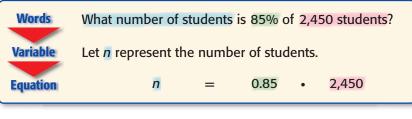
For strategies in reading this lesson, visit ca.gr6math.com.



buddy icons on their instant messengers. **Source:** AOL Research Real-World EXAMPLE

INSTANT MESSAGING Use the information at the left to predict how many of the 2,450 students at Washington Middle School use buddy icons on their instant messengers.

You need to predict how many of the 2,450 students use buddy icons.



 $n = 0.85 \cdot 2,450$ Write the percent equation.

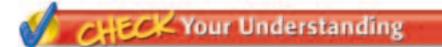
n = 2,082.5 Multiply.

About 2,083 of the students use buddy icons.

CHECK Your Progress

b. INSTANT MESSAGING This same survey found that 59% of people use sound on their instant messengers. Predict how many of the 2,450 students use sound on their instant messengers.

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Example 1

(p. 434)

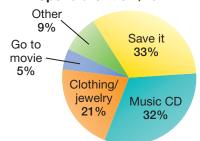
SPENDING For Exercises 1 and 2, use the circle graph that shows the results of a poll to which 60,000 teens responded.

- How many of the teens surveyed said that they would save their money?
- Predict how many of the approximately 28 million teens in the United States would buy a music CD if they were given \$20.

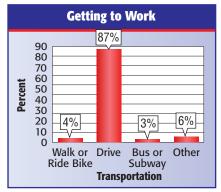
Example 2 (p. 435) TRANSPORTATION For Exercises 3 and 4, use the bar graph that shows the results of a survey in which working adults in America were asked how they get to work.

- **3.** Out of the 143 million working adults in America, predict how many ride a bicycle to work.
- 4. Predict how many working adults in America drive to work.

How Would You Spend a Gift of \$20?



Source: USA WEEKEND



Source: Gallup Poll

Exercises

HOMEWORK HELP		
For Exercises	See Examples	
5-8	1, 2	

COMPUTERS For Exercises 5 and 6, use the table that shows the results of a survey in which students were asked how they use a personal computer at home.

5. Predict how many of the 1,745 Allegheny Valley Middle School students use a PC for homework.

PC Use	Percent
Educational programs	93%
Homework	80%
Games	70%
Download music	95%

- 6. About how many of the students use a PC for games?
- 7. **CAMERAS** In a survey, 14% of teens said that they own a digital camera. Predict how many of the 420,000 teens in Arizona own digital cameras.
- 8. **VOLUNTEERING** A survey showed that 90% of teens donate money to a charity during the holidays. Based on that survey, how many teens in a class of 400 will donate money the next holiday season?

Match each situation with the appropriate equation or proportion.

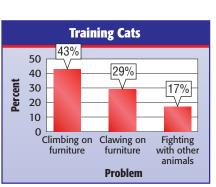
9. 27% of MP3 owners download music weekly. Predict how many MP3 owners out of 238 owners download music weekly.

a.	$n = 27 \cdot 2.38$
b.	$\frac{27}{100} = \frac{n}{238}$
c.	$\frac{27}{238} = \frac{n}{100}$

- **10**. 27 MP3s is what percent of 238 MP3s?
- **11.** 238% of 27 is what number?

CATS For Exercises 12 and 13, use the graph that shows the percent of cat owners who train their cats in each category.

- 12. Out of 255 cat owners, predict how many owners trained their cat not to climb on furniture.
- **13**. Out of 316 cat owners, predict how many more cat owners have trained their cat not to claw on furniture than have trained their cat not to fight with other animals.



Source: Purina Cat Chow

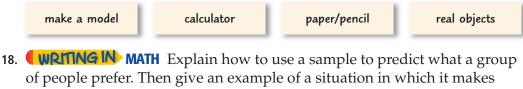
See pages 700, 722. Math 🔽 🗐 🛄 🤤 **FIND THE DATA** Refer to the California Data File on pages 16–19. 14. Self-Check Quiz at ca.gr6math.com

H.O.T. Problems

EXTRAPRACTICE

- Choose some data and write a real-world problem in which you could use the percent proportion or percent equation to make a prediction.
- **15. CHALLENGE** A survey found that 80% of teens enjoy going to the movies in their free time. Out of 5,200 teens, predict how many said that they do not enjoy going to the movies in their free time.
- **16. OPEN ENDED** Select a newspaper or magazine article that contains a table or graph. Identify the population and explain how you think the results were found.

17. SELECT A TOOL A survey showed that 15% of the people in Tennessee over the age of 16 belong to a fitness center. Predict how many of the 5,900,962 people in Tennessee over the age of 16 belong to a fitness center. Select one or more of the following tools to solve the problem. Justify your selection(s).



sense to use a sample.

STANDARDS PRACTICE

19. A survey of 80 seventh graders at Lincoln Middle School was taken to find how they get to school each day. The results are shown in the table.

Getting to School	Percent
Take a Bus	33%
Walk	29%
Adult Drives	18%
Other	20%

Of the 423 seventh graders in the school, predict about how many walk to school.

A	23	C	123
B	64	D	394

- **20**. Yesterday, a bakery baked 54 loaves of bread in 20 minutes. Today, the bakery needs to bake 375 loaves of bread. At this rate, predict how long it will take to bake the bread.
 - **F** 1.5 hours **H** 3.0 hours
 - G 2.3 hours J 3.75 hours
- **21**. Of the 357 students in a freshman class, about 82% plan to go to college. How many students plan on going to college?

A 224	C	314
B 293	D	325

Spiral Review

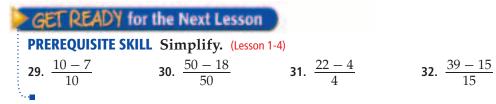
RUNNING For Exercises 22–24, refer to the table that shows the time it took Dale to run each mile of a 5-mile run.

- 22. Make a scatter plot of the data. (Lesson 8-6)
- **23**. Describe the relationship, if any, between the two sets of data. (Lesson 8-6)
- 24. Suppose the trend continues. Predict the time it would take Dale to run a sixth mile. (Lesson 8-5)

Multiply. (Lesson 2-6)

25. -4×6

26. $5 \times (-8)$ **27.** $-6 \times (-9)$ **28.** 8×3



Mile	Time
1	4 min 19 s
2	4 min 28 s
3	4 min 39 s
4	4 min 54 s
5	5 min 1 s

Using Sampling to Predict

Main IDEA

Predict the actions of a larger group by using a sample.



Standard 6SDAP2.1 Compare different

samples of a population with the data from the entire population and identify a situation in which it makes sense to use a sample.

Standard 6SDAP2.2 Identify different ways of selecting a sample (e.g., convenience sampling, responses to a survey, random sampling) and which method makes a sample more representative for a population.

Standard 6SDAP2.5 Identify claims based on statistical data and, in simple cases, evaluate the validity of the claims.

NEW Vocabulary

sample unbiased sample simple random sample biased sample convenience sample voluntary response sample

GET READY for the Lesson

CELL PHONES The manager of a local cell phone company wants to conduct a survey to determine what kind of musical ring tones people typically use.

 Suppose she decides to survey the listeners of a rock radio station. Do you think the results would represent the entire population? Explain.



- **2**. Suppose she decides to survey a group of people standing in line for a symphony. Do you think the results would represent the entire population? Explain.
- **3**. Suppose she decides to mail a survey to every 100th household in the area. Do you think the results would represent the entire population? Explain.

The manager of the cell phone company cannot survey everyone. A smaller group called a **sample** is chosen. A sample should be representative of the population.

Population

Sample

- United States citizens California residents Six Flags Marine World visitors
- registered voters homeowners teenagers

For valid results, a sample must be chosen very carefully. An **unbiased sample** is selected so that it is representative of the entire population. A simple random sample is the most common type of unbiased sample.

CONCE	PT Summary	Unbiased Samples
Туре	Description	Example
Simple Random Sample	Each item or person in the population is as likely to be chosen as any other.	Each student's name is written on a piece of paper. The names are placed in a bowl, and names are picked without looking.



Everyday Use a tendency or prejudice.

Math Use error introduced by selecting or encouraging a specific outcome.

• In a **biased sample**, one or more parts of the population are favored over others. Two ways to pick a biased sample are listed below.

CONCEPT Summary Biased Sample		
Туре	Description	Example
Convenience Sample	A convenience sample includes members of a population that are easily accessed.	To represent all the students attending a school, the principal surveys the students in one math class.
Voluntary Response Sample	A voluntary response sample involves only those who want to participate in the sampling.	Students at a school who wish to express their opinion are asked to complete an online survey.

EXAMPLES Determine Validity of Conclusions

Determine whether each conclusion is valid. Justify your answer.

To determine what kind of movies people like to watch, every tenth person that walks into a video rental store is surveyed. The store carries all kinds of movies. Out of 180 customers surveyed, 62 stated that they prefer action movies. The store manager concludes that about a third of all customers prefer action movies.

The conclusion is valid. Since the population is every tenth customer of a video rental store, the sample is an unbiased random sample.

2 A television program asks its viewers to visit a Web site to indicate their preference for two presidential candidates. 76% of the viewers who responded preferred candidate A, so the television program announced that most people prefer candidate A.

The conclusion is not valid. The population is restricted to viewers who have Internet access, it is a voluntary response sample, and is biased. The results of a voluntary response sample do not necessarily represent the entire population.

CHECK Your Progress

Determine whether each conclusion is valid. Justify your answer.

- **a.** To determine what people like to do in their leisure time, people at a local mall are surveyed. Of these, 82% said they like to shop. The mall manager concludes that most people like to shop during their leisure time.
- b. To determine what kind of sport junior high school students like to watch, 100 students are randomly selected from each of four junior high schools in a city. Of these, 47% like to watch football. The superintendent concludes that about half of all junior high students like to watch football.

In Lesson 8-7, you used the results of a random sampling method to make predictions. In this lesson, you will first determine if a sampling method is valid and if so, use the results to make predictions.

STUDY TIP

Misleading Predictions

Predictions based on biased samples can be misleading. If the students surveyed were all boys, the predictions generated by the survey would not be valid, since both girls and boys attend the junior high school.

Real-World EXAMPLE

MASCOTS The Student Council at a new junior high school surveyed 5 students from each of the 10 homerooms to determine what mascot students would prefer. The results of the survey are shown at the right. If there are 375 students at the school, predict how many students prefer a tiger as the school mascot.

Mascot	Number
Tornadoes	15
Tigers	28
Twins	7

The sample is an unbiased random sample since students were randomly selected. Thus, the sample is valid.

 $\frac{28}{50}$ or 56% of the students prefer a tiger. So, find 56% of 375.

 $0.56 \times 375 = 210$ 56% of 375 = 0.56 × 375

So, about 210 students would prefer a tiger as the school mascot.

CHECK Your Progress

c. **AIRLINES** During flight, a pilot determined that 20% of the passengers were traveling for business and 80% were traveling for pleasure. If there are 120 passengers on the next flight, how many can be expected to be traveling for pleasure?

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Your Understanding

Examples 1, 2 (p. 439)

Determine whether each conclusion is valid. Justify your answer.

- 1. To determine the number of umbrellas the average household in the United States owns, a survey of 100 randomly selected households in Arizona is conducted. Of the households, 24 said that they own 3 or more umbrellas. The researcher concluded that 24% of the households in the United States own 3 or more umbrellas.
- 2. A researcher randomly surveys ten employees from each floor of a large company to determine the number of employees who carpool to work. Of these, 31% said that they carpool. The researcher concludes that most employees do not carpool.
- Example 3 (p. 440)3. LUNCH Jared randomly surveyed some students to determine their lunch habits. The results are shown in the table. If there are 268 students in the school, predict how many bring their lunch from home.

Lunch Habit	Number
Bring Lunch from Home	19
Buy Lunch in the Cafeteria	27
Other	4

Exercises

HOMEWORKHELP		
For Exercises	See Examples	
4–9	1, 2	
10, 11	3	

Determine whether each conclusion is valid. Justify your answer.

- 4. The principal of a high school randomly selects 50 students to participate in a school improvement survey. Of these, 38 said that more world language courses should be offered. As a result, the principal decides to offer both Japanese and Italian language classes.
- 5. To evaluate their product, the manufacturer of light bulbs inspects the first 50 light bulbs produced on one day. Of these, 2 are defective. The manufacturer concludes that about 4% of light bulbs produced are defective.
- **6**. To evaluate its service, a restaurant asks its customers to call a number and complete a telephone survey. The majority of those who replied said that they prefer broccoli instead of carrots as the vegetable side dish. As a result, the restaurant decides to offer broccoli instead of carrots.
- **7**. To determine which type of pet is preferred by most customers, the manager of a pet store surveys every 15th customer that enters the store.
- 8. To determine which school dance theme most students favor, 20 students from each grade level at Lakewood Middle School are surveyed. The results are shown in the table. Based on these results, the student council decides that the dance theme should be *Unforgettable*.

Theme	Number
Starry Night	23
Unforgettable	26
At the Hop	11



Real-World Link ···· There are more than 600 shapes of pasta produced worldwide. Source: ilovepasta.org

- **9.** To determine whether 15 boxes of porcelain tea sets have not been cracked during shipping, the owner of an antique store examines the first two boxes. None of the tea sets have been cracked, so the owner concludes that none of the tea sets in the remaining boxes are cracked.
- 10. LAWNS A researcher randomly surveyed 100 households in a small community to determine the number of households that use a professional lawn service. Of these, 27% of households use a professional lawn service. If there are 786 households in the community, how many can be expected to use a professional lawn service?
- •11. **PASTA** A grocery store asked every 20th person entering the store what kind of pasta they preferred. The results are shown in the table. If the store decides to restock their shelves with 450 boxes of pasta, how many boxes of lasagna should they order?

Pasta	Number
Macaroni	38
Spaghetti	56
Rigatoni	12
Lasagna	44

12. FURNITURE The manager of a furniture store asks the first 25 customers who enter the store if they prefer dining room tables made of oak, cherry, or mahogany wood. Of these, 17 said they prefer cherry. If the store manager orders 80 dining room tables in the next shipment, how many should be made of cherry wood?

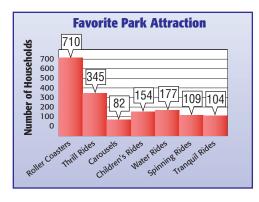
Aath 💓 🕅 🗐 🖯

- 13. RADIO A radio station asks its listeners to dial one of two numbers to indicate their preference for one of two candidates in an upcoming election. Of the responses received, 76% favored candidate A. If there are 1,500 registered voters, how many will vote for candidate A?
- **14. HOBBIES** Pedro wants to conduct a survey about the kinds of hobbies that sixth graders enjoy. Describe a valid sampling method he could use.

AMUSEMENT PARKS For Exercises 15 and 16,use the following information.

The manager of an amusement park mailed 2,000 survey forms to households near the park. The results of the survey are shown in the graph at the right.

15. Based on this survey, if there are5,000 park visitors, how many would be expected to prefer water rides?



16. Based on the survey results, the manager concludes that about 36% of park visitors prefer roller coasters. Is this a valid conclusion? Explain.

INTERNET For Exercises 17–19, use the following information.

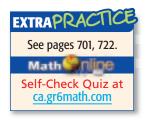
A survey is to be conducted to find out how many hours students at a school spend on the Internet each weeknight. Describe the sample and explain why each sampling method might not be valid.

- **17**. Ten randomly selected students from each grade level are asked to keep a log during their winter vacation.
- 18. Randomly selected parents are mailed a questionnaire and asked to return it.
- **19**. A questionnaire is handed out to all students on the softball team.

COMPARE SAMPLES For Exercises 20–23, use the following information.

Suppose you were asked to determine the approximate percent of students in your school who are left-handed without surveying every student in the school.

- **20**. Describe three different samples of the population that you could use to approximate the percent of students who are left-handed.
- **21**. Would you expect the percent of left-handed students to be the same in each of these three samples? Explain your reasoning.
- 22. Describe any additional similarities and differences in your three samples.
- **23**. You could have surveyed every student in your school to determine the percent of students who are left-handed. Describe a situation in which it makes sense to use a sample to describe aspects of a population instead of using the entire population.
- 24. **FIND THE DATA** Refer to the California Data File on pages 16–19. Choose some data and write a real-world problem in which you would make a prediction based on samples.



CORBIS

H.O.T. Problems

- **25. CHALLENGE** Is it possible to create an unbiased random sample that is also a convenience sample? Explain and cite an example, if possible.
- **26. WRITING IN MATH** Explain why the way in which a survey question is asked might influence the results that are obtained. Cite at least two examples in your explanation.

STANDARDS PRACTICE

- 27. Yolanda wants to conduct a survey to determine what type of salad dressing is preferred by most students at her school. Which of the following methods is the best way for her to choose a random sample of the students at her school?
 - A Select students in her math class.
 - **B** Select members of the Spanish Club.
 - C Select ten students from each homeroom.
 - D Select members of the girls basketball team.

- 28. The manager of a zoo wanted to know which animals are most popular among visitors. She surveyed every 10th visitor to the reptile exhibit. Of these, she found that 75% like snakes. If there are 860 visitors to the zoo, which of the following claims is valid?
 - F About 645 zoo visitors like snakes.
 - **G** The reptile exhibit is the most popular exhibit.
 - H 25% of zoo visitors prefer mammals.
 - J No valid prediction can be made since the sample is a convenience sample.

Spiral Review

- **29. SCHOOL** In a survey of 120 randomly selected students at Jefferson Middle School, 34% stated that science was their favorite class. Predict how many of the 858 students in the school would choose science as their favorite class. (Lesson 8-7)
- **30. HEALTH** Use the scatter plot at the right to predict the height of a 16 year-old. (Lesson 8-6)
- **31. SHOPPING** Nora bought a pair of running shoes that were discounted 35%. If the original price of the shoes were \$89.90, find the discounted price to the nearest cent. (Lesson 7-7)

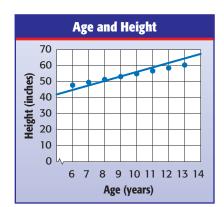
Write each percent as a fraction in simplest form. (Lesson 6-8)

32. 17% **33.** 62.5% **34.** 12.8%

GET READY for the Next Lesson

PREREQUISITE SKILL Determine whether each statement is *true* or *false*. (Lesson 8-6)

- **35**. The vertical scale on a line graph must have equal intervals.
- 36. You do not need to label the axes of a line graph.





Misleading Statistics

Main IDEA

Recognize when statistics and graphs are misleading.



Standard 6SDAP2.3 Analyze data displays and

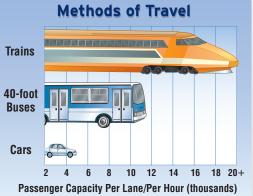
explain why the way in which the question was asked might have influenced the results obtained and why the way in which the results were displayed might have influenced the conclusions reached.

Standard 6SDAP2.4 Identify data that represent sampling errors and explain why the sample (and the display) might be biased.

GET READY for the Lesson

TRANSPORTATION A graph like the one at the right appeared in a brochure describing various modes of transportation.

- About how many more passengers per lane can a 40-foot bus transport in an hour than a car can transport?
- 2. Is the bus on the graph twice as large as the car? Explain.

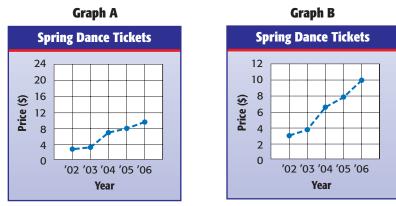


3. Do you think the graph appeared in a brochure for a train/bus transit company or for a car company? What makes you think so?

Graphs let readers analyze and interpret data easily, but are sometimes drawn to influence conclusions by misrepresenting the data. The use of different scales can influence conclusions drawn from graphs.

EXAMPLE Changing the Interval of Graphs

SCHOOL DANCES The graphs show how the price of spring dance tickets increased.



Do the graphs show the same data? If so, explain how they differ. The graphs show the same data. However, the graphs differ in that Graph A uses an interval of 4, and Graph B uses an interval of 2.

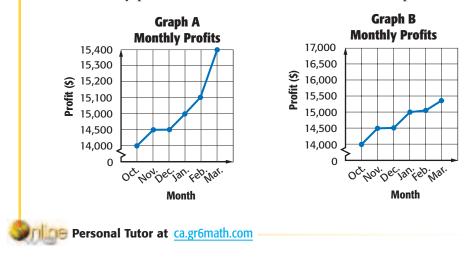
Which graph makes it appear that the prices increased more rapidly? Graph B makes it appear that the prices increased more rapidly even though the price increase is the same.



Changing Scales To emphasize a change over time, reduce the scale interval on the vertical axis. Which graph might Student Council use to show that while ticket prices have risen, the increase is not significant? Explain. They might use Graph A. The scale used on the vertical axis of this graph makes the increase appear less significant.

CHECK Your Progress

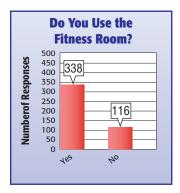
a. **BUSINESS** The line graphs show monthly profits of a company from October to March. Which graph suggests that the business is extremely profitable? Is this a valid conclusion? Explain.



Sometimes the data used to create the display comes from a biased sample. In these cases, the data and the display are both biased and should be considered invalid.

EXAMPLE Identify Biased Displays

2 **FITNESS** The president of a large company mailed a survey to 500 of his employees in order to determine if they use the fitness room at work. The results are shown in the graph. Identify any sampling errors and explain why the sample and the display might be biased.



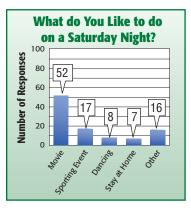
Not all of the surveys were returned

since 338 + 116 < 500. This is a biased, voluntary response sample. The sample is not representative of the entire population since only those who wanted to participate in the survey are involved in the sampling.

The display is biased because the data used to create the display came from a biased sample.

CHECK Your Progress

b. **MOVIES** The manager of a movie theater asked 100 of his customers what they like to do on a Saturday night. The results are shown in the graph. Identify any sampling errors and explain why the sample and the display might be biased.



Statistics can also be used to influence conclusions.

EXAMPLE Misleading Statistics

 $\frac{109 + 135 + 115 + 365 + 126}{5} = \frac{850}{5}$

3 MARKETING Refer to the table that gives the height of roller coasters at an amusement park. The park boasts that the average height of their roller coasters is 170 feet. Explain how this is misleading.

Park Rollercoaster Heights		
Coaster	Height (ft)	
Viper	109	
Monster	135	
Red Zip	115	
Tornado	365	
Riptide	126	

mean:

median: 109, 115, 126, 135, 365

mode: none

The average used by the park was the mean. This measure is much greater than most of the heights listed because of the outlier, 365 feet. So, it is misleading to use this measure to attract visitors.

= 170

A more appropriate measure to describe the data would be the median, 126 feet, which is closer to the height of most of the coasters.

CHECK Your Progress

c. SALARY ABC Corporation claims the average salary for its employees is more than \$60,000, while the average salary at XYZ Incorporated is only \$25,000. Use the table to explain their reasoning and determine where you would prefer to work.

Position	Salary (\$)	
Position	ABC Corp.	XYZ Inc.
President	500,000	120,000
1st Vice President	400,000	85,000
2nd Vice President	240,000	75,000
Sales Staff (5)	20,000	40,000
Supporting Staff (2)	15,000	25,000
Catalog Staff (7)	9,000	22,500



Real-World Link The tallest roller coaster

in the world is the Kingda Ka in Jackson, New Jersey, with a height of 456 feet. Source: ultimaterollercoaster.com

C Your Understanding

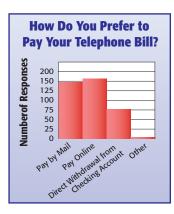
Example 1 (pp. 444)

1. BASEBALL Refer to the graphs below. Which graph suggests that Hank Aaron hit four times as many home runs as Willie Mayes? Is this a valid conclusion? Explain.



Example 2 (p. 445)

2. **PHONES** The manager of a telephone company mailed a survey to 400 households asking each household how they prefer to pay their monthly bill. The results are shown in the graph at the right. Identify any sampling errors and explain why the sample and the display might be biased.



611

660

Home Runs

714

755

Example 3

(p. 446)

3. TUNNELS The table lists the five largest land vehicle tunnels in the U.S. Write a convincing argument for which measure of central tendency you would use to emphasize the average length of the tunnels.

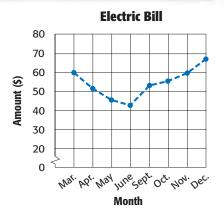
U.S. Vehicle Tunnels on Land		
Name	Length (ft)	
Anton Anderson Memorial	13,300	
E. Johnson Memorial	8,959	
Eisenhower Memorial	8,941	
Allegheny	6,072	
Liberty Tubes	5,920	

Source: Federal Highway Association

Exercises

HOMEWORKHELP		
For Exercises	See Examples	
4, 8	1	
5, 9	2	
6, 7	3	

4. **UTILITIES** The line graph shows the monthly electric bill for the condominium that Toshiko is interested in renting. Why is the graph misleading?



5. **SCHOOL** To determine how often his students are tardy, Mr. Kessler considered his first period class. The results are shown in the graph at the right. Identify any sampling errors and explain why the sample and the display might be biased.

TRAVEL For Exercises 6 and 7, use the table.

- **6.** Find the mean, median, and mode of the data. Which measure might be misleading in describing the average annual number of visitors that visit these sights? Explain.
- 7. Which measure would be best if you wanted a value close to the most number of visitors? Explain.



Annual Sight-Seeing Visitors					
Sight	Visitors*				
Cape Cod	4,600,000				
Grand Canyon	4,500,000				
Lincoln Memorial	4,000,000				
Castle Clinton	4,600,000				
Smoky Mountains	10,200,000				

Source: The World Almamac *Approximation

8. STOCK The graphs below show the increases and decreases in the monthly closing prices of Skateboard Depot's stock.





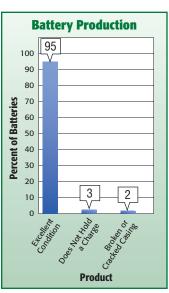
Suppose you are a stockbroker and want to show a customer that the price of the stock has been fairly stable since January. Write a convincing argument as to which graph you should show the customer.

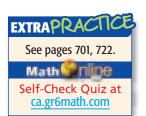
9. MANUFACTURING To evaluate their product, the manager of an assembly line inspects the first 100 batteries that are produced out of 30,000 total batteries produced that day. He displays the results in the graph at the right and then releases it to the local newspaper. Identify any sampling errors and explain why the sample and the display might be biased.

APARTMENTS For Exercises 10 and 11, create a display that would support each argument given the monthly costs to rent an apartment for the last five years are \$500, \$525, \$560, \$585, and \$605.

10. Rent has remained fairly stable.

11. Rent has increased dramatically.



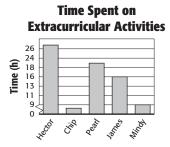


H.O.T. Problems

- **12. CHALLENGE** Does adding values that are much greater or much less than the other values in a set of data affect the median of the set? Give an example to support your answer.
- **13. WRITING IN MATH** Describe at least two ways in which the display of data can influence the conclusions reached.

STANDARDS PRACTICE

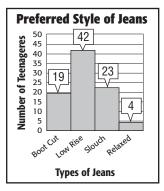
 The bar graph shows the average number of hours each week that a group of students attend an extracurricular activity after school.



Which statement best tells why the graph may be misleading if you want to use the graph to compare the number of hours the students attend an extracurricular activity?

- **A** The vertical scale should show days instead of hours.
- **B** The graph does not show which activity each person attended.
- **C** The intervals on the vertical scale are inconsistent.
- **D** The graph's title is misleading.

15. A department store mailed 100 surveys to teenagers about their preferred style of jeans. The graph shows the results.



Which of the following is true concerning the sample and the display?

- **F** Both the display and the sample are unbiased.
- **G** The display is biased because the sample is a biased, voluntary response sample.
- **H** The display is biased because the sample is a biased, convenience sample.
- J The sample is biased but the display is unbiased.



- 16. CARS To determine what kind of automobile is preferred by most customers, the owner of an auto dealership surveys every 10th person that enters the dealership. Of these, 54% state that they prefer 4-door sedans. Based on these results, if the dealership stocks 150 cars, about how many of them should be 4-door sedans? (Lesson 8-8)
- **17. MP3 PLAYERS** In a survey, 46% of randomly selected teens said they own an MP3 player. Predict how many of the 850 teens at Harvey Middle School own an MP3 player. (Lesson 8-7)

CHAPTER

Study Guide and Review



Download Vocabulary Review from ca.gr6math.com

DLDA BLES

GET READY to Study

Be sure the following Key Concepts are noted in your Foldable.



Key Concepts

Mean, Median, and Mode (Lesson 8-2)

- The mean of a set of data is the sum of the data divided by the number of items in the set.
- The median of a set of data is the middle number of the ordered data if there is an odd number of values, or the mean of the middle two numbers if there is an even number of values.
- The mode of a set of data is the number or numbers that occur most often. If there are two or more numbers that occur most often, all of them are modes.

Statistical Displays (Lessons 8-1, 8-3 through 8-9)

- Line plots show how many times each number occurs in a data set.
- Stem-and-leaf plots list all individual numerical data in a condensed form.
- Bar graphs show the data in specific categories.
- Histograms show the frequency of data divided into smaller intervals.
- Circle graphs compare data parts to the whole.
- Line graphs show change over a period of time.
- Scatter plots determine if there is a relationship between two sets of data.

Sampling Methods (Lesson 8-8)

- In a random sample, each item or person in the population is as likely to be chosen as any other.
- A convenience sample includes members of a population that are easily accessed.
- A voluntary response sample involves only those who want to participate in the sampling.

Key Vocabulary

analyze (p. 397) bar graph (p. 415) cluster (p. 397) convenience sample (p. 439) mean (p. 402) data (p. 396) histogram (p. 416) leaf (p. 410) line graph (p. 426) line plot (p. 396) mean (p. 402) measures of central tendency (p. 402) median (p. 403) mode (p. 403) outlier (p. 397) random sample (p. 438) range (p. 397) scatter plot (p. 427) statistics (p. 396) stem (p. 410) stem-and-leaf plot (p. 410) voluntary response sample (p. 439)

Vocabulary Check

State whether each sentence is *true* or *false*. If *false*, replace the underlined word or number to make a true sentence.

- 1. The <u>range</u> is the difference between the greatest and the least values in a set of data.
- 2. The <u>mode</u> divides a set of data in half.
- **3.** A graph that uses bars to make comparisons is a <u>bar graph</u>.
- 4. A <u>scatter plot</u> shows two sets of related data.
- 5. The <u>median</u> is a data value that is quite separated from the rest of the data.
- **6.** The <u>mean</u> is the arithmetic average of a set of data.
- 7. The number or item that appears most often in a set of data is the <u>mode</u>.
- 8. The <u>range</u> is the middle number of the ordered data, or the mean of the middle two numbers.



Lesson-by-Lesson Review

8-1

8-2

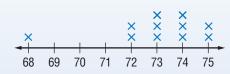
Line Plots (pp. 396–401)

Display each set of data in a line plot. Identify any clusters, gaps, or outliers.

- **9.** 10°, 12°, 10°, 8°, 13°, 10°, 8°, 12°.
- **10**. 7 ft, 8 ft, 8 ft , 9 ft, 14 ft, 9 ft, 8 ft, 7 ft
- **11**. Number of Calories: 43, 41, 42, 45, 43, 42, 43, 46, 44, 44

Example 1 Display the test scores 72, 75, 72, 74, 73, 68, 73, 74, 74, 75, and 73 in a line plot. Identify any clusters, gaps, or outliers.

Test Scores



There is a cluster from 72 to 75, a gap between 68 and 72, and an outlier at 68.

Measures of Central Tendency and Range (pp. 402–408)

Find the mean, median, and mode. Round to the nearest tenth if necessary.

- **12**. Number of siblings: 2, 3, 4, 3, 4, 3, 8, 7, 2
- **13.** 89°, 76°, 93°, 100°, 72°, 86°, 74°
- 14. MONEY Which measure, mean, median, mode, or range best represents the amount of money students spent on clothing?

Money Spent (\$)						
125	108	172	136			
121	112	218	172			

Example 2 Find the mean, median, and mode for the following college students' ages: 23, 22, 19, 19, and 20.

mean:	$\frac{23 + 22 + 19 + 19 + 20}{5}$	or 20.6 years
mean.	5	- 01 20.0 years

median: 20, the middle value of the ordered set

mode: 19, the data value that occurs most often

8-3

Stem-and-Leaf Plots (pp. 410–414)

Display each set of data using a stemand-leaf plot.

- **15**. Hours worked: 29, 54, 31, 26, 38, 46, 23, 21, 32, 37
- **16**. Number of points: 75, 83, 78, 85, 87, 92, 78, 53, 87, 89, 91
- **17**. Birthdates: 9, 5, 12, 21, 18, 7, 16, 24, 11, 10, 3, 14

Example 3 Display the number of pages read 12, 15, 17, 20, 22, 22, 23, 25, 27, and 35 in a stem-and-leaf plot.

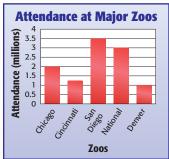
The tens digits	Pages Read			
form the stems,	Stem Leaf			
and the ones		257		
digits form	2	0 2 2 3 5 7		
the leaves.	3	5		
		2 3 = 23 pages		



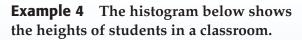


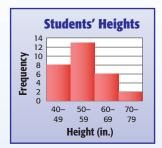
Bar Graphs and Histograms (pp. 415–421)

ATTENDANCE For Exercises 18–20, refer to the graph.



- 18. Which zoo did the most people attend?
- **19**. About what was the total attendance for all five zoos?
- **20**. Write a statement comparing the attendance at the National Zoo to the attendance at the Denver Zoo.





How many students are 50–59 inches tall?

13 students

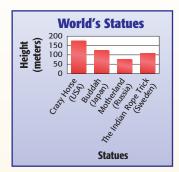
Write a statement comparing the 70–79 interval to the 60–69 interval.

The 60–69 interval is three times larger than the 70–70 interval.



PSI: Use a Graph (pp. 424–425)

STATUES For Exercises 21 and 22, use the graph that shows the heights of free-standing statues in the world.



- 21. Which statue is the tallest?
- **22**. Compare the height of the *Motherland* statue to the height of the *Crazy Horse* statue.

Example 5 The graph shows the results of a survey about favorite vacation places.



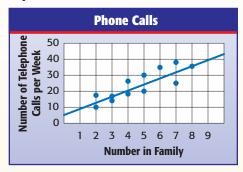
Which place was favored by most students?

The beach was favored by 12 students, which was the greatest number.

8-6

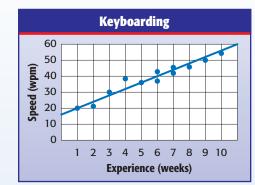
Using Graphs to Predict (pp. 426–431)

PHONE CALLS For Exercises 23 and 24, use the graph showing the number of people in a family and the number of weekly calls.



- **23**. Describe the relationship between the two sets of data.
- 24. Predict the number of weekly phone calls for a family of 10.

Example 6 The scatter plot below shows the keyboarding speeds in words per minute of 12 students.



Describe the relationship between the two sets of data.

The graph shows a positive relationship. That is, as the weeks pass, speed increases.

8-7

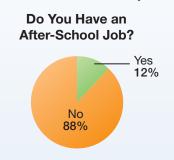
Using Data to Predict (pp. 434–437)

CAREERS For Exercises 25 and 26, use the table that shows the results of a university survey of incoming freshman.

Career Goal	Percent
Elementary teacher	5.5%
Engineer	6.4%

- **25**. Predict how many of the 3,775 freshmen would choose a career as an elementary teacher.
- **26**. How many of the 3,775 freshmen would you expect to choose a career as an engineer?
- 27. **SHOES** A survey showed that 72% of teens bought new athletic shoes for the new school year. Based on that survey, how many teens in group of 225 bought new athletic shoes for the new school year?

Example 7 The circle graph shows the results of a survey to which 150 students at McAuliffe Middle School responded. Predict how many of the 644 students at the school have after-school jobs.



Find 12% of 644.

 $n = 0.12 \cdot 644$ Write an equation. = 77.28 Multiply.

So, you could predict that about 77 students at McAuliffe Middle School have after-school jobs.



8-8

8-9

Using Sampling to Predict (pp. 438–443)

Determine whether each conclusion is valid. Justify your answer.

- **28.** To determine the number of vegetarians in a city, a restaurant owner surveys the first 50 customers who enter the restaurant. Of these, 6 said they are vegetarians, so the owner concludes that about 12% of the city's population are vegetarians.
- **29.** The principal of a junior high school randomly surveys 40 students from each grade level to determine how many students are interested in after-school tutoring. Of these, 88% are interested, so the principal decides to offer after-school tutoring.
- **BOOKS** The owner of a bookstore surveyed every 10th person that entered the store to determine her customers' preferred type of book. Of these, 32% preferred mysteries. If the owner will order 500 new books, about how many should be mysteries?

Example 8 To determine the preference of her customers, a florist mails surveys to 100 of her customers. The results are shown in the table. Based on these results, the florist decides to stock more roses.

Type of Flower	Number
Roses	45
Tulips	26
Lilacs	17

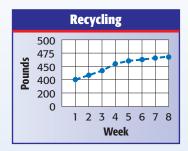
This conclusion is invalid. This is a biased, voluntary response sample. Not all surveys were returned.

Misleading Statistics (pp. 444–449)

31. SALES The graph below shows the monthly CD sales for one year at the Music Madness Warehouse. Why might the graph be misleading?



Example 9 The graph shows the pounds of cans recycled in eight weeks. Why might this graph be misleading?



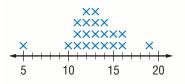
The scale is not divided into equal intervals. It has intervals of 200, 50, and 25.

Practice Test

For Exercises 1 and 2, use the line plot that shows the number of hours students spend listening to the radio per week.

CHAPTER

Number of Radio Hours



- 1. Identify any clusters, gaps, or outliers.
- 2. Describe how the range of data would change if 5 was not part of the data set.
- **3. INSECTS** The lengths in inches of several insects are given below. Find the mean, median, and mode of the data set. Round to the nearest tenth if necessary.

0.75, 1.24, 0.95, 2.6, 1.18, 1.3

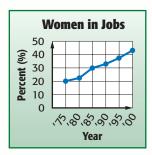
Display each data set in a stem-and-leaf plot.

- **4.** 37°, 59°, 26°, 42°, 57°, 53°, 31°, 58°
- **5**. \$461, \$422, \$430, \$425, \$425, \$467, \$429
- 6. **STANDARDS PRACTICE** Refer to the data below. Which of the following statements is true concerning the measures of central tendency?

41, 45, 42, 38, 77, 44, 36, 43

- **A** The mode is most affected by the inclusion of the outlier.
- **B** The median is not affected by the inclusion of the outlier.
- **C** The mean is most affected by the inclusion of the outlier.
- **D** None of the measures of central tendency are affected by the inclusion of the outlier.
- **7. GRADES** Make a histogram for the following French test grades: 95, 76, 82, 90, 83, 76, 79, 82, 95, 85, 93, 81, and 63.

8. **EMPLOYMENT** The line graph shows the percent of women who had jobs outside the home from 1975 to 2000. Use the graph to predict the number of women who will have jobs outside the home in 2010.



- 9. AMUSEMENT PARKS A researcher asked 250 students at Lake Valley Middle School to dial one of four telephone numbers to indicate their preference for the type of amusement park rides that they enjoy. Of these, 19% said they prefer the Ferris wheel. The researcher concludes that about 1/5 of the students at Lake Valley Middle School prefer the Ferris wheel.
- 10. **STANDARDS PRACTICE** The line graph shows ship sales at Marvin's Marina in thousands of dollars. Which of the following statements best tells why the graph is misleading?



- **F** The graph's title is misleading.
- **G** The intervals on the horizontal scale are inconsistent.
- **H** The graph does not show any data.
- J The vertical axis is not labeled.

CHAPTER

California Standards Practice Cumulative, Chapters 1–8



Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.

- 1 Ed's Used Car Lot bought 5 used cars for \$32,000. The business later bought another used car for \$4,600. What was the mean cost of all of the used cars?
 - A \$3,200.00 C \$6,100.00 **B** \$4,600.00 D \$8,500.00
- 2 A fitness club charges a membership fee of \$50 plus \$25 each month you belong to the club. Which expression could be used to find the total cost of belonging to the club for 10 months?
 - **F** 50(10) + 25
 - **G** 50 25(10)
 - H 50 + 25(10)
 - T 50(10) + 25(10)
- 3 Sierra has 11.5 yards of fabric. She will use 20% of the fabric to make a flag. How many yards of fabric will she use?

A	9.2 yd	С	4.5 yd
B	8.6 yd	D	2.3 yd

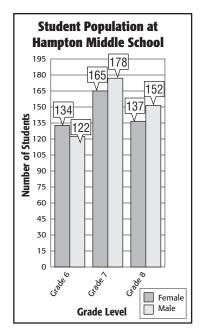
4 Ms. Thompson made 17 liters of punch for a party. The punch contained 5 liters of orange juice. Which equation could be used to find *y*, the percent of orange juice in the punch?

$$F \quad \frac{17}{5} = \frac{y}{100}$$
$$G \quad \frac{5}{17} = \frac{y}{100}$$
$$H \quad 5 \quad 100$$

$$17 - y$$

 $17 - 100$

The number of students in each grade level at Hampton Middle School is shown in the graph below.



Which statement is true based on this information?

- A There are more total students in the 6th grade than there are in the 8th grade.
- **B** The female 7th graders outnumber the male 8th graders.
- **C** The student population decreases by the same amount as each grade level increases.
- **D** There are more female students in each grade level than male students.
- 6 A football team scored 20, 32, 28, 21, and 24 points in their first five games. How many points should they score in the next game so that the median and mode scores are equal?

F 32	H 21
-------------	-------------

G 24 I 20



More California Standards Practice For practice by standard, see pages CA1–CA39.

7 Regina priced six MP3 players. The prices are shown below.

\$120.00, \$90.00, \$75.00, \$105.00, \$85.00, \$150.00

What is the median price?

- A \$90.00
- **B** \$97.50
- **C** \$104.17
- **D** \$105.00
- 8 Which of the following is the prime factorization of the lowest common denominator of $\frac{3}{8} + \frac{5}{6}$? F 2 × 3 G 2 × 2 × 2 H 2 × 2 × 2 × 3 I 2 × 2 × 2 × 3
- **9** If *a* is a negative number and *b* is a negative number, which of the following expressions is always negative?
 - $\mathbf{A} \ a + b$
 - **B** a-b
 - $\mathbf{C} a \times b$
 - $\mathbf{D} \ a \div b$
- **10** . The numbers of monthly minutes Gary used on his cell phone for the last eight months are shown below.

400, 550, 450, 620, 550, 600, 475, 425

What is the mode of this data?

F	550	Н	450
G	475	I	400

- 11 Taylor spends between \$125 and \$200 per month on food. Which is the best estimate of how much she spends on food in 6 months?
 - A From \$1,500 to \$2,400
 - **B** From \$750 to \$1,200
 - **C** From \$250 to \$400
 - **D** From \$125 to \$200
- 12 A store has 2,545 CDs. On Saturday, the store sold $12\frac{1}{2}\%$ of the CDs. What fraction of the CDs were sold on Saturday?



EST-TAKING TIP

Question 13 If you find that you cannot answer every part of an open-ended question, do as much as you can. You may earn partial credit.

Pre-AP

Record your answers on a sheet of paper. Show your work.

13 The table shows how values of a painting increased over ten years.

Year	Value	Year	Value	
1997	\$350	2002	\$1,851	
1998	\$650	2003	\$2,151	
1999	\$950	2004	\$2,451	
2000	\$1,200	2005	\$2,752	
2001	\$1,551	2006	\$3,052	

- **a**. Make a line graph of the data.
- **b**. Use the graph to predict what the value of the painting will be in 2010.

NEED EATRA HELP:													
If You Missed Question	1	2	3	4	5	6	7	8	9	10	11	12	13
Go to Lesson	8-2	1-6	7-1	7-2	8-6	8-2	8-2	4-1	2-4	8-2	1-1	6-8	8-6
For Help with Standard	SDAP1.1	AF1.2	NS1.4	NS1.3	SDAP2.3	SDAP1.2	SDAP1.1	NS1.4	NS2.3	SDAP1.1	MR2.7	NS1.2	SDAP2.3





Standard SDAP3.0 Determine theoretical and experimental probabilities and use these to make predictions about events.

Key Vocabulary

compound event (p. 492) independent event (p. 492) probability (p. 460) sample space (p. 465)

Probability



GAMES Rolling number cubes allows you to advance forward or backward in many board games. Probability tells you that rolling doubles on a pair of number cubes happens only about 17% of the time.





2 Roll up bottom edges so that all tabs are the same size.

Write the chapter title on the front. Label each tab with a lesson number and title. Label the last tab Vocabulary.





KS Studios

the fold.

GET READY for Chapter 9

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 2

Math Info Take the Online Readiness Quiz at ca.gr6math.com.

Take the Quick Check below. Refer to the Quick Review for help.

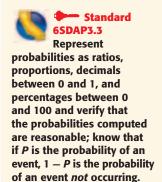
Option 1

QUICKCheck	QUICKReview
Multiply. (Prior Grade) 1. 7×15 2. 24×6 3. 13×4 4. 8×21 5. 5×32 6. 30×8 7. $7 \times 6 \times 5$ 8. $8 \times 7 \times 6$ 9. $6 \times 5 \times 4 \times 3$ 10. $4 \times 3 \times 2 \times 1$ 11. $10 \times 9 \times 8 \times 7$ 12. $11 \times 10 \times 9$ 13. JOBS If you earn \$9 an hour and work 5 hours each day for 7 days, how much have you earned? (Prior Grade)	Example 1 Multiply 7 × 6 × 5 × 4. 7 × 6 × 5 × 4 = 42 × 5 × 4 Multiply from = 210 × 4 left to right. = 840
Write each fraction in simplest form. Write <i>simplified</i> if the fraction is already in simplest form. (Lesson 4-4) 14. $\frac{8}{12}$ 15. $\frac{3}{18}$ 16. $\frac{4}{9}$ 17. $\frac{5}{15}$ 18. SLEEP If the average adult gets 8 hours of sleep, what fraction of the day, in simplest form, is spent asleep? (Lesson 4-4)	Example 2 Write $\frac{21}{28}$ in simplest form. $\overrightarrow{21}_{28} = 3$ $\overrightarrow{4}_{7}$ Divide the numerator and denominator by the GCF, 7. $\overrightarrow{7}_{7}$
Find each value. (Prior Grade) 19. $\frac{6 \times 5}{3 \times 2}$ 20. $\frac{9 \times 8 \times 7}{5 \times 4 \times 3}$ 21. $\frac{4 \times 3 \times 2}{3 \times 2 \times 1}$ 22. $\frac{7 \times 6 \times 5 \times 4}{4 \times 3 \times 2 \times 1}$	Example 3 Find the value of $\frac{6 \times 5 \times 4}{3 \times 2 \times 1}$. $\frac{6 \times 5 \times 4}{3 \times 2 \times 1} = \frac{120}{6}$ \leftarrow Multiply the numerator. = 20 Simplify.

Simple Events

Main IDEA

Find the probability of a simple event.



NEW Vocabulary

outcome simple event probability random complementary event

READING Math

Probability

P(even number) is read the probability of rolling an even number.

GET READY for the Lesson

TAFFY A box of saltwater taffy contains six pieces of each flavor shown at the right.

- 1. What fraction of the taffy is vanilla? Write in simplest form.
- 2. Suppose you take one piece of taffy from the box without looking. Are your chances of picking vanilla the same as picking root beer? Explain.

An **outcome** is any one of the possible results of an action. For the action of picking a piece of taffy out of the box described above, there are 48 total outcomes.

A **simple event** is one outcome or a collection of outcomes. For example, picking a piece of vanilla taffy is a simple event. The chance of that event happening is called its **probability**.

KEY CONCEPT

Words	If all outcomes are equally likely, the probability of a simple event is a ratio that compares the number of favorable outcomes to the number of possible outcomes.	
Symbols	$P(\text{event}) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$	

EXAMPLE Find Probability

What is the probability of rolling an even number on a number cube marked with 1, 2, 3, 4, 5, and 6 on its faces?

 $P(\text{even number}) = \frac{\text{even numbers possible}}{\text{total numbers possible}}$ $= \frac{3}{6} \text{ or } \frac{1}{2}$



The probability of rolling an even number is $\frac{1}{2}$, 0.5, or 50%.

CHECK Your Progress

Use the number cube above to find each probability. Write as a fraction in simplest form.

a. *P*(odd number)

b. *P*(5 or 6)

c. *P*(prime number)

Saltwater Taffy Flavors

peppermint

grape

cherry

root beer

chocolate

raspberry

vanilla

orange creme

Probability

Outcomes occur at **random** if each outcome occurs by chance. For example, rolling a number on a number cube occurs at random.



Real-World Link Parcheesi is derived from the Indian word *pacis*, which means 25. Source: www.yesterdayland.com

Real-World EXAMPLE

PARCHEESI Jewel and her three friends are playing Parcheesi. To decide which player goes first, each player rolls a number cube. The player who rolls the lowest number goes first. If her friends rolled a 4, 3, and 5, what is the probability that Jewel will go first?

The possible outcomes of rolling a number cube are 1, 2, 3, 4, 5, and 6. In order for Jewel to go first, she will need to roll a 1 or 2.

Let P(A) be the probability that Jewel will go first.

 $P(A) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$ $= \frac{2}{6}$ There are 6 possible outcomes and 2 of them are favorable. $= \frac{1}{3}$ Simplify.

The probability that Jewel will go first is $\frac{1}{3}$, 0. $\overline{3}$, or about 33%.

CHECK Your Progress

MUSIC The table at the right shows the numbers of brass instruments in the California Symphony. Suppose one brass instrument musician is randomly selected to be a featured performer. Find the probability of each event. Write as a fraction in simplest form.

California Symphony Brass Instruments			
Horn	3		
Trombone	3		
Trumpet	2		
Tuba	1		

d. *P*(trumpet)

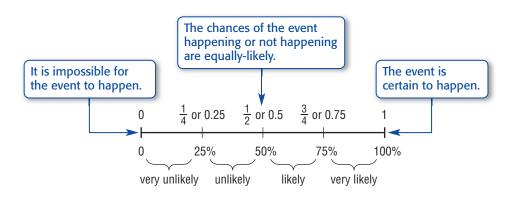
f. *P*(flute)

e. P(brass)

g. *P*(horn or tuba)

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The probability that an event will happen can be any number from 0 to 1, including 0 and 1, as shown on the number line below. Notice that probabilities can be written as fractions, decimals, or percents.





Either Jewel will go first or she will *not* go first. These two events are **complementary events**. The sum of the probabilities of an event and its complement is 1 or 100%. In other words, P(A) + P(not A) = 1.

STUDY TIP

Complement of an Event The

probability that event A will not occur is noted as P(not A). Since P(A) + P(not A) $= 1 - P(A) \cdot P(not A)$ is read as the probability of the complement of A.

EXAMPLE Complementary Events

3 PARCHEESI Refer to Example 2. Find the probability that Jewel will *not* go first.

The probability that Jewel will *not* go first is the complement of the probability that Jewel will go first.

P(A) + P(not A) = 1Definition of complementary events $\frac{\frac{1}{3} + P(not A) = 1}{\frac{-\frac{1}{3}}{3} - \frac{-\frac{1}{3}}{\frac{-\frac{1}{3}}{3}}}$ Substitute $\frac{1}{3}$ for P(A). $\frac{P(not A) = \frac{2}{3}}{\frac{1}{3} - \frac{1}{3}}$ Subtract $\frac{1}{3}$ from each side. $1 - \frac{1}{3}$ is $\frac{3}{3} - \frac{1}{3}$ or $\frac{2}{3}$

The probability that Jewel will *not* go first is $\frac{2}{3}$, 0.6, or about 67%.

CHECK Your Progress

SCHOOL Ramón's teacher uses a spinner similar to the one shown at the right to determine the order in which each group will make their presentation. Use the spinner to find each probability. Write as a fraction in simplest form.



ponse

6 15

4

3 or more

h. *P*(*not* group 4)

i. *P*(*not* group 1 or group 3)

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more pets?

Example 1 (p. 460)	Use the spinner to fraction in simple	o find each probat est form.	oility. Write as a	l	KL	A
	1 . <i>P</i> (J)	2 . <i>P</i> (E or H)	3 . <i>P</i> (vowel))		
Examples 2, 3 (pp. 461–462)	5 purple, 12 red, a each probability i	has a bag that cont and 6 orange marb if he draws one ma te as a fraction in a	les. Find arble at random	L	G	F
	4. P(purple)	5 . <i>P</i> (red or	orange)	6. P(green)	
	7 . <i>P</i> (<i>not</i> blue)	8 . <i>P</i> (<i>not</i> red	or orange)	9 . P(<i>not</i> yellow)	
Example 3 (p. 462)		té asked her classn . The responses are	5		Number of Pets	Res
	student in her	class is selected at	random, what i	S	None	
	the probability	v that the student d	loes not own 3 o	r	1-2	

Exercises

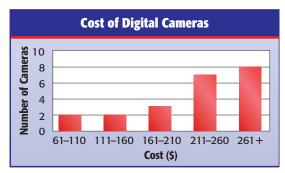
HOMEWORK HELP			
For Exercises	See Examples		
11-14	1		
17–22	2		
15–16, 23–26	3		

A set of 20 cards is numbered 1, 2, 3, \ldots , 20. Suppose you pick a card at random without looking. Find the probability of each event. Write as a fraction in simplest form.

11. <i>P</i> (1)	12 . <i>P</i> (3 or 13)	13 . <i>P</i> (multiple of 3)
14 . <i>P</i> (even number)	15. <i>P</i> (<i>not</i> 20)	16. <i>P</i> (<i>not</i> a factor of 10)

STUDENT COUNCIL The table shows the membership of the Student Council at Lincoln Middle School. Suppose one student is randomly selected as the president. Find the probability of each event. Write as a fraction in simplest form.

- **17**. *P*(girl) **18**. *P*(boy)
- **19.** *P*(5th grader)
 20. *P*(8th grader)
- **21**. *P*(boy or girl) **22**. *P*(6th or 8th grader)
- **23**. P(not 6th grader) **24**. P(not 7th grader)
- **25. SOUP** A cupboard contains 20 soup cans. Seven are tomato, 4 are cream of mushroom, 5 are chicken, and 4 are vegetable. If one can is chosen at random from the cupboard, what is the probability that it is *neither* cream of mushroom *nor* vegetable soup? Write as a percent.
- **26. VIDEOS** In a drawing, one name is randomly chosen from a jar of 75 names to receive free video rentals for a month. If Enola entered her name 8 times, what is the probability that she is *not* chosen to receive the free rentals? Write as a fraction in simplest form.
- 27. **TECHNOLOGY** The graph shows the cost of 22 digital cameras. If one camera is chosen at random, what is the probability that the cost ranges from \$111 up to \$160? Write as a fraction in simplest form. Explain how you know the answer is reasonable.



Student Council

30

20

25

15

10

girls

boys

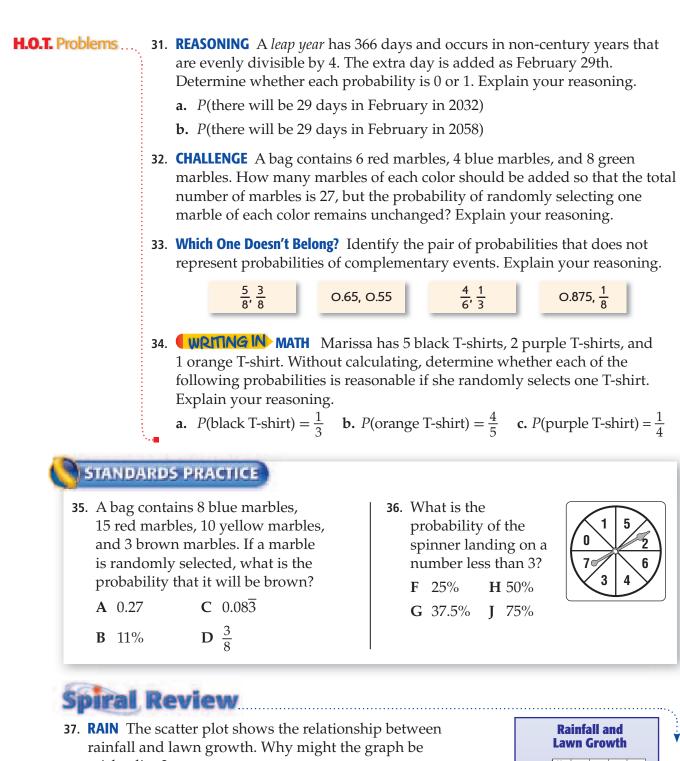
8th graders

7th graders

6th graders

- 28. MOVIES The probability of buying a defective DVD is 0.002.What is the probability of buying a DVD that is *not* defective?
- **29. WEATHER** The forecast for tomorrow says that there is a 37% chance of rain. Describe the complementary event and predict its probability.
 - **30. FUND-RAISER** The Jefferson Middle School Band is selling raffle tickets for a new computer system. They sold 1,000 tickets at \$2 each. Ted's parents spent \$200 on tickets. What is the probability they will *not* win?

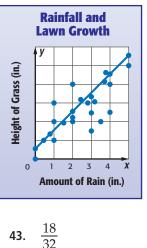
EXTRAPRACTICE	2
See pages 701, 723.	
Math 🎱 nine	
Self-Check Quiz at <u>ca.gr6math.com</u>	



- misleading? (Lesson 8-8)
- **38. PARKS** A researcher randomly selected 100 households near a city park. Of these, 26% said they visit the park daily. If there are 500 households near the park, about how many visit it daily? (Lesson 8-8)

GET READY for the Next Lesson

PREREQUISITE SKILL Write each fraction in simplest form. (Lesson 4-4)





Sample Spaces

Main IDEA

Find sample spaces and probabilities.



Represent all possible outcomes for compound events in an organized way (e.g., tables, grids, tree diagrams) and express the theoretical probability of each outcome.

NEW Vocabulary

sample space tree diagram fair game



Making a Table

Begin with one choice and list *all* of the outcomes that correspond with that choice before listing the outcomes that correspond with another choice.

MINI Lab

- Here is a probability game that you can play with two counters.
- Mark one side of the first counter A. Mark the other side B. Mark both sides of the second counter A.
- Player 1 tosses the counters. If both sides shown are the same, Player 1 wins a point. If the sides are different, Player 2 wins a point. Record your results.
- Player 2 then tosses the counters and the results are recorded. Continue alternating the tosses until each player has tossed the counters ten times. The player with the most points wins.
- **1**. Before you play, make a conjecture. Do you think that each player has an equal chance of winning? Explain.
- 2. Now, play the game. Who won? What was the final score?

The set of all of the possible outcomes in a probability experiment is called the **sample space**. A table or grid can be used to list the sample space.

EXAMPLE Find the Sample Space

ICE CREAM A vendor sells vanilla and chocolate ice cream. Customers can choose from a waffle or sugar cone and either hot fudge or caramel topping. Find the sample space for all possible orders of one scoop of ice cream in a cone with one topping.

Make a table that shows all of the possible outcomes.

Outcomes				
Vanilla	Waffle	Hot Fudge		
Vanilla	Waffle	Caramel		
Vanilla	Sugar	Hot Fudge		
Vanilla	Sugar	Caramel		
Chocolate	Waffle	Hot Fudge		
Chocolate	Waffle	Caramel		
Chocolate	Sugar	Hot Fudge		
Chocolate	Sugar	Caramel		

CHECK Your Progress

a. **PETS** The animal shelter has both male and female Labradors in yellow, brown, or black. Find the sample space for all possible Labradors available at the shelter.

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A **tree diagram** can also be used to display the sample space.

STANDARDS EXAMPLE

A scooter comes in silver, red, or purple with 125 or 180-millimeter wheel sizes. Which list shows all possible color-wheel size outcomes?

Α	Out	tcomes	C	Ou	tcomes
	silver	125 mm		silver	125 mm
	silver	180 mm		red	180 mm
	red	125 mm		purple	125 mm
	red	180 mm		silver	180 mm
	purple	125 mm			
	purple	180 mm			
D			D		
В	Out	tcomes	D	Ou	tcomes
	silver	125 mm		silver	125 mm
	red	180 mm		red	180 mm
	purple	125 mm		purple	125 mm
				silver	180 mm
				purple	180 mm

Read the Item The scooter comes in 3 colors, silver, red, or purple, and 2 wheel sizes, 125 or 180 millimeters. Find all of the color-wheel size combinations.

Solve the Item	Scooter Color	Wheel Size	Sample Space
Make a tree diagram to show the sample space.	silver <	- 125 mm - - 180 mm -	— silver, 125mm — silver, 180mm
There are 6 different color-wheel size	- red <	125 mm - 180 mm -	— red, 125 mm — red, 180 mm
combinations. The answer is A.	purple	- 125 mm - - 180 mm -	— purple, 125mm — purple, 180mm

CHECK Your Progress

b. For dessert, you can have apple or cherry pie with or without ice cream. Which list shows all the possible outcomes of choosing pie and ice cream?

J

F	Outcomes		
	apple	with ice cream	
	cherry	without ice cream	

G	Outcomes			
	apple	with ice cream		
	apple without ice cream			
	cherry	with ice cream		
	cherry	without ice cream		

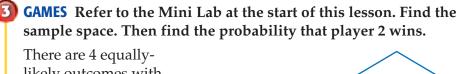
Η	Outcomes			
	apple	without ice cream		
	cherry	with ice cream		

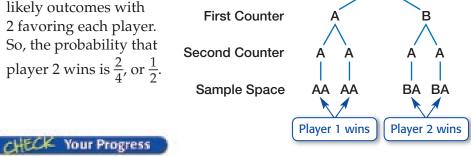
Outcomes		
apple	with ice cream	
cherry	with ice cream	
apple	without ice cream	

Test-Taking Tip

Educated Guess Find out if there is a penalty for incorrect answers. If there is no penalty, making an educated guess can only increase your score, or at worst, leave your score the same. You can use a table or a tree diagram to find the probability of an event.

EXAMPLE Find Probability





c. **GAMES** Pablo tosses three coins. If all three coins show up heads, Pablo wins. Otherwise, Kara wins. Find the sample space. Then find the probability that Pablo wins.



Examples 1, 2 (pp. 465–466)

- **2** For each situation, find the sample space using a table or tree diagram.
 - 1. A number cube is rolled twice.
 - 2. A pair of brown or black sandals are available in sizes 7, 8, or 9.

Example 2 (p. 466) 3.

STANDARDS PRACTICE Sandwiches can be made with ham or turkey on rye, white, or sourdough breads. Which list shows all the possible outcomes?

Α	Outcomes		C	0	utcomes
	ham	rye		ham	rye
	turkey	white		turkey	rye
	ham	sourdough		ham	white
	ham	rye		turkey	white
	turkey	white		ham	sourdoug
	turkey	sourdough		turkey	sourdoug
B	0	outcomes	D	0	utcomes
B	o ham	outcomes rye	D	o ham	utcomes rye
B			D	-	

Example 3

 (p. 467)
 GAMES Brianna spins a spinner with four sections of equal size twice, labeled A, B, C, and D. If letter A is spun at least once, Brianna wins. Otherwise, Odell wins. Find the probability that Odell wins.

Exercises

HOMEWORKHELP

For Exercises	See Examples
5-12	1, 2
28	2
13–14	3



Real-World Link ...

The average family size in the United States is 2.59 people. **Source:** U.S. Census Bureau

For each situation, find the sample space using a table or tree diagram.

- choosing a card with a shape and spinning the spinner from the choices at the right
- **6.** choosing a card with a shape and either boots, gym shoes, or dress shoes
- 7. tossing a coin and rolling a number cube
- 8. picking a number from 1 to 5 and choosing the color red, white, or blue
- **9**. choosing a purple, green, black, or silver mountain bike having 10, 18, 21, or 24 speeds
- **10**. choosing a letter from the word SPACE and choosing a consonant from the word MATH
- **11. CLOTHES** Jerry can buy a school T-shirt with either short sleeves or long sleeves in either gray or white and in small, medium, or large. Find the sample space for all possible T-shirts he can buy.
- 12. **FOOD** Three-course dinners can be made from the menu shown. Find the sample space for a dinner consisting of an appetizer, entrée, and dessert.

Appetizers	Entrees	Desserts
Soup	Steak	Carrot Cake
Salad	Chicken	Cheesecake
	Fish	

ORANGE

GREEN

BLUE

RED

YELLOW

For each game, find the sample space. Then find the indicated probability.

- **13**. Elba tosses a quarter, a dime, and a nickel. If tails comes up at least twice, Steve wins. Otherwise Elba wins. Find *P*(Elba wins).
- 14. Ming rolls a number cube, tosses a coin, and chooses a card from two cards marked A and B. If an even number and heads appears, Ming wins, no matter which card is chosen. Otherwise Lashonda wins. Find *P*(Ming wins).

•• FAMILIES Mr. and Mrs. Romero are expecting triplets. Suppose the chance of each child being a boy is 50% and of being a girl is 50%. Find each probability.

- **15**. *P*(all three children will be boys) **16**. *P*(at least one boy and one girl)
- **17**. *P*(two boys and one girl)
- **18**. *P*(at least two girls)
- **19**. *P*(the first two born are boys and the last born is a girl)
- **20. GAMES** The following is a game for two players. Find the probability that each player wins.
 - Three counters are labeled according to the table at the right.
 - Toss the three counters.
 - If exactly 2 counters match, Player 1 scores a point. Otherwise, Player 2 scores a point.

	Side 1	Side 2
Counter 1	А	В
Counter 2	А	C
Counter 3	В	С

UNIFORMS For Exercises 21 and 22, use the information below and at the right.

Linus is a big fan of the Oakland Athletics baseball team and wears a different jersey and cap every time

	Home Jersey	Road Jersey	Practice Jersey	Сар
Green	0	0	2	2
White	1	0	0	0
Gray	0	1 🏉	0	0

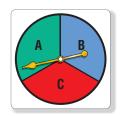
he goes to a game. The table shows the number of different jerseys and caps Linus owns.

- **21**. How many jersey/cap combinations can Linus wear when he goes to the baseball game to cheer on the Athletics?
- **22**. If Linus picks a jersey/cap combination at random, what is the probability that he will pick a practice jersey with a green cap?
- **23. RESEARCH** Use the Internet or another resource to find the number of jerseys and caps your favorite professional sports team has as part of its uniform. How many jersey/cap combinations are there for the team you picked?
- **24. CHALLENGE** Refer to Exercise 20. A *fair game* is one in which each player has an equal chance of winning. Adjust the scoring of the game so that it is fair.
- **25. SELECT A TOOL** Mei wants to determine the probability of guessing correctly on two true-false questions on her history test. Which of the following tools might Mei use to determine the probability of answering both questions correctly by guessing? Justify your selection(s). Then use the tool(s) to solve the problem.

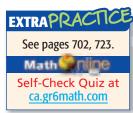


26. FIND THE ERROR Rhonda and Elise are finding all the possible unique outcomes of rolling an even number on a number cube and landing on A or B on the spinner shown. Who is correct? Explain your reasoning.

Rho	nda	Eli	ise
Outcomes		Outco	omes
Number Cube	Spinner	Number Cube	Spinner
2	А	2	А
2	В	2	В
4	С	4	А
4	А	4	В
6	В	6	А
6	С	6	В



27. WRITING IN MATH Describe a game between two players using one coin in which each player has an equal chance of winning.



H.O.T. Problems ...

STANDARDS PRACTICE

28. Mr. Zajac will choose one student from each of the two groups below to present their history report to the class.

Group 1	Group 2
Julia	Keith
Antoine	Isabel
Greg	

Which set shows all the possible choices of two students?

- A {(Julia, Keith), (Antoine, Keith), (Greg, Keith)}
- **B** {(Julia, Antoine), (Antoine, Greg), (Isabel, Keith)}
- C {(Julia, Keith), (Antoine, Keith), (Greg, Keith), (Julia, Isabel), (Antoine, Isabel), (Greg, Isabel)}
- D {(Isabel, Antoine), (Keith, Greg), (Julia, Isabel), (Keith, Antoine)}

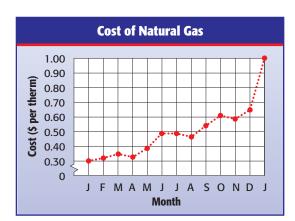


PROBABILITY A spinner is equally likely to stop on each of its regions numbered 1 to 20. Find each probability as a fraction in simplest form. (Lesson 9-1)

- 29. a prime number
 30. GCF(12, 18)
 32. *not* a multiple of 4
 33. factor of 10 or 6
- **31**. multiple of 2 or 3
- 34. *not* an even number

UTILITIES For Exercises 35 and 36, use the graph that shows the prices for natural gas charged by an Illinois natural gas supplier. (Lesson 8-6)

- **35**. What trend seems to be revealed in the line graph?
- **36**. What problems might there be in using this information to predict future prices of natural gas?
- **37. INTEREST** If Carlota invests \$2,100 in a CD for 5 years at a simple interest rate of 4.75%, how much will the CD be worth after 5 years? (Lesson 7-8)



Find each number. Round to the nearest tenth if necessary. (Lesson 7-1)

38. 43% of 266	39. 17% c	of 92	40 . 2.5% of 44
GET READY fo	or the Next Lesson		
PREREQUISITE SK	LL Multiply.		
41 . 7 • 22	42 . 11 • 16	43 . 23 • 20	44 . 131 • 4



The Fundamental Counting Principle

SizesLengths3petite5regular7tall9111315

Main IDEA

Use multiplication to count outcomes and find probabilities.

Standard 6SDAP3.1 Represent all possible outcomes for compound events in an organized way (e.g., tables, grids, tree diagrams) and express the theoretical probability of each outcome.

NEW Vocabulary

Fundamental Counting Principle

GET READY for the Lesson

RETAIL SALES The Jean Factory sells juniors' jeans in different sizes and lengths. The table shows what they have available.

- 1. According to the table, how many sizes of juniors' jeans are there?
- 2. How many lengths are there?
- **3**. Find the product of the two numbers you found in Exercises 1 and 2.
- 4. Draw a tree diagram to help you find the number of different size and length combinations. How does the number of outcomes compare to the product you found above?

In the activity above, you discovered that multiplication, instead of a tree diagram, can be used to find the number of possible outcomes in a sample space. This is called the **Fundamental Counting Principle**.

KEY CONCEPT

Fundamental Counting Principle

Words

If event *M* has *m* possible outcomes and event *N* has *n* possible outcomes, then event *M* followed by event *N* has $m \times n$ possible outcomes.

EXAMPLE Find the Number of Outcomes

Find the total number of outcomes when a coin is tossed and a number cube is rolled.

number of	number of	total	
outcomes on	outcomes on one	number of	
one coin	number cube	outcomes	
2 •	6 =	12	Fundamental

Fundamental Counting Principle

There are 12 different outcomes.

Check Draw a tree diagram to show the sample space.

CHECK Your Progress

a. Find the total number of outcomes when choosing from bike helmets that come in three colors and two styles.

READING in the Content Area

For strategies in reading this lesson, visit ca.gr6math.com.

The Fundamental Counting Principle can be used to find the number of possible outcomes and solve probability problems in more complex problems, when there are more than two events.

Real-World EXAMPLE

FOOD A famous steak house allows customers to create their own steak dinners. The choices are shown at the right. Find the number of steak dinners possible. Then find the probability that a customer randomly

451 Steakhouse				
Steak	How Steaks Are Cooked	Potatoes		
New York Strip Ribeye Filet Porterhouse T-Bone	rare medium well	mashed baked twice baked au gratin		

selects a well-done ribeye steak and a baked potato.

number of types of steaks		number of ways steaks can be cooke		number of types of potatoes	tc	otal number of steak dinners	
5	•	3	•	4	=	60	Fundamental Counting Principle

There are 60 different ways of choosing a steak dinner. Out of the 60 possible outcomes, only one is favorable. So, the probability of randomly selecting a well-done ribeye steak and a baked potato is $\frac{1}{60}$.

CHECK Your Progress

b. FOOD If the chef adds sirloin steak and scalloped potatoes to the menu, find the number of possible steak dinners. Then find the probability of randomly selecting a medium-done sirloin steak and mashed potatoes.

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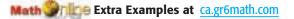
CHECK Your Understanding

Example 1 (p. 471)

- Use the Fundamental Counting Principle to find the total number of outcomes in each situation.
 - 1. tossing a quarter, a dime, and a nickel
 - 2. choosing scrambled, sunny-side up, or poached eggs with bacon or sausage and milk or orange juice
 - **3**. choosing a card from 20 different cards and spinning the spinner at the right



Example 2 (p. 472)
 4. CLOTHES Beth has 3 sweaters, 4 blouses, and 6 skirts that coordinate. Find the number of different outfits consisting of a sweater, blouse, and skirt that are possible. Then find the probability of randomly selecting a particular sweater-blouse-skirt outfit.



Exercises

HOMEWORKHELP		
For Exercises	See Examples	
5-10	1	
11-12	2	

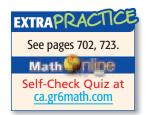
Use the Fundamental Counting Principle to find the total number of outcomes in each situation.

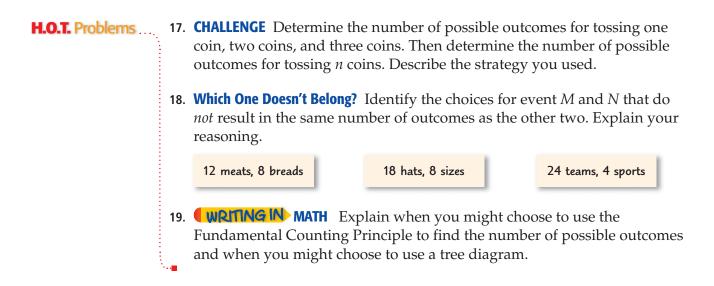
- **5.** choosing a bagel with one type of cream cheese from the list shown in the table
- **6.** choosing a number from 1 to 20 and a color from 7 colors
- **7.** picking a month of the year and a day of the week
- BagelsCream
Cheeseplainplainblueberrychivecinnamon
raisinsun-dried
tomatogarlic
- **8.** choosing from a comedy, horror, or action movie each shown in four theaters
- 9. rolling a number cube and tossing two coins
- **10.** choosing iced tea in regular, raspberry, lemon, or peach flavors; sweetened or unsweetened; and in a glass or a plastic container
- **11. ROADS** Two roads, Broadway and State, connect the towns of Eastland and Harping. Three roads, Park, Fairview, and Main, connect the towns of Harping and Johnstown. Find the number of possible routes from Eastland to Johnstown that pass through Harping. Then find the probability that State and Fairview will be used if a route is selected at random.
- •12. **APPLES** An orchard makes apple nut bread, apple pumpkin nut bread, and apple buttermilk bread using 6 different varieties of apples, including Fuji. Find the number of possible bread choices. Then find the probability of selecting a Fuji apple buttermilk bread if a customer buys a loaf of bread at random.
- **13. GAMES** Find the number of possible outcomes if five number cubes are rolled at one time during a board game.
- 14. **PASSWORDS** Find the number of possible choices for a 2-digit password that is greater than 19. Then find the number of possible choices for a 4-digit Personal Identification Number (PIN) if the digits *cannot* be repeated.
- **15. ADVERTISING** The Wake-Up Restaurant advertises that you can have a different pancake breakfast every day of the year. It offers 25 different kinds of pancakes and 14 flavored syrups. If the restaurant is open every day of the year, is its claim valid? Justify your answer.
- **16. ANALYZE TABLES** The table shows cell phone options offered by a wireless phone company. If a phone with one payment plan and one accessory is given away at random, predict the probability that it will be Brand B and have a headset. Explain your reasoning.

Phone Brands	Payment Plans	Accessories
Brand A	Individual	Leather Case
Brand B	Family	Car Mount
Brand C	Business	Headset
	Government	Travel Charger









STANDARDS PRACTICE

20. A bakery offers white, chocolate, or yellow cakes with white or chocolate icing. There are also 24 designs that can be applied to a cake. If all orders are equally likely, what is the probability that a customer will order a white cake with white icing in one of these designs?

A
$$\frac{1}{30}$$
 C $\frac{1}{120}$

 B $\frac{1}{64}$
 D $\frac{1}{144}$

21. WritePen makes 8 different styles of pens in several colors with 2 types of grips. If the company makes 112 kinds of pens, how many different colors do they make?

F	7	Η	16
G	8	J	1,792

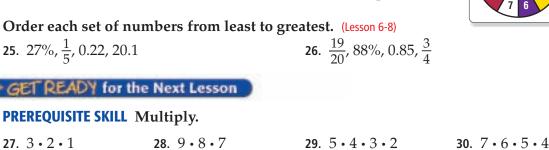


22. SCHOOL Horacio can choose from 2 geography, 3 history, and 2 statistics classes. Find the sample space for all possible schedules. (Lesson 9-2)

PROBABILITY Find the probability that the spinner shown		
at the right will stop on each of the fol	lowing. Write as a	
fraction in simplest form. (Lesson 9-1)		

23. an even number

24. a multiple of 4





Permutations

Main IDEA

Find the number of permutations of a set of objects and find probabilities.

Standard 6SDAP3.1 Represent all possible outcomes for compound events in an organized way (e.g., tables, grids, tree diagrams) and express the theoretical probability of each outcome.

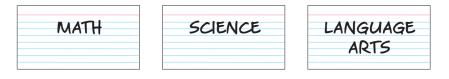
NEW Vocabulary

permutation

MINI Lab

How many different ways are there to arrange your first 3 classes if they are math, science, and language arts?

STEPT) Write math, science, and language arts on the index cards.



STEP 2) Find and record all arrangements of classes by changing the order of the index cards.

- 1. When you first started to make your list, how many choices did you have for your first class?
- **2**. Once your first class was selected, how many choices did you have for the second class? Then, the third class?

A **permutation** is an arrangement, or listing, of objects in which order is important. In the example above, the arrangement Science, Math, Language Arts is a permutation of Math, Science, Language Arts because the order of the classes is different. You can use the Fundamental Counting Principle to find the number of possible permutations.

EXAMPLE Find a Permutation

SCHEDULES Find the number of possible arrangements of classes in the Mini-Lab above using the Fundamental Counting Principle.

There are **3** choices for the first class.

There are **2** choices that remain for the second class.

There is 1 choice that remains for the third class.

3 • 2 • 1 = 6 The number of permutations of 3 classes

There are 6 possible arrangements, or permutations, of the 3 classes.

CHECK Your Progress

a. **VOLLEYBALL** In how many ways can the starting six players of a volleyball team stand in a row for a picture?

You can use a permutation to find the probability of an event.

Real-World EXAMPLE Find Probability

SWIMMING The finals of the Northwest Swimming League features 8 swimmers. If each swimmer has an equally likely chance of finishing in the top two, what is the probability that Yumii will be in first place and Paquita in second place?

Northwest League Finalists		
Octavia Eden		
Natasha	Paquita	
Calista	Samantha	
Yumii	Lorena	

There are **8** choices for first place.

There are 56 possible arrangements, or permutations, of the 2 places.

Since there is only one way of having Yumii come in first and Paquita second, the probability of this event is $\frac{1}{56}$.

CHECK Your Progress

b. LETTERS Two different letters are randomly selected from the letters in the word *math*. What is the probability that the first letter selected is *m* and the second letter is *h*?

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CHECK Your Understanding

Example 1 (p. 475)

- 1. **TRANSPORTATION** In how many ways can the 7 students shown waiting at the bus stop board the bus when it arrives?
- 2. **COMMITTEES** In how many ways can a president, vice-president, and secretary be randomly selected from a class of 25 students?



Example 2 (p. 476)

- 2 3. DVD You have five seasons of your favorite TV show on DVD. If you randomly select two of them from a shelf, what is the probability that you will select season one first and season two second?
 - 4. **PASSWORDS** A password consists of four letters, of which none are repeated. What is the probability that a person could guess the entire password by randomly selecting the four letters?

Exercises

HOMEWORK HELP		
For Exercises	See Examples	
5-8	1	
9–12	2	

- 5. **CONTESTS** In the Battle of the Bands contest, in how many ways can the four participating bands be ordered?
- 6. **ZIP CODES** How many different 5-digit zip codes are there if no digit is repeated?
- 7. **LETTERS** How many permutations are possible of the letters in the word *friend*?
- 8. **NUMBERS** How many different 3-digit numbers can be formed using the digits 9, 3, 4, 7, and 6? Assume no number can be used more than once.
- 9. CAPTAINS The members of the Evergreen Junior High Quiz Bowl team are listed at the right. If a captain and an assistant captain are chosen at random, what is the probability that Walter is selected as captain and Mi-Ling as co-captain?

Evergreen Ju Quiz Bow	
Jamil	Luanda
Savannah	Mi-Ling
Tucker	Booker
Ferdinand	Nina
Walter	Meghan

- 10. BASEBALL Adriano, Julián and three of their friends will sit in a row of five seats at a baseball game. If each friend is equally-likely to sit in any seat, what is the probability that Adriano will sit in the first seat and Julián will sit in the second seat?
- **11. GAMES** Alex, Aiden, Dexter, and Dion are playing a video game. If they each have an equally-likely chance of getting the highest score, what is the probability that Dion will get the highest score and Alex the second highest?
- **12. BLOCKS** A child has wooden blocks with the letters *G*, *R*, *T*, *I*, and *E*. Find the probability that the child randomly arranges the letters in the order TIGER.



-13. SELECT A TOOL Refer to the information in the table. The best dog in each breed competes to win one of four top ribbons in the group. Which of the following tools might you use to find the number of ways a ribbon can be awarded to a dog in the Working group? Justify your selection(s). Then use your tool(s) to solve the problem.

mental math



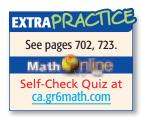
estimation

Westminst Club Dog Attendan	g Show
Group	Number of Breeds
Herding	19
Hounds	25
Non-Sporting	18
Sporting	28
Terriers	28
Тоу	23
Working	24



Real-World Link ...

At the 2005 Westminster Kennel Club Dog Show, Carlee, a German Shorthaired Pointer from the Sporting Group, won the Best in Show Trophy. Source: Westminster Kennel Club



calculator

- 14. **PHOTOGRAPHY** A family discovered they can stand in a row for their portrait in 720 different ways. How many members are in the family?
- **15. STUDENT ID** Hamilton Middle School assigns a four-digit identification number to each student. The number is made from the digits 1, 2, 3, and 4, and no digit is repeated. If assigned randomly, what is the probability that an ID number will end with a 3?

H.O.T. Problems

- **16. CHALLENGE** There are 1,320 ways for three students to win first, second, and third place during a debate match. How many students are there on the debate team? Explain your reasoning.
- 17. **WRITING IN MATH** Describe a real-world situation that has 6
- permutations. Justify your answer.

STANDARDS PRACTICE

- The five finalists in a random drawing are shown. Find the probability that Sean is awarded first prize and Teresa is awarded second prize.
 - $\mathbf{A} \quad \frac{1}{5} \\ \mathbf{B} \quad \frac{1}{10} \\ \mathbf{C} \quad \frac{2}{5} \\ \mathbf{D} \quad \frac{1}{20}$

Finalists
Cesar
Teresa
Sean
Nikita
Alfonso

- **19.** A baseball coach is setting a batting order for his nine starting players with the pitcher batting last. How many batting orders are possible?
 - F 8G 72H 40,320J 362,880

.....



- **20. BREAKFAST** Find the total number of outcomes if you can choose from 8 kinds of bagels, 3 toppings, and 4 beverages. (Lesson 9-3)
- 21. LUNCH Make a tree diagram showing different ways to make a sandwich with turkey, ham, or salami and either cheddar or Swiss cheese. (Lesson 9-2)
- **22. PROBABILITY** What is the probability of rolling a number greater than four on a number cube? (Lesson 9-1)

Find each product. Write in simplest form. (Lesson 5-5)

 23. $\frac{4}{5} \times 2\frac{1}{3}$ 24. $11\frac{1}{8} \times \frac{1}{2}$ 25. $4\frac{5}{6} \times \frac{7}{8}$
GET READY for the Next Lesson PREREQUISITE SKILL Find each value. (Lesson 1-4)

 26. $\frac{5 \cdot 4}{2 \cdot 1}$ 27. $\frac{8 \cdot 7 \cdot 6}{3 \cdot 2 \cdot 1}$ 28. $\frac{5 \cdot 4 \cdot 3}{4 \cdot 3 \cdot 2}$ 29. $\frac{10 \cdot 9 \cdot 8 \cdot 7}{8 \cdot 7 \cdot 6 \cdot 5}$

CHAPTER

Mid-Chapter Quiz

Lessons 9-1 through 9-4

A number cube is rolled. Find each probability. Write as a fraction in simplest form. (Lesson 9-1)

- 1. *P*(an odd number)
- 2. *P*(a number not greater than 4)
- **3**. *P*(a number less than 6)
- 4. *P*(a multiple of 2)
- 5. **DVDS** Andrés has 2 action, 3 comedy, and 5 drama DVDs. If he randomly picks a DVD to watch, what is the probability that he will *not* pick a comedy? Write as a percent. (Lesson 9-1)

For each situation, find the sample space using a table or tree diagram. (Lesson 9-2)

- 6. Two coins are tossed.
- The spinner shown is spun, and a digit is randomly selected from the number 803.



- 8. **STANDARDS PRACTICE** At a diner, a customer can choose from eggs or pancakes as an entrée and from ham or sausage as a side. Which set shows all the possible choices of one entrée and one side? (Lesson 9-2)
 - A {(eggs, pancakes), (ham, sausage)}
 - **B** {(eggs, ham), (eggs, sausage), (pancakes, ham), (pancakes, sausage)}
 - C {(eggs, ham), (eggs, pancakes), (sausage, pancakes)}
 - D {(eggs, ham), (pancakes, sausage)}
- **9. GAMES** Abbey rolls a number cube and chooses a card from among cards marked *A*, *B*, and C. If an odd number and a vowel turn up, Abbey wins. Otherwise Benny wins. Find the sample space. Then find the probability that Benny wins. (Lesson 9-2)

For Exercises 10 and 11, use the Fundamental Counting Principle to find the total number of possible outcomes in each situation. (Lesson 9-3)

10. A customer chooses a paper color, size, and binding style for some copies.

Color	Size	Binding
white	8.5″ x 11″	paper clip
yellow	8.5" x 14"	binder clip
green	8.5″ x 17″	staple

- **11.** A number cube is rolled and three coins are tossed.
- 12. **CARS** A certain car model comes in the colors in the table and either automatic or manual transmission. Find the probability

Exterior	Interior
Black	Gray
White	Tan
Red	
Silver	

that a randomly selected car will have a black exterior, tan interior, and manual transmission if all combinations are equally likely. (Lesson 9-3)

- **13. STUDENT COUNCIL** In how many ways can a president, treasurer, and a secretary be chosen from among 8 candidates? (Lesson 9-4)
- 14. **STANDARDS PRACTICE** Noriko packed five different sweaters for her weekend vacation. If she randomly selects one sweater to wear each day, what is the probability that she will select the brown sweater on Friday, the orange sweater on Saturday, and the pink sweater on Sunday? She will not wear each sweater more than once. (Lesson 9-4)

$$\begin{array}{c} \mathbf{F} \quad \frac{1}{60} \\ \mathbf{G} \quad \frac{1}{120} \\ \mathbf{H} \quad \frac{3}{5} \\ \mathbf{J} \quad \frac{1}{5} \end{array}$$

Combinations

Main IDEA

Find the number of combinations of a set of objects and find probabilities.



Standard 6SDAP3.1 Represent all

possible outcomes for compound events in an organized way (e.g., tables, grids, tree diagrams) and **express the theoretical probability of each outcome.**

NEW Vocabulary

combination



result of putting objects together, as in a combination of ingredients

Math Use an arrangement of objects in which order is not important

GET READY for the Lesson

BASKETBALL Coach Chávez wants to select co-captains for her basketball team. She will select two girls from the four oldest members on the team: Jenna, Bailey, Oleta, and Danielle.

- 1. Use the first letter of each name to list all of the permutations of co-captains. How many are there?
- **2**. Cross out any arrangement that contains the same letters as another one in the list. How many are there now?
- 3. Explain the difference between the two lists.

An arrangement, or listing, of objects in which order is not important is • called a **combination**. In the activity above, choosing Jenna and Bailey is the same as choosing Bailey and Jenna.

Permutations and combinations are related. You can find the number of combinations of objects by dividing the number of permutations of the entire set by the number of ways the smaller set can be arranged.

EXAMPLE Find the Number of Combinations

FOOD Terrence's Pizza Parlor is offering the special shown in the table. How many different two-topping pizzas are possible?

This is a combination problem because the order of the toppings on the pizza is not important.

Today's Special: Large two-topping pizza for \$14.99

> **Toppings** Pepperoni Sausage Green Peppers Onions Mushrooms

METHOD 1 Make a list.

Use the first letter of each topping to list all of the permutations of the toppings taken two at a time. Then cross out the pizzas that are the same as another one.

p, s	s,p	8, p	0, p	m, p
р, о	s, 0	8,8	0,8	m, s
p, m	s, m	g, 0	o, m	m, 0
p, g	s, g	g, m	o, g	m, g
So, the	re are 10	different	two-toppi	ing pizzas.

480 Chapter 9 Probability

METHOD 2	Use a permutation.
Step 1	Find the number of permutations of the entire set. $5 \cdot 4 = 20$ A permutation of 5 toppings, taken 2 at time
Step 2	Find the number of permutations of the smaller set. $2 \cdot 1 = 2$ Number of ways to arrange 2 toppings
Step 3	Find the number of combinations. $\frac{20}{2}$ or 10 Divide the number of permutations of the entire set by the number of permutations of each smaller set.

So, there are 10 different two-topping pizzas.

CHOOSE Your Method

a. **FOOD** How many different three-topping pizzas are possible if Terrence adds ham and anchovies to the topping choices?

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Real-World EXAMPLES

2 CHECKERS A checkers tournament features each of the top 8 regional players playing every opponent one time. The 2 players with the best records will then play in a final championship round. How many matches will be played if there are no ties?

Find the number of ways 2 players can be chosen from a group of 8.

```
There are 8 \cdot 7 ways to choose 2 people. \rightarrow \frac{8 \cdot 7}{2 \cdot 1} = \frac{56}{2} or 28
There are 2 \cdot 1 ways to arrange 2 people. \rightarrow \frac{3 \cdot 7}{2 \cdot 1} = \frac{56}{2} or 28
```

There are 28 matches plus 1 final match to determine the champion. So, there will be 29 matches played.

Check Make a diagram in which each person is represented by a point. Draw a line segment between each pair of points to represent all the matches. This produces 28 line segments, or 28 matches. Then add the final-round match to make a total of 29 matches.



3 If the players in Example 2 are selected at random, what is the probability that player 2 will play player 7 in the first match?

There are 28 possible first matches and only one favorable outcome. So, the probability is $\frac{1}{28}$.

CHECK Your Progress

b. CHECKERS What is the probability that player 2 will play player 16 in the first match if the top 16 regional players are invited to play in the tournament?



Real-World Link Checkers is played on an 8-by-8 board in the U.S., England, Australia, and Ireland. People in eastern Europe play on a 10-by-10 board. Source: about.com

CHECK Your Understanding

Example 1 (p. 480–481)	 PUPPIES In how many ways can you pick 2 puppies from a litter of 7? SCIENCE FAIR In how many ways can 3 out of 10 students be chosen to present their projects at a science fair?
Examples 2, 3	PAINTING For Exercises 3 and 4, use the information below.
(p. 481)	Jade is going to paint her room two different colors from among white, gray, sage, or yellow.
	3 . How many combinations of two paint colors are there?

4. Find the probability that two colors chosen randomly will be white and sage.

Exercises

HOMEWO	RKHELP	I
For Exercises	See Examples	
5–8	1, 2	
9–10	3	l

- 5. **ESSAYS** In how many ways can you select 4 essay questions out of 10?
- 6. **ART** In how many ways can four paintings out of 15 be chosen for display?
- 7. **INTERNET** Of 12 Web sites, in how many ways can you choose to visit 6?
- 8. **SPORTS** On an 8-member volleyball team, how many different 6-player starting teams are possible?
- 9. STUDENT COUNCIL The students listed are members of Student Council. Three will be chosen at random to form a committee. Find the probability that the three students chosen will be Placido, Maddie, and Akira.
- **10. FOOD** At a hot dog stand, customers can select three toppings from among chili, onions, cheese, mustard, or relish. What is the probability that three toppings selected at random will include onions, mustard, and relish?

11. MUSIC Marissa practiced the five

pieces listed at the right for a recital.

Find the number of different ways

that three pieces will be randomly

chosen for her to play. Then find

the probability that all three were

composed by Beethoven.

Recital Piece Composer Ludwig van Beethoven Sergei Rachmaninoff Antonio Vivaldi

0

Roster

Leon

Placido

Maddie Adrahan

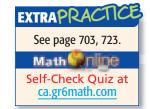
Matt

Akira

Fur Elise First Piano Sonata The Four Seasons Cappricio Ludwig van Beethoven Moonlight Sonata Ludwig van Beethoven

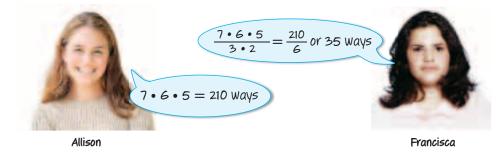
Tell whether each problem represents a *permutation* or a *combination*. Then solve the problem.

- 12. Six children remain in a game of musical chairs. If two chairs are removed, how many different groups of four children can remain?
- 13. How many ways can first and second chair positions be awarded in a band that has 10 flute players?
- 14. How many ways can 12 books be stacked in a single pile?



H.O.T. Problems

- **15. CHALLENGE** How many people were at a party if each person shook hands exactly once with every other person and there were 105 handshakes?
- **16. FIND THE ERROR** Allison and Francisca are calculating the number of ways that a 3-member committee can be chosen from a 7-member club. Who is correct? Explain your reasoning.



17. **WRITING IN MATH** Write about a real-world situation that can be solved using a combination. Then solve the problem.

STANDARDS PRACTICE

18. Three cheerleaders will be randomly selected to represent the squad at a game. If there are 12 cheerleaders, find the probability that the three members chosen are Kameko, Lynn, and Tory.

A

$$\frac{1}{220}$$
 C
 $\frac{1}{4}$

 B
 $\frac{3}{110}$
 D
 $\frac{1}{3}$

19. Four students are to be chosen from a roster of 9 students to attend a science camp. In how many ways can these 4 students be chosen?

F	5	Η	126
G	36	J	3,024



20. SAILING Six sailboats are entered in a race. In how many different ways can the race be completed? Assume there are no ties. (Lesson 9-4)

23. $\frac{5}{12} - \frac{1}{9}$

21. CARS A certain brand of car has the choices listed in the table. How many different cars are possible? (Lesson 9-3)

Estimate. (Lesson 5-2)
22.
$$\frac{1}{10} + \frac{7}{8}$$

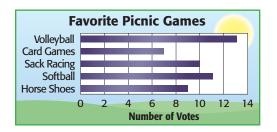
$$\frac{1}{0} + \frac{7}{8}$$

GET READY for the Next Lesson

PREREQUISITE SKILL For Exercises 24 and 25, use the graph. (Lesson 8-5)

- 24. How many students were surveyed?
- 25. Find the probability that a student's favorite picnic game is sack racing.

Engine	Extras	Seats	Color
2.5 L	DVD-player	Cloth	Silver
3.1 L	CD-player	Leather	Green
4.0 L	CD-changer		Red
			White



9-6

Problem-Solving Investigation

MAIN IDEA: Solve problems by acting it out.

Standard 6SDAP3.2 Use data to estimate the probability of future events (e.g., batting averages or number of accidents per mile driven). Standard 6SDAP2.4 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.

P.S.I. TERM +

4 free-th EXPLORE Yo Yo Da PLAN Sp	: Determine	e the throw vera y. Idie m ddie a	e pr ws i nge c	obab n a of 3	oilii row out	ty t	hat ever	ry			-		
Eddie makes Eddie: I 4 free-th EXPLORE Yo Yo Da PLAN Sp	two free-t make an a hrows I try /ou know that Ed /ou could have Ed	vera y. Idie m ddie a	ws i nge c	n a of 3 In aver	out	of	evei				-		
4 free-th EXPLORE Yo Yo Da PLAN Sp	hrows I tr /ou know that Ed /ou could have Ed	у. Idie m ddie a	akes a	in ave	rage o						11	Č.	
Yo ba PLAN Sp	ou could have E	ddie a				f 3 ou	t of ev						
		YOU CO	ould al				s, but	that re					-
	Spin a spinner, no ne makes the free Repeat the experi	e-thro	w. If th	ne spir	nner la						, or 3,		
SOLVE Sp	Spin the spinner a	and m	nake a	table	of the	result	s.						
	Trials	1	2	3	4	5	6	7	8	9	10		
	First Spin	4	1	4	3	1	2	2	1	3	2		
	Second Spin The highlighted c hrows in a row. S						4 ne 10 ti	rials re	4 esulted	3 d in tw	3 o free-		
	Repeat the experi		· ·				ether t	he res	ults a	gree.			2

Analyze The Strategy

- 1. Explain whether the results of the experiment would be the same if it were repeated.
- 2. **WRITING IN MATH** Write a problem that can be solved by acting it out. Then solve the problem by acting it out.

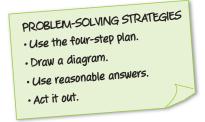


Mixed Problem Solving

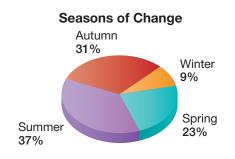
For Exercises 3–6, use the *act it out* strategy.

- **3. POP QUIZ** Determine whether using a spinner with four equal sections is a good way to answer a 5-question multiple-choice quiz if each question has choices A, B, C, and D. Justify your answer.
- 4. **PHOTOGRAPHS** Samuel is taking a photo of the Spanish Club's five officers. The president will always stand on the left, and the vice-president will always stand on the right. How many different ways can he arrange the officers for the photo?
- **5. RUNNING** Six runners are entered in a race. Assuming no ties, in how many different ways can first and second places be awarded?
- 6. **MOVIES** In how many different ways can four friends sit in a row of four seats at the movies if two of the friends insist on sitting next to each other?

Use any strategy to solve Exercises 7–11. Some strategies are shown below.



7. **SEASONS** Refer to the graph. In a middle school of 800 students, would about 150, 250, or 350 be a reasonable answer for the number of students that prefer autumn? Justify your solution.



- 8. **SPACE SCIENCE** A 21-kilogram sample of rocks from the Moon is composed of 40% oxygen and 19.2% silicon. How many kilograms more is the oxygen than the silicon mass?
- **9. ALGEBRA** The pattern below is known as Pascal's Triangle. Would 1, 6, 10, 10, 6, 1 be a reasonable conjecture for the numbers in the 6th row? Justify your answer.

1st Row					1				
2nd Row				1		1			
3rd Row			1		2		1		
4th Row		1		3		3		1	
5th Row	1		4		6		4		1

- 10. **SOCCER** Sixteen teams are playing in a soccer tournament. If a team loses one game, it is eliminated. How many total games will be played in the tournament?
- 11. **SCHOOL** Suppose rolling an even number on a number cube corresponds to an answer of *true* and rolling an odd number corresponds to an answer of *false*. Determine whether rolling this number cube is a good way to answer a 5-question true-false quiz. Justify your answer.

Select the Operation

For Exercises 12–14, select the appropriate operation(s) to solve the problem. Justify your selection(s) and solve the problem.

- **12. TRANSPORTATION** A taxi charges \$3.25 for the first 0.4 mile and \$0.75 for each additional 0.4 mile. Find the cost of a 4-mile taxi ride.
- 13. **MOUNTAINS** The mountain Mauna Kea in Hawaii, is about 1.38×10^4 feet tall while Mt. Everest is about 29,000 feet tall. About how many feet taller is Mt. Everest?
- 14. **MONEY** Lola purchased a \$35 book bag at a sale price of \$27.50. What was the approximate percent of decrease from the original price to the sale price?

Theoretical and Experimental Probability

Main IDEA

Find and compare experimental and theoretical probabilities.



NEW Vocabulary

theoretical probability experimental probability

REVIEW Vocabulary

sample space a list of all possible outcomes (Lesson 9-2)

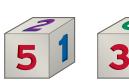
GET READY for the Lesson

Follow the steps to determine how many times a sum of 7 is expected to turn up when two number cubes are rolled.

Step 1 Use an addition table from 1 to 6 to help you find the expected number of times the sum of 7 should come up after rolling two number cubes 36 times. The top row represents one number cube, and the left column represents the other number cube. A partial addition table is shown below.

[+	1	2	3	4	5	6	
	1	2	3	4	5	6	7	
	2	3	4	5	6	7	8	$\left\{ \right\}$

Step 2 Roll two number cubes 36 times. Record the number of times the sum of the number cubes is 7.



- 1. Compare the number of times you *expected* to roll a sum of 7 with the number of times you *actually* rolled a sum of 7. Then compare your result to the results of other groups.
- **2.** Write the probability of rolling a sum of 7 out of 36 rolls using the number of times you *expected* to roll a 7 from Step 1. Then write the probability of rolling a sum of 7 out of 36 rolls using the number of times you *actually* rolled a sum of 7 from Step 2.

In the Mini-Lab above, you found both the theoretical probability and the experimental probability of rolling a sum of 7 using two number cubes. **Theoretical probability** is based on what *should* happen when conducting a probability experiment. This is the probability you have been using since Lesson 10-1. **Experimental probability** is based on what *actually* occurred during such an experiment.

Theoretical Probability

Experimental Probability

 $\frac{6}{36}$ \leftarrow 6 rolls *should* occur total number of rolls

 $\frac{n}{36} \leftarrow n \text{ rolls } actually \text{ occured} \\ \leftarrow \text{ total number of rolls}$

The theoretical probability and the experimental probability of an event may or may not be the same. As the number of times an experiment is conducted increases, the theoretical probability and the experimental probability should become closer in value.

EXAMPLE Experimental Probability

Two number cubes are rolled 75 times, and a sum of 9 is rolled 10 times. What is the experimental probability of rolling a sum of 9?

P(9) =<u>number of these times a sum of 9 occurs</u>

$$=\frac{10}{75} \text{ or } \frac{2}{15}$$

The experimental probability of rolling a sum of 9 is $\frac{2}{15}$.

CHECK Your Progress

- **a**. In the above experiment, what is the experimental probability of rolling a sum that is *not* 9?
- **b**. In the above experiment, what is the experimental probability of rolling a sum that is *not* six if a sum of six was rolled 18 times?

STUDY TIP

Trials A *trial* is one experiment in a series of successive experiments.

EXAMPLES Experimental and Theoretical Probability

You Call It!

20

0

Heads

Tails

The graph shows the results of an experiment in which a coin was tossed thirty times. Find the experimental probability of tossing tails for this experiment.

The frequency graph indicates that the coin landed on heads 12 times and tails 18 times.

$$P(\text{tails}) = \frac{\text{number of times tails occurs}}{\text{total number of tosses}}$$

$$=\frac{18}{30} \text{ or } \frac{3}{5}$$

The experimental probability of tossing tails was $\frac{3}{5}$.

Compare the experimental probability you found in Example 2 to its theoretical probability.

The coin has two possible outcomes, heads or tails. So, the theoretical probability of tossing tails on a coin is $\frac{1}{2}$. Since $\frac{3}{5} \approx \frac{1}{2}$, the experimental probability is close to the theoretical probability.

CHECK Your Progress

- **c.** Refer to Example 2. If the coin was tossed 2 more times and landed on tails each time, predict the experimental probability of tossing heads for this experiment.
- **d**. Compare the experimental probability you found in Exercise c to its theoretical probability.

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Real-World Career ...

How Does a Chef Use Math? In addition to cooking, chefs order enough food and supplies based on customers' preferences and recent sales.

5

3

Math Onlog For more information,

go to ca.gr6math.com.

Experimental probability can be used to make predictions about future events.

Real-World EXAMPLES Predict Future Events

FOOD In a survey, 100 people in a city were asked to name their favorite Independence Day side dishes. What is the experimental probability that macaroni salad was someone's favorite side dish?

There were 100 people surveyed and 12 chose macaroni salad. So, the

experimental probability is $\frac{12}{100}$, or $\frac{3}{25}$.

Side Dish	Number of People
potato salad	55
green salad or vegetables	25
macaroni salad	12
coleslaw	8

Suppose 2,500 people attend the city's Independence Day barbecue. Based on the survey results how many can be expected to choose macaroni salad as their favorite side dish?

$$\frac{3}{25} = \frac{x}{2,500}$$
 Write a proportion.
• 2,500 = 25 • x Find the cross products
7,500 = 25x Multiply.
300 = x Divide each side by 25.

About 300 will choose macaroni salad.

CHECK Your Progress

- e. What is the experimental probability of potato salad being someone's favorite dish?
- f. About how many people can be expected to choose potato salad as their favorite dish if 400 attend the barbecue?

CHECK Your Understanding

Examples 1–3 (p. 487)	 For Exercises 1–3, a coin is tossed 50 times, and it lands on heads 28 times. 1. Find the experimental probability of the coin landing heads. 2. Find the theoretical probability of the coin landing heads. 3. Compare the probabilities in Exercises 1 and 2. 			
	TRAFFIC For Exercises 4 and 5, use the table of the types of vehicles that drove through an intersection between 3:00 and 4:00 P.M. one Saturday.	Vehicle sedan	Number of Vehicles	
Example 4	4. Based on this information, what is the probability	truck	15	
(p. 488)	that a vehicle that drives through the intersection is a sports car?	sports car	6	
Example 5 (p. 488)	•		vould you	



Exercises

HOMEWORK HELP				
For Exercises	See Examples			
6–7	1–3			
8–9	4			
10-11	5			

For Exercises 6 and 7, a number cube is rolled 20 times and lands on 1 two times and on 5 four times.

- **6**. Find the experimental probability of landing on 5. Compare the experimental probability to the theoretical probability.
- **7**. Find the experimental probability of *not* landing on 1. Compare the experimental probability to the theoretical probability.

X GAMES For Exercises 8–11, use the graph of a survey of 50 students asked to name their favorite X Game sport.

- **8.** What is the probability of Moto X being someone's favorite sport?
- **9**. What is the probability of skateboarding being someone's favorite sport?
- **10**. Suppose 500 students attend the X Games. Predict how many will choose inline as their favorite sport.
- Suppose 850 students attend. Predict how many will choose speed climbing as their favorite sport.

X Games

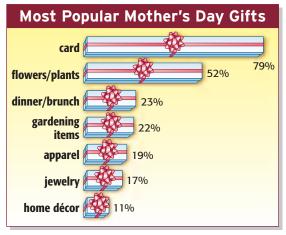
For Exercises 12–14, a spinner with three equal-sized sections marked A, B, and C was spun 100 times. The results are shown in the table.

Secti	on	Frequency
A		24
В		50
C		26

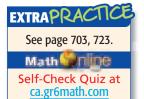
- **12**. What is the experimental probability of landing on A? Of landing on C?
- **13**. If this spinner is spun 20 more times, predict how many of these times the pointer will land on B.
- 14. Make a drawing of what the spinner might look like based on its experimental probabilities. Explain your reasoning.

GIFTS For Exercises 15–17, use the graph at the right.

- **15.** What is the probability that a mother will receive a gift of flowers or plants? Write the probability as a fraction.
- **16**. Out of 400 mothers that receive gifts, predict how many will receive flowers or plants.
- 17. Out of 750 mothers that receive gifts, is it reasonable to expect 250 mothers to receive jewelry? Why or why not?



Source: Carlton Cards





18. CHALLENGE The experimental probability of a coin landing on heads is $\frac{7}{12}$. If the coin landed on tails 30 times, find the number of tosses.

- **19. REASONING** Twenty sharpened pencils are placed in a box containing an unknown number of unsharpened pencils. Suppose 15 pencils are taken out at random, of which five are sharpened. Based on this, is it reasonable to assume that the number of unsharpened pencils was 40? Explain your reasoning.
- 20. **WRITING IN MATH** Compare and contrast experimental probability and theoretical probability.

STANDARDS PRACTICE

21. The frequency table shows Mitch's record for the last thirty par-3 holes he has played.

Mitch's Golf Results				
Score Number of Holes				
2	4			
3	14			
4	9			
5	3			

Based on this record, what is the probability that Mitch will score a 2 or 3 on the next par-3 hole?

3

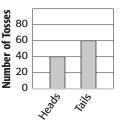
10 9

50

A	$\frac{7}{9}$	C
B	$\frac{3}{5}$	D

22. J.R. tossed a coin 100 times and graphed the results.





Based on this information, what is the experimental probability of tossing tails on the next toss?

F	$\frac{1}{5}$	Н	$\frac{3}{5}$
G	$\frac{2}{3}$	J	$\frac{4}{5}$

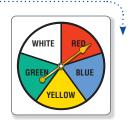


- **23. SPINNERS** In how many ways could the colors in the spinner shown be arranged so that red and blue remain in the same places? (Lesson 9-6)
- 24. **BASEBALL** How many ways can a baseball coach select four starting pitchers from a pitching staff of eight? (Lesson 9-5)
- **25. CLOTHES** A pair of jeans comes in 4 different styles, 3 different colors, and 5 different sizes. How many unique outcomes are possible? (Lesson 9-3)

GET READY for the Next Lesson

PREREQUISITE SKILL Write each fraction as a percent. (Lesson 6-8)





Extend 9-7

Probability Lab Simulations

Main IDEA

Investigate experimental probability by conducting a simulation.

Standard 6SDAP3.2 Use data to estimate the probability of future events (e.g., batting averages or number of accidents per

mile driven). **Standard 6MR1.2** Formulate and justify mathematical conjectures based on a general description of the mathematical question or problem posed.



Assumption This simulation assumes that each prize is equally likely to appear in each box of cereal. A *simulation* is a way of acting out a problem situation. Simulations often use models to act out events that would be difficult or impractical to perform. In this lab, you will simulate purchasing a box of cereal and getting one of four possible prizes inside.

ACTIVITY

- **STEP1)** Place four different colored cubes into a paper bag.
- Without looking, draw a cube from the bag, record its color, and then place the cube back in the bag.
- Repeat steps 1 and 2 until you have drawn a cube from the bag a total of four times.



ANALYZE THE RESULTS

- 1. Based on your results, predict the probability of getting each prize.
- 2. What is the theoretical probability of getting each prize?
- 3. How do your probabilities in Exercises 1 and 2 compare?
- 4. **MAKE A PREDICTION** Predict the probability of selecting all four prizes in four boxes of cereal.
- **5**. Repeat the simulation above 20 times. Use this data to predict the probability of selecting all four prizes in four boxes of cereal.
- **6**. Calculate the experimental probability describe in Exercise 5 using the combined data of five different groups. How does this probability compare with your prediction?
- 7. Describe a simulation that could be used to predict the probability of taking a five question true/false test and getting all five questions correct by guessing. Choose from among two-sided counters, number cubes, coins, or spinners as your model.
- 8. **COLLECT THE DATA** Conduct 50 trials of the experiment you described in Exercise 7. Then calculate the experimental probability of getting all five questions correct by guessing.



Compound Events

Main IDEA

Find the probability of independent and dependent events.



Standard 6SDAP3.4

Understand that the probability of either of two disjoint events occurring is the sum of the two individual probabilities and that the probability of one event following another, in independent trials, is the product of the two probabilities. Standard 6SDAP3.5 Understand the difference between independent and dependent events.

NEW Vocabulary

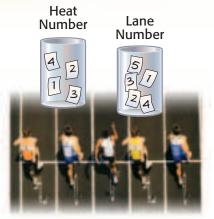
compound event independent events dependent events disjoint events

READING Math

Probability Notation P(A, B) is read the probability of A followed by B.

GET READY for the Lesson

TRACK AND FIELD The 100-meter dash features 20 runners competing in a preliminary round of 4 heats. The winner of each heat advances to the final race. Before the race, each runner chooses a number from jar 1 to determine the heat in which he runs and a number from jar 2 to determine one of five lanes



he occupies. Omar is the first runner to choose from the jars.

- 1. What is the probability of Omar being in the second heat? in lane 3?
- 2. Multiply your answers in Exercise 1. What does this number represent?

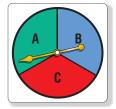
In the example above, choosing the heat and the lane is a compound event. A **compound event** consists of two or more simple events. Since choosing the heat number does not affect choosing the lane number, the two events are called independent events. The outcome of one event does not affect the outcome of the other event.

EXAMPLE Independent Events

A coin is tossed, and the spinner shown is spun. Find the probability of tossing heads and spinning a consonant.

H, C

List the sample space. Use H for heads and T for tails.



T.A T.B T.C number of possible coutcomes $P(\text{H and a consonant}) = \frac{2}{6} \text{ or } \frac{1}{3}$

So, the probability is $\frac{1}{3}$ or about 33%.

H, B

CHECK Your Progress

H, A

A number cube is rolled, and the spinner in Example 1 is spun. Find each probability.

a. *P*(4 and a consonant)

b. P(odd and a B)

The probability in Example 1 can also be found by multiplying the probabilities of each event. $P(H) = \frac{1}{2}$ and $P(C) = \frac{1}{3}$ and so $P(H \text{ and } C) = \frac{1}{2} \cdot \frac{1}{3}$ or $\frac{1}{6}$. This leads to the following.

KEY CONCEPT

Probability of Independent Events

Words The probability of two independent events can be found by multiplying the probability of the first event by the probability of the second event.

Symbols $P(A \text{ and } B) = P(A) \cdot P(B)$

Real-World EXAMPLE

2 SNACKS Kayla chooses from a box containing 2 oatmeal, 3 strawberry, and 6 cinnamon snack bars. For a drink, she chooses from milk or water. If Kayla chooses a snack and a drink at random, find the probability that she chooses a cinnamon bar and milk.

 $P(\text{cinnamon and milk}) = P(\text{cinnamon}) \cdot P(\text{milk})$

 $= \frac{6}{11} \cdot \frac{1}{2}$ 6 out of 11 bars are cinnamon. 1 out of 2 drink choices is milk.

So, the probability is $\frac{3}{11}$ or about 27%.

CHECK Your Progress

c. **SNACKS** If tea and juice are added to Kayla's drink choices, find the probability that she chooses an oatmeal bar and water.

 $=\frac{\frac{3}{6}}{11}\cdot\frac{1}{2}\,\mathrm{or}\,\frac{3}{11}$

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If the outcome of one event affects the outcome of a second event, the events are called **dependent events**. Just as in independent events, the probabilities of dependent events can be found by multiplying the probabilities of each event. However, now the probability of the second event depends on the fact that the first event has already occurred.

KEY CONCEPT

Probability of Dependent Events

Words If two events, *A* and *B*, are dependent, then the probability of both events occurring is the product of the probability of *A* and the probability of *B* after *A* occurs.

Symbols $P(A \text{ and } B) = P(A) \cdot P(B \text{ following } A)$



Reasonable Answer You can check your answer in Example 2 by listing the sample space or by making a tree diagram.

EXAMPLE Dependent Events

3) There are 2 red, 5 green, and 8 yellow marbles in a jar. Martina randomly selects two marbles without replacing the first marble. What is the probability that she selects two green marbles?

Since the first marble is not replaced, the first event affects the second event. These are dependent events.

 $P(\text{first marble is green}) = \frac{5}{15}$ \leftarrow number of green marbles total number of marbles $P(\text{second marble is green}) = \frac{4}{14}$ number of green marbles after one green marble is removed total number of marbles after one green marble is removed $P(\text{two green marbles}) = \frac{\frac{1}{5}}{\frac{1}{15}} \cdot \frac{\frac{2}{4}}{\frac{1}{14}} \text{ or } \frac{2}{21}$

So, the probability of selecting two green marbles is $\frac{2}{21}$, or about 9.5%.

CHECK Your Progress

d. There are 4 blueberry, 6 raisin, and 2 plain bagels in a bag. Javier randomly selects two bagels without replacing the first bagel. Find the probability that he selects a raisin bagel and then a plain bagel.

Sometimes two events cannot happen at the same time. For example, when a coin is tossed, the outcome of heads cannot happen at the same time as tails. Either heads or tails will turn up. Tossing heads and tossing tails are examples of **disjoint events**, or events that cannot happen at the same time. Disjoint events are also called *mutually exclusive events*.

EXAMPLE Disjoint Events

4) A number cube is rolled. What is the probability of rolling an odd number or a 6?

These are disjoint events since it is impossible to roll an odd number and a 6 at the same time.

 $P(\text{odd number or } 6) = \frac{4}{6}$ There are four favorable outcomes: 1, 3, 5, or 6.

So, the probability of rolling an odd number or a 6 is $\frac{4}{6}$, or $\frac{2}{3}$.

CHECK Your Progress

e. Twenty-six cards are labeled, each with a letter of the alphabet, and placed in a box. A single card is randomly selected. What is the probability that the card selected will be labeled with the letter M or the letter T?

Disjoint Events When finding the probabilities of disjoint events, the word or is usually used.



Probability

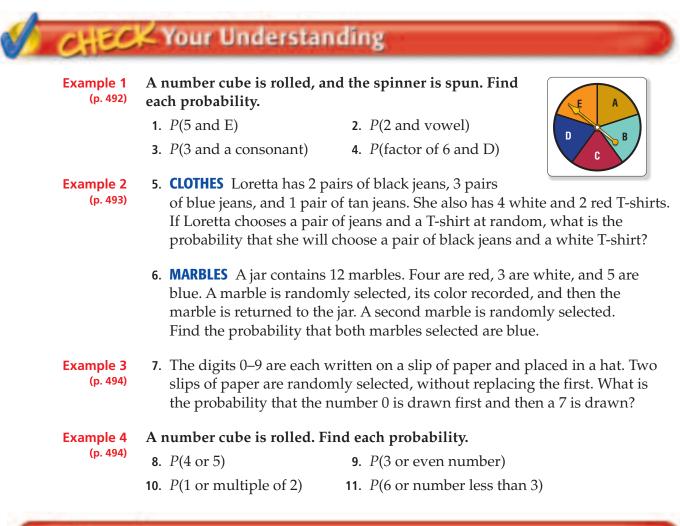
The probability of two disjoint events is the *sum* of the two individual probabilities. The probability of two independent events is the *product* of the two individual probabilities. Notice that the probability in Example 4 can also be found by adding the probabilities of each event.

KEY CONCEPT

Probability of Disjoint Events

Words If two events, *A* and *B*, are disjoint, then the probability that either *A* or *B* occurs is the sum of their probabilities.

Symbols P(A or B) = P(A) + P(B)



Exercises

HOMEWO	RKHELP	A coin is tossed, and a numb	er cube is rolled. Find each probability.		
For	See	12 . <i>P</i> (heads and 1)	13 . <i>P</i> (tails and multiple of 3)		
Exercises	Examples	A set of Constructed in Islands	1 E A second set of the reader contains the		
12-17	1	A set of five cards is labeled 1–5. A second set of ten cards contains the			
18-19	2	U	following colors: 2 red, 3 purple, and 5 green. One card from each set is		
20-21	3	selected. Find each probabili	ity.		
22-25	4	14 . <i>P</i> (5 and green)	15 . <i>P</i> (odd and red)		
		16 . <i>P</i> (prime and purple)	17 . <i>P</i> (even and yellow)		

- **18. MUSIC** Denzel is listening to a CD that contains 12 songs. If he presses the random button on his CD player, what is the probability that the first two songs played will be the first two songs listed on the album?
- **19. JUICE POPS** Lakita has two boxes of juice pops with an equal number of pops in each flavor. Find the probability of randomly selecting a grape juice pop from the first box and randomly selecting a juice pop from the second box that is *not* grape.



- **20. FRUIT** Francesca randomly selects two pieces of fruit from a basket containing 8 oranges and 4 apples without replacing the first fruit. Find the probability that she selects two oranges.
- **21. SCHOOL** The names of 24 students, of which 14 are girls and 10 are boys, in Mr. Santiago's science class are written on cards and placed in a jar. Mr. Santiago randomly selects two cards without replacing the first to determine which students will present their lab reports today. Find the probability that two boys are selected.

A day of the week is randomly selected. Find each probability.

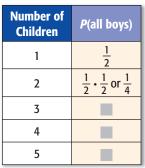
- **22**. *P*(Monday or Tuesday)
- **23**. *P*(a day beginning with T or Friday)
- **24**. *P*(a weekday or Saturday)
- **25**. *P*(Wednesday or a day with 6 letters)

A coin is tossed twice, and a letter is randomly picked from the word *event*. Find each probability.

- **26.** P(two heads and T)**27.** P(tails, not tails, consonant)
- **28.** P(heads, tails, not V)**29.** P(two tails and vowel)

FAMILY For Exercises 30–32, use the fact that the probability for a boy or a girl is each $\frac{1}{2}$.

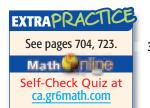
- **30**. Copy and complete the table that gives the probability that all the children in a family are boys given the number of children in the family.
- **31**. Predict the probability that, in a family of ten children, all ten are boys.
- **32**. Predict the probability that, in a family of *n* children, all *n* are boys.



33. TRAFFIC Two consecutive traffic signals on a street

operate independently of each other. The first signal is green 45% of the time, and the second signal is yellow 10% of the time and red 40% of the time. What is the probability of a person driving down the street making both green lights? Write as a percent.

34. RESEARCH The *contiguous* United States consists of all states excluding Alaska and Hawaii. If one of these contiguous states is chosen at random, what is the probability that it will end with the letter A or O? Write as a percent.



H.O.T. Problems CHALLENGE For Exercises 35 and 36, use the spinner.

- **35**. Use a tree diagram to construct the sample space of all the possible outcomes of three successive spins.
- **36**. Suppose the spinner is designed so that for each spin there is a 40% probability of spinning red and a 20% chance of spinning blue. What is the probability of spinning two reds and then one blue?



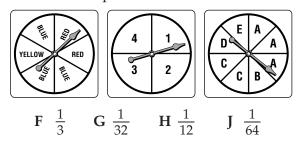
37. WRITING IN MATH A shelf has books A, B, and C on it. You pick a book at random, place it on a table, and then pick a second book. Explain why the probability that you picked books A and B is *not* $\frac{1}{\Omega}$.

STANDARDS PRACTICE

38. A jar contains 8 white marbles, 4 green marbles, and 2 purple marbles. If Darla picks one marble from the jar without looking, what is the probability that it will be either white or purple?

A	$\frac{5}{7}$	$C \frac{2}{7}$
B	$\frac{4}{7}$	$\mathbf{D} \frac{1}{7}$

39. What is the probability of spinning a red, the number 1, and the letter A on the three spinners below?





40. **PROBABILITY** Paz performed a probability experiment by spinning a spinner 20 times. The results are shown in the table. If the spinner is divided into four equal sections, how many sections would you expect to be blue? (Lesson 9-7)

Color	Frequency	
red	Ш	
green	ШШ	
blue	₩	

41. **CHORES** This weekend, Brennen needs to do laundry, mow the lawn, and clean his room. How many different ways can he do these three chores? (Lesson 9-6)

ALGEBRA Evaluate each expression if a = 6, b = -4, and c = -3. (Lesson 2-7) **45**. 5*b*² **43.** -8*a*

42. 9c

44. 2*bc*

Cross-Curricular Project

Math and Recreation

Step Right Up and Win a Prize It's time to complete your project. Use the information and data you have gathered about carnival games to prepare a Web page or poster. Be sure to include a scale drawing of the game you design with your project.

Math Cross-Curricular Project at ca.gr6math.com

HAPTER

Study Guide and Review



Download Vocabulary Review from ca.gr6math.com

OLDA RLES

READY to Study

Be sure the following Key Concepts are noted in your Foldable.



Key Concepts

Probability (Lesson 9-1)

• The probability of a simple event is a ratio that compares the number of favorable outcomes to the number of possible outcomes.

Fundamental Counting Principle (Lesson 9-3)

• If event *M* has *m* possible outcomes and is followed by event N that has n possible outcomes, then the event *M* followed by *N* has $m \times n$ possible outcomes.

Theoretical and Experimental Probability (Lesson 9-7)

- Theoretical probability is based on what should happen when conducting a probability experiment.
- Experimental probability is based on what actually occurred during a probability experiment.

Independent Events (Lesson 9-8)

• The probability of two independent events can be found by multiplying the probability of the first event by the probability of the second event.

Dependent Events (Lesson 9-8)

• If two events, A and B, are dependent, then the probability of both events occurring is the product of the probability of A and the probability of B after A occurs.

Disjoint Events (Lesson 9-8)

 If two events are disjoint, then the probability that either event will occur is the sum of their individual probabilities.

Key Vocabulary

combination (p. 480) complementary events (p. 462) composite event (p. 492) dependent events (p. 493) disjoint events (p. 494) experimental probability (p. 486) **Fundamental Counting**

Principle (p. 471)

independent events (p. 492) outcome (p. 460) permutation (p. 465) probability (p. 460) random (p. 461) sample space (p. 465) simple event (p. 460) theoretical probability (p. 486) tree diagram (p. 466)

Vocabulary Check

State whether each sentence is *true* or *false*. If *false*, replace the underlined word or number to make a true sentence.

- 1. <u>Composite events</u> consists of two or more simple events.
- 2. A random outcome is an outcome that occurs by chance.
- **3**. *P*(not *A*) is read the <u>permutation</u> of the complement of A.
- 4. The Fundamental Counting Principle counts the number of possible outcomes using the operation of addition.
- 5. Events in which the outcome of the first event does not affect the outcome of the other event(s) are <u>simple events</u>.
- 6. The <u>sample space</u> of an event is the set of outcomes not included in the event.
- 7. Events that cannot occur at the same time are called <u>dependent</u> events.



Lesson-by-Lesson Exercises and Examples

9-1

9-2

Simple Events (pp. 460–464)

A bag contains 6 red, 3 pink, and 3 white bows. Suppose you draw a bow at random. Find the probability of each event. Write as a fraction in simplest form.

- 8. *P*(red)
- 9. P(white)
- **10**. *P*(red or pink)
- **11**. *P*(*not* pink)
- **12**. *P*(red, white, or pink)
- 13. **ARRIVALS** The probability that a plane will arrive at the airport on time is $\frac{23}{25}$. Find the probability that the plane will *not* arrive on time. Write as a percent.

Example 1 What is the probability of rolling an odd number on a number cube?

$$P(\text{odd}) = \frac{\text{number of odd outcomes}}{\text{total number of possible outcomes}}$$
$$= \frac{3}{6} \text{ Three numbers are odd: 1, 3, and 5.}$$
$$= \frac{1}{2} \text{ Simplify.}$$
Therefore, $P(\text{odd}) = \frac{1}{2}$.

Sample Spaces (pp. 465–470)

For each situation, find the sample space using a table or tree diagram.

- 14. rolling a number cube and tossing a coin
- **15.** choosing from white, wheat, or rye bread and turkey, ham, or salami to make a sandwich.
- 16. GAMES Eliza and Zeke are playing a game in which Zeke spins the spinner shown and rolls a number cube. If the sum of the numbers is less than six, Eliza wins. Otherwise Zeke wins. Find the sample space. Then find the probability that Zeke wins.



Example 2 Ginger and Micah are playing a game in which a coin is tossed twice. If heads comes up exactly once, Ginger wins. Otherwise Micah wins. Find the sample space. Then find the probability that Ginger wins.

Make a tree diagram.

First Toss	Second Toss	Sample Space	
_ H <	H	— НН — НТ	Micah wins Ginger wins
∕ T <	H		Ginger wins Micah wins

There are four equally-likely outcomes with 2 favoring each player. The probability that Ginger wins is $\frac{2}{4}$ or $\frac{1}{2}$.



9-3

The Fundamental Counting Principle (pp. 471–474)

Use the Fundamental Counting Principle to find the total number of outcomes in each situation.

- **17**. rolling two number cubes
- making an ice cream sundae selecting from 5 flavors of ice cream and 4 different toppings
- 19. SHOPPING A catalog offers a jogging suit in three colors, gray, pink, and black. It comes in sizes S, M, L, XL, and XXL and is available with a hood or without a hood. If a jogging suit is selected at random, what is the probability that it will be a pink hooded suit in size medium?

Example 3 Use the Fundamental Counting Principle to find the total number of outcomes for a family that has four children.

There are 2 possible outcomes, a boy or a girl, each time a child is born. For a family with four children, there are $2 \cdot 2 \cdot 2 \cdot 2$, or 16 outcomes.

Example 4 Find the probability that, in a family of four children, all four children are girls.

There are 16 outcomes. There is one possible outcome resulting in four girls. So, the probability that all four children are girls is $\frac{1}{16}$.

9-4

Permutations (pp. 475–478)

- **20. BASKETBALL** In how many ways can five basketball players be placed in three positions: center, forward, and guard?
- 21. **LETTERS** How many permutations are there of the letters in the word *computer*?
- 22. **RUNNING** Jacinda and Raul are entered in a race with 5 other runners. If each runner is equally likely to win, what is the probability that Jacinda will finish first and Raul will finish second?

Example 5 Nathaniel needs to choose two of the chores shown to do after school. If he is equally likely to choose the chores, what is the probability that he will walk the dog first and rake the leaves second?

Chores

Walk the Dog Do Homework Clean the Kitchen Rake the Leaves

There are $4 \cdot 3$, or 12, arrangements in which Nathaniel can complete the chores. There is one way in which he will walk the dog first and rake the leaves second. So, the probability that he will walk the dog first and rake the leaves second is $\frac{1}{12}$.

9-5

Combinations (pp. 480–483)

- **23. PIZZA** How many three-topping pizzas are possible given eight different toppings?
- 24. **KITTENS** How many groups of three kittens are possible from a litter of six?
- **25. GAMES** In how many ways can Rondell select two board games from the ten games that his family owns?
- **26. QUIZ** Frances must answer 3 of the 5 questions on a quiz, numbered 1–5. What is the probability that Frances will answer questions 2, 3, and 4?



Example 6 Caitlin and Román are playing a game in which Román chooses four different numbers from 1–15. What is the probability that Caitlin will guess all four numbers correctly?

There are $15 \cdot 14 \cdot 13 \cdot 12$ permutations of four numbers chosen from 15 numbers. There are $4 \cdot 3 \cdot 2 \cdot 1$ ways to arrange the 4 numbers.

$$\frac{15 \cdot 14 \cdot 13 \cdot 12}{4 \cdot 3 \cdot 2 \cdot 1} = \frac{32,760}{24} \text{ or } 1,365$$

There are 1,365 ways to choose four numbers from 15 numbers. There is one way to guess all four numbers correctly, so the probability that Caitlin will guess all four numbers correctly is $\frac{1}{1,365}$.

9-6 PSI: Act it Out (pp. 484–485)

Solve each problem. Use the *act it out* strategy.

- **27. QUIZ** Determine whether tossing a coin is a good way to answer a 6-question true-false quiz. Justify your answer.
- 28. FAMILY PORTRAIT In how many ways can the Maxwell family pose for a portrait if Mr. and Mrs. Maxwell are sitting in the middle and their three children are standing behind them?
- **29. AMUSEMENT PARK** In how many ways can 4 friends be seated in 2 rows of 2 seats each on a roller coaster if Judy and Harold must ride together?

Example 7 In how many ways can three females and two males sit in a row of six seats at a concert if the females must sit in the first three seats?

Place five desks or chairs in a row. Have three females and two males sit in any of the seats as long as the females sit in the first three seats. Continue rearranging until you find all the possibilities. Record the results.

F_1	F_2	F_3	M_1	M_2	F_2	F_3	F_1	M_1	M_2
F_1	F_2	F_3	M_2	M_1	F_2	F_3	F_1	M_2	M_1
F_1	F_3	F_2	M_1	M_2	F_3	F_2	F_1	M_1	M_2
F_1	F_3	F_2	M_2	M_1	F_3	F_2	F_1	M_2	M_1
F_2	F_1	F_3	M_1	M_2	F_3	F_1	F_2	M_1	M_2
F_2	F_1	F_3	M_2	M_1	F_3	F_1	F_2	M_2	M_1

There are 12 possible arrangements.



HAPTER

9-7

Theoretical and Experimental Probability (pp. 486–490)

The results of spinning a spinner labeled A-E fifty times are given. Fin the experimental probability of each event.

	Letter	Frequency
nd –	А	8
	В	17
	С	9
	D	6
	E	10

30. *P*(A) **31**. *P*(D) **32**. *P*(E)

33. *P*(A or B) **34**. *P*(*not* C) **35**. *P*(B or D)

36. If the spinner is equally likely to land on each section, what is the theoretical probability of landing on B?

Example 8 A coin is tossed 75 times, and it lands on tails 55 times. What is the experimental probability of the coin landing on heads?

The coin landed on heads 20 times.

$$P(\text{heads}) = \frac{\text{number of times heads occurs}}{\text{total number of possible outcomes}}$$
$$= \frac{20}{75} \text{ or } \frac{4}{15}$$

So, the experimental probability of the coin landing on heads is $\frac{4}{15}$ or about 27%.

9-8

Compound Events (pp. 492–497)

A bag contains 6 green, 8 white, and 2 blue counters. Two counters are randomly drawn. Find each probability if the first counter is replaced before the second counter is drawn. Then find each probability if the first counter is not replaced.

- **37**. *P*(green, blue)
- **38**. *P*(2 white)
- **39**. *P*(blue, not white)
- **40**. *P*(not white, green)
- 41. **PROBABILITY** A coin is tossed and a number cube is rolled. Find the probability that tails and a number less than 5 comes up.
- **42. COMPUTERS** A computer randomly generates a digit from 0–9. Find the probability that an odd number or the number 8 is generated.

Example 9 A box contains 12 solid, 14 striped, and 10 spotted marbles. You reach in and grab two marbles. Find the probability of choosing a striped marble, replacing it, and then choosing a spotted marble.

 $P(\text{striped}) = \frac{14}{36}$

 $P(\text{spotted}, \text{after replacing the striped}) = \frac{10}{36}$

$$\frac{14}{36} \cdot \frac{10}{36} = \frac{140}{1,296} \text{ or } \frac{35}{324}$$

So, the probability of choosing a striped marble, replacing it, and then choosing a spotted marble is $\frac{35}{324}$, or about 11%.

Practice Test

The spinner shown has an equal chance of landing on each number. Find each probability.



- 1. *P*(odd number)
- **2**. *P*(1 or 7)

CHAPTER

- **3**. *P*(*not* a prime number)
- **4**. *P*(number greater than 1)

For each situation, use a table or a tree diagram to find the sample space.

- 5. A coin is tossed three times.
- **6.** A letter is chosen from the word *MATH* and then a digit from the number 123.
- GAMES Randall and Lucy are playing a game in which Lucy rolls a number cube and selects a card from the cards *A* and *B*. If a number less than 4 and a consonant comes up,



Lucy wins. Otherwise Randall wins. Find the sample space. Then find the probability that Lucy wins.

Use the Fundamental Counting Principle to find the total number of outcomes in each situation.

- 8. A 3-digit security code is chosen.
- 9. A number cube is rolled four times.
- 10. **STANDARDS PRACTICE** A cooler contains 8 grape juice boxes, 12 orange juice boxes, and 4 apple juice boxes. If a juice box is selected at random, what is the probability that it will be grape?

Α	50%	C	$0.1\overline{6}$
В	$\frac{1}{3}$	D	$\frac{5}{6}$

- **11. PARADES** If there are 50 floats in a parade, how many ways can a first place and a second place trophy be awarded?
- 12. **STANDARDS PRACTICE** A brand of yogurt has 15 different flavors. Which of the following gives the number of ways in which you can choose three flavors?

F	2,730	Η	45
G	455	J	5

- **13. CAMPING** Four campers are chosen from nine to pitch the tents. If Sandy, Jarrod, Dyami, and Clara are among the nine campers, find the probability that they are chosen.
- 14. **SCHOOL** Determine whether spinning a spinner with five equal sections would be a good way to answer a 5-question multiple-choice quiz if each question has answer choices *A*, *B*, *C*, *D*, and *E*. Justify your answer.
- **15. SURVEY** Two hundred fifty teenagers were asked what type of pet they owned. The results of the survey are in the table. What is the experimental probability that a teenager owns a pet? Write as a percent.

Pet	Number of Teenage Pet Owners
fish	26
cat	65
dog	86
bird	20
other	38
no pet	15 📖

16. POPCORN Two variety bags of popcorn each contain 100 pieces of regular popcorn, 60 pieces of cheese popcorn, and 40 pieces of caramel popcorn. Peter picks one piece of popcorn from each bag. What is the probability that he picks caramel from the first bag and regular from the second bag?

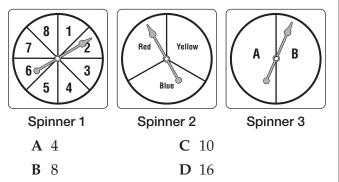
CHAPTER

California Standards Practice Cumulative, Chapters 1–9



Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.

1 Jessica played a game where she spun each of the spinners shown below once. If she spins an even number on Spinner 1, red or yellow on Spinner 2, and a B on Spinner 3, how many possible unique combinations are there?



2 Mr. Campos bought 40 pencils priced at 8 for \$0.99 and 3 dozen notebooks priced at 4 for \$2.49. Find the total amount, not including tax, Mr. Campos spent on pencils and notebooks.

F	\$28.86	Н	\$17.88
G	\$27.36	J	\$15.96

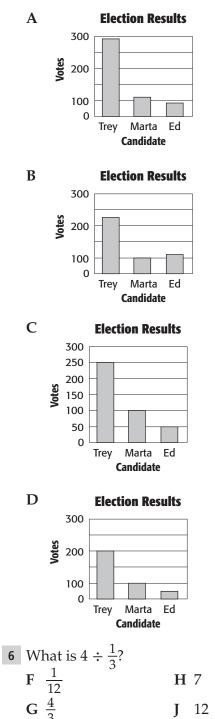
3 In a movie theatre there are 168 seats. If 75% of the theatre is filled, how many people are sitting in the movie theatre?

A	156	C	134
B	148	D	126

4 Mr. Blackwell gave his math students a pop quiz. The students' scores are listed below. What is the median quiz score?

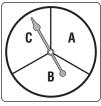
		23	19	18	12	21	24	25
F	12]	H 2	4	
G	21				J	2	5	

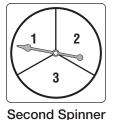
5 The results of an election for student body president showed that Trey received 250 votes, Marta 100 votes, and Ed 50 votes. Which of the following correctly displays the election results?



More California Standards Practice For practice by standard, see pages CA1–CA39.

 Hanako spins each spinner shown below once. Find the total possible letter/number combinations that could have resulted from Hanako's spins.





First Spinner

- **A** 3
- **B** 6
- **C** 9
- **D** 12
- **8** Juan rolled a number cube four times. Each time, the number 3 appeared. If Juan rolls the number cube one more time, what is the probability that the number 3 will appear?
 - **F** $\frac{2}{3}$ **H** $\frac{1}{6}$ **G** $\frac{1}{2}$ **J** $\frac{5}{6}$
- **9** The owner of a fruit stand has *x* pounds of apples on display. She sells 30 pounds and then adds 4*y* pounds of apples to the display. Which of the following expressions represents the weight in pounds of the apples that are now on the display?

A
$$x + 30 + 4y$$

B
$$x - 30 + 4y$$

C
$$x + 30 - 4y$$

D
$$x - 30 - 4y$$

A building is 182 meters tall. About how tall is the building in feet and inches? (1 meter ≈ 39 inches)

F	56 ft 0 in.	H 591 ft 5 in.
G	546 ft 5 in.	I 591 ft 6 in.

11 Wilson has 7 different pieces of fruit in his refrigerator. If he randomly selects 3 pieces of fruit, how many possible unique combinations are there?

A 7	C 21
B 14	D 35

EST-TRACING TIP

Question 11 You may want to find your own answer before looking at the answer choices. Doing so keeps you from being tempted by wrong answer choices that look correct, but are still wrong.

Pre-AP

Record your answers on a sheet of paper. Show your work.

- 12 Paula has a 5-disc CD player. She has jazz, country, rap, pop, and R&B CDs in the player. She listens to the CDs on random mode on both Friday and Saturday night.
 - **a**. Make a tree diagram that shows all of the possible outcomes.
 - **b**. What is the probability that Paula will hear a country song first on Friday night?
 - **c.** What is the probability that Paula will hear a rap song first on Friday night and a jazz song first on Saturday night?

NEED EATRA HELP?												
If You Missed Question	1	2	3	4	5	6	7	8	9	10	11	12
Go to Lesson	9-2	1-1	7-1	8-2	8-4	5-7	9-2	9-8	3-1	6-4	9-2	9-8
For Help with Standard	SDAP3.3	MR1.1	NS1.4	SDAP1.1	SDAP2.3	NS2.1	SDAP3.1	SDAP3.5	AF1.1	AF2.1	SDAP3.1	SDAP3.5

Unit 5 Geometry and Measurement

Focus

Use π , geometric properties, relationships, and formulas to model and analyze situations and solve problems.

CHAPTER 10 Geometry: Polygons

BIG Idea) Identify and describe the properties of two-dimensional figures.

CHAPTER 11 Measurement: Two- and Three-Dimensional Figures

BIG Idea) Deepen understanding of the measurement of plane and solid shapes and use this understanding to solve problems.

BIG Idea) Construct figures that meet given conditions and by identifying attributes of figures.

BIG Idea) Investigate geometric patterns and describe them algebraically.

CHAPTER 12 Looking Ahead to Grade 7: Geometry and Measurment

BIG Idea) Know the Pythagorean Theorem and deepen the understanding of plane and solid geometric shapes.

Cross-Curricular Project

Math and History

It's All Greek To Me Are you ready for some time travel? You've been selected to join us on an adventure back to the time of the ancient Greeks. Along the way, you'll research the life and mathematical discoveries of Pythagoras. You'll also explore many three-dimensional solids known to the ancient Greeks and construct one of your own. Our time machine will be leaving soon, so pack your geometry tool kit and prepare to meet a geometry giant!

Math Dine Log on to ca.gr6math.com to begin.





 Standard 6MG2.0 Identify and describe the properties of two-dimensional figures.

Key Vocabulary

complementary angles (p. 514) line of symmetry (p. 558) similar figures (p. 540) supplementary angles (p. 514)

Geometry: Polygons



Real-World Link

Tigers Geometry is used to explain how the face of a tiger shows a line of vertical reflection symmetry.



Geometry: Polygons Make this Foldable to help you organize your notes. Begin with a piece of 11" by 17" paper.

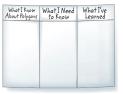
O Fold a 2" tab along the long side of the paper.



2 Unfold the paper and fold in thirds widthwise.



Open and draw lines along the folds. Label the head of each column as shown. Label the front of the folded table with the chapter title.



GET READY for Chapter 10

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 2

Option

Math Online Take the Online Readiness Quiz at ca.gr6math.com.

Take the Quick Check below. Refer to the Quick Review for help.

QUICKCheck

Multiply or divide. Round to the nearest hundredth if necessary. (Prior Grade)

1 . 360 × 0.85	2 . 48 ÷ 191
3 . 24 ÷ 156	4 . 0.37 × 360
5 . 33 ÷ 307	6 . 0.69 × 360

Solve each equation. (Lesson 3-2)

- **7.** 122 + x + 14 = 180
- **8**. 45 + 139 + k + 17 = 360
- **9. SCHOOL** There are 180 school days at Lee Middle School. If school has been in session for 62 days and there are 13 days until winter break, how many school days are after the break? (Lesson 3-2)

Solve each proportion. (Lesson 6-5)

10. $\frac{4}{a} = \frac{3}{9}$	11. $\frac{7}{16} = \frac{h}{32}$
12. $\frac{5}{8} = \frac{15}{y}$	13. $\frac{t}{42} = \frac{6}{7}$

14. READING Sandra can read 28 pages of a novel in 45 minutes. At this rate, how many pages can she read in 135 minutes? (Lesson 6-5)

QUICKReview

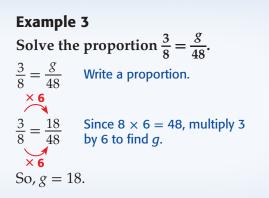
Example 1
Find 0.92 × 360.
360
$\times 0.92$ - Two decimal places
720
<u>+ 32400</u>
331.20
So, $0.92 \times 360 = 331.2$.

Example 2

Solve the equation. 46 + 90 + p = 180.

46 + 90 + p = 180 136 + p = 180 -136 - 136p = 44 Write the equation. Add 46 and 90. Subtract 136 from each side.

The solution to the equation 46 + 90 + p = 180 is p = 44.



Angle Relationships

Main IDEA

Classify angles and identify vertical and adjacent angles.

Standard 6MG2.1 Identify angles as vertical, adjacent, complementary, or supplementary and provide descriptions of these terms.

NEW Vocabulary

angle degrees vertex congruent angles right angle acute angle obtuse angle straight angle vertical angles adjacent angles



Geometry symbols

- ∠ angle
- ° degree

READING in the Content Area

For strategies in reading this lesson, visit ca.gr6math.com.

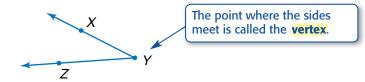
GET READY for the Lesson

CLOCKS The hands of a clock form angles of different sizes.



- 1. Name other times in which the hands of a clock form angles less than 90°, equal to 90°, and greater than 90°.
- **2.** How many degrees is the angle that is formed by clock hands at 6:00?

An **angle** has two sides that share a common endpoint and is measured in units called **degrees**. If a circle were divided into 360 equal-sized parts, each part would have an angle measure of 1 degree (1°).



An angle can be named in several ways. The symbol for angle is \angle .

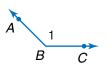
EXAMPLE Naming Angles

- Name the angle at the right.
 - Use the vertex as the middle letter and a point from each side.
 ∠ABC or ∠CBA
 - Use the vertex only. $\angle B$
 - Use a number.

The angle can be named in four ways: $\angle ABC$, $\angle CBA$, $\angle B$, or $\angle 1$.

CHECK Your Progress

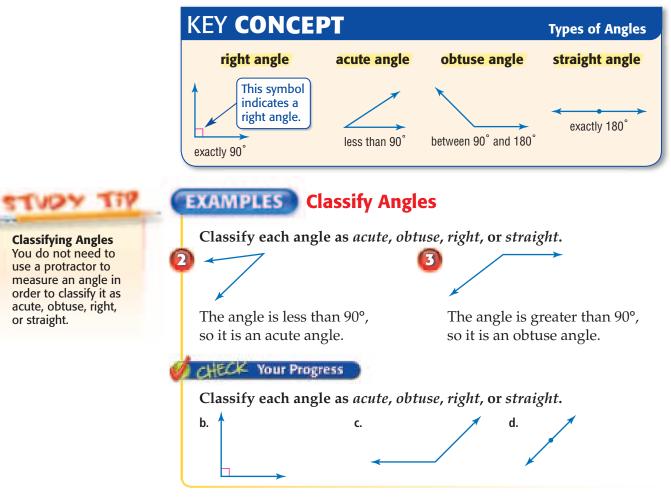
a. Name the angle shown in four ways.



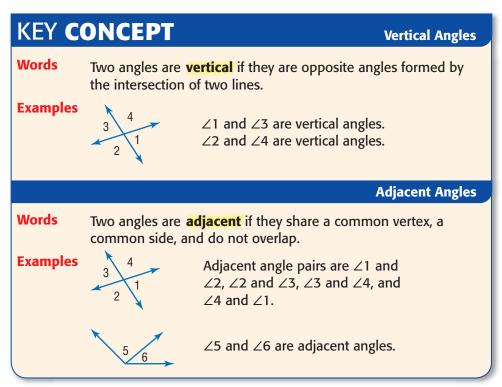




Angles are classified according to their measure. Two angles that have the same measure are said to be **congruent**.



Some angle pairs share a special relationship.



Math Tige Extra Examples at <u>ca.gr6math.com</u>



Real-World Link . The United States has a total of 6,407,637 kilometers of roadways. Of these, 4,164,637 kilometers are paved. Source: Central

Real-World EXAMPLE

INTERSECTIONS Identify a pair of A) vertical angles in the diagram at the right. Justify your response.

Since $\angle 2$ and $\angle 4$ are opposite angles formed by the intersection of two lines, they are vertical angles. Similarly, $\angle 1$ and $\angle 3$ are also vertical angles.



CHECK Your Progress

Refer to the diagram at the right. Identify each of the following. Justify your response.

e. a pair of vertical angles

f. a pair of adjacent angles

Personal Tutor at ca.gr6math.com

Your Understanding

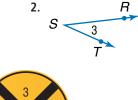
Examples 1–3 (pp. 510-511)

Intelligence Agency

Name each angle in four ways. Then classify the angle as *acute*, *right*, obtuse, or straight.



3. **RAILROADS** Identify a pair

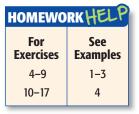


Example 4 (p. 512)

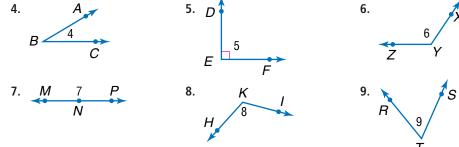
of vertical angles on the railroad crossing sign. Justify your response.



Exercises



Name each angle in four ways. Then classify the angle as *acute*, *right*, obtuse, or straight.



EXTRAPRACTICE	•
See pages 704, 724.	
Math 🍚 🛯 🛄 🙂	
Self-Check Quiz at <u>ca.gr6math.com</u>	

For Exercises 10–15, refer to the diagram at the right. Identify each angle pair as *adjacent*, *vertical*, or *neither*.

10. $\angle 2$ and $\angle 5$ **11.** $\angle 4$ and $\angle 6$ **12.** $\angle 3$ and $\angle 4$ **13.** $\angle 5$ and $\angle 6$ **14.** $\angle 1$ and $\angle 3$ **15.** $\angle 1$ and $\angle 4$

GEOGRAPHY For Exercises 16 and 17, use the diagram at the right and the following information.

The corner where the states of Utah, Arizona, New Mexico, and Colorado meet is called the Four Corners.

- **16**. Identify a pair of vertical angles. Justify your response.
- **17**. Identify a pair of adjacent angles. Justify your response.

H.O.T. Problems ... CHALLENGE For Exercises 18 and 19, determine whether each statement is *true* or *false*. If the statement is true, provide a diagram to support it. If the statement is false, explain why.

18. A pair of obtuse angles can also be vertical angles.

∕angle

- **19**. A pair of straight angles can also be adjacent angles.
- 20. **WRITING IN MATH** Describe the differences between vertical and adjacent angles.

STANDARDS PRACTICE

- 21. Which word best describes the angle marked in the figure?
 - A acute
 - B obtuse
 - C right
 - D straight

22. Which of the following is true in the diagram?

F $\angle 1$ and $\angle 4$ are adjacent angles.

- **G** $\angle 2$ and $\angle 3$ are vertical angles.
- **H** \angle 3 and \angle 4 are vertical angles.
- J $\angle 2$ and $\angle 3$ are adjacent angles.

Spiral Review

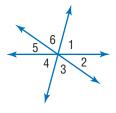
A coin is tossed twice and a number cube is rolled. Find each probability. (Lesson 9-8)

- **23**. *P*(2 heads and 6) **24**. *P*(1 head, 1 tail, and a 3) **25**. *P*(2 tails and *not* 4)
- **26. PROBABILITY** Anica spins a spinner fifty times, and it lands on 3 fifteen times. What is the experimental probability of *not* landing on 3? (Lesson 9-7)

.....

GET READY for the Next Lesson

ALGEBRA Solve each equation. Check your solution. (Lesson 3-2)27. 44 + x = 9028. 117 + x = 18029. 90 = 36 + x30. 180 = 75 + x





Complementary and Supplementary Angles

Main IDEA

Identify complementary and supplementary angles and find missing angle measures.

angle.

Standard 6MG2.1 Identify angles as vertical, adjacent,

complementary, or supplementary and provide descriptions of these terms. Standard 6MG2.2 Use the properties of complementary and supplementary angles and the sum of the angles of a triangle to solve problems involving an unknown

NEW Vocabulary

complementary angles supplementary angles

READING Math

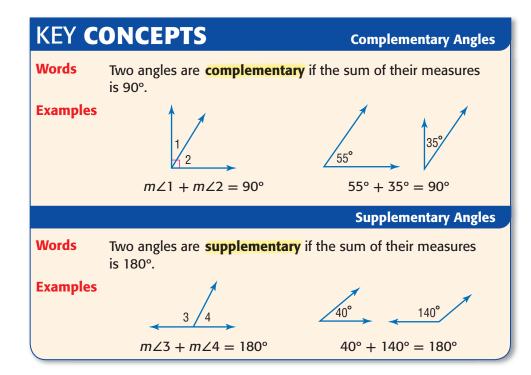
Angle Measure The notation $m \ge 1$ is read the measure of angle 1.

MINI Lab

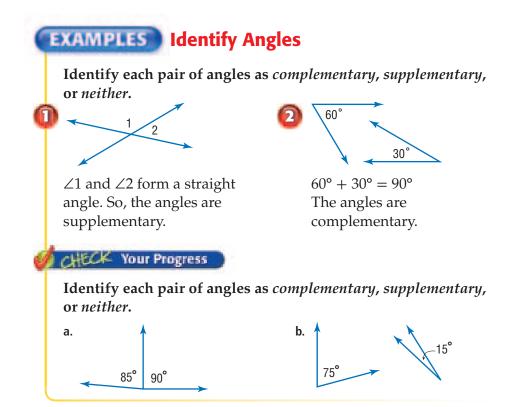
GEOMETRY Refer to $\angle A$ shown at the right.

- 1. Classify it as *acute*, *right*, *obtuse*, or *straight*.
- Copy the angle onto a piece of paper. Then draw a ray that separates the angle into two congruent angles. Label these angles ∠1 and ∠2.
- **3**. What is $m \angle 1$ and $m \angle 2$?
- **4**. What is the sum of $m \angle 1$ and $m \angle 2$?
- Copy the original angle onto a piece of paper. Then draw a ray that separates the angle into two non-congruent angles. Label these angles ∠3 and ∠4.
- **6**. What is true about the sum of $m \angle 3$ and $m \angle 4$?
- 7. Complete Exercises 1–6 for ∠B shown at the right.

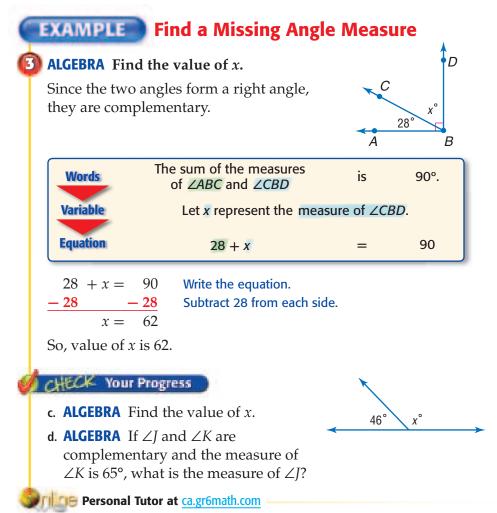
A special relationship exists between two angles whose sum is 90°. A special relationship also exists between two angles whose sum is 180°.



You can use these relationships to identify complementary and supplementary angles.



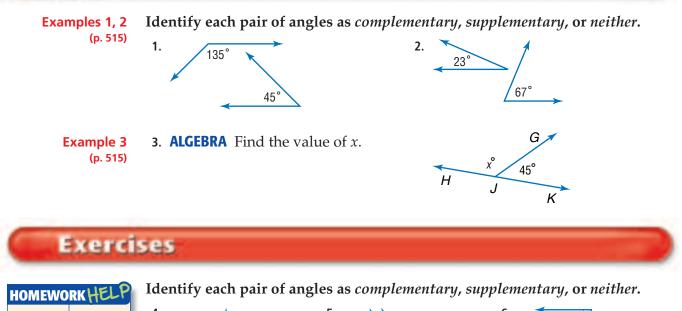
You can use angle relationships to find missing measures.



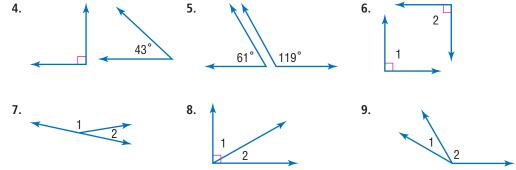
READING Math

Perpendicular Lines or sides that meet to form right angles are perpendicular.

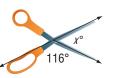
CHECK Your Understanding

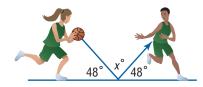


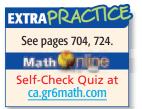
HOMEWO	RKHELF	
For Exercises	See Examples	4
4–9	1, 2	
10–11	3	



- **10. ALGEBRA** If $\angle A$ and $\angle B$ are complementary and the measure of $\angle B$ is 67°, what is the measure of $\angle A$?
- **11. ALGEBRA** What is the measure of $\angle J$ if $\angle J$ and $\angle K$ are supplementary and the measure of $\angle K$ is 115°?
- **12. SCHOOL SUPPLIES** What is the measure of the angle given by the opening of the scissors, *x*?
- **13. BASKETBALL** Beatriz makes a bounce pass to Tyrone. Find the value of *x* so that Beatriz's pass hits Tyrone's hands.

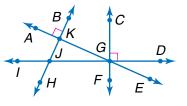


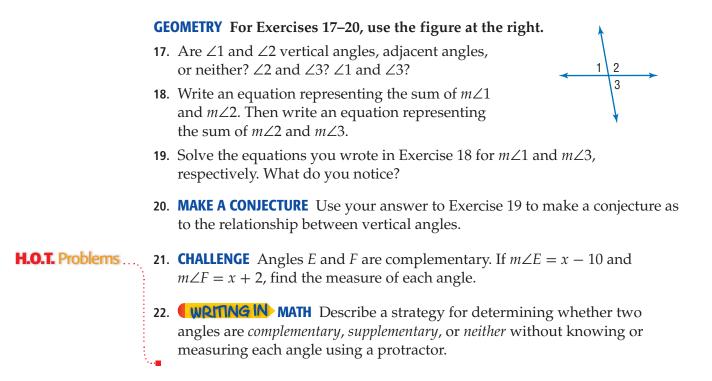




Use the figure at the right to name the following.

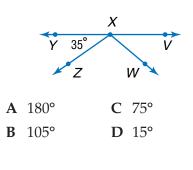
- 14. a pair of supplementary angles
- **15**. a pair of complementary angles
- **16**. a pair of vertical angles



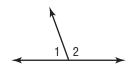


STANDARDS PRACTICE

23. In the figure below, $m \angle YXZ = 35^{\circ}$ and $m \angle WXV = 40^{\circ}$. What is $m \angle ZXW$?



24. Which is a true statement about angles 1 and 2 shown below?



- **F** $\angle 1$ is complementary to $\angle 2$.
- **G** $\angle 1$ and $\angle 2$ are vertical angles.
- **H** $\angle 1$ is supplementary to $\angle 2$.
- J Both angles are obtuse.



- 25. Name the angle at the right in four ways. Then classify it as *acute*, *right*, *obtuse*, or *straight*. (Lesson 10-1)
- **26. MEASUREMENT** A house for sale has a rectangular lot with a length of 250 feet and a width of 120 feet. What is the area of the lot? (Lesson 3-6)

GET READY for the Next Lesson

 PREREQUISITE SKILL Multiply or divide. Round to the nearest hundredth if necessary. (p. 674 and p. 676)

 27. 0.62 ⋅ 360
 28. 360 ⋅ 0.25
 29. 17 ÷ 146
 30. 63 ÷ 199

Statistics: Display Data in a Circle Graph

Main IDEA

Construct and interpret circle graphs.



in appropriate graphs and representations (e.g., histogram, circle graphs) and explain which types of graphs are appropriate for various data sets.

NEW Vocabulary

circle graph

GET READY for the Lesson

COLORS In a recent survey, people ages 13–20 were asked to choose their favorite shade of blue. The results are shown in the table.

- 1. Explain how you know that each person surveyed chose only one shade of blue.
- **2.** If 500 people took part in the survey, how many preferred aquamarine?

Favorite Shade of Blue for People Ages 13–20	
Shade	Percent
Navy	35%
Sky/Light Blue	30%
Aquamarine 17%	
Other 18%	

Source: Amercian Demographics

Navy 35%

Other

18%

Sky/Light Blue

30%

Aquamarine 17%

A graph that shows data as parts of a whole is called a **circle graph**. In a circle graph, the percents add up to 100.

EXAMPLE Display Data in a Circle Graph

1 COLORS Display the data above in a circle graph.

• There are 360° in a circle. Find the degrees for each part.

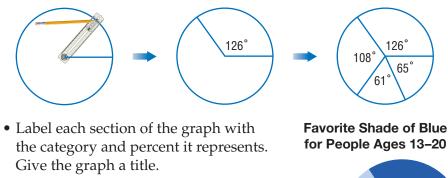
35% of $360^\circ = 0.35 \cdot 360^\circ$ or 126° Round to the nearest whole degree.

30% of $360^{\circ} = 0.30 \cdot 360^{\circ}$ or 108°

17% of 360° = $0.17 \cdot 360^\circ$ or about 61°

 $18\% \text{ of } 360^\circ = 0.18 \cdot 360^\circ \text{ or about } 65^\circ$

• Draw a circle with a radius as shown. Then use a protractor to draw the first angle, in this case 126°. Repeat this step for each section or *sector*.



Check To draw an accurate circle graph, make sure the sum of the angle measures is equal to, or is approximately equal to, 360°.





a. **SCIENCE** The table shows the present composition of Earth's atmosphere. Display the data in a circle graph.

Composition of Earth's Atmosphere		
Element	Percent	
Nitrogen	78%	
Oxygen	21%	
Other gases	1%	
Source: www.nasa.gov		

When constructing a circle graph, you may need to first convert the data to ratios and decimals and then to degrees and percents.

EXAMPLE Construct a Circle Graph

- **2 OLYMPICS** The table shows the number of each type of medal won by the United States during the Summer Olympics from 1896 to 2004. Make a circle graph of the data.
 - Find the total number of medals: 907 + 697 + 615 or 2,219.
 - Find the ratio that compares each number with the total. Write the ratio as a decimal rounded to the nearest hundredth.

gold: $\frac{907}{2,219} \approx 0.41$ silver: $\frac{697}{2,219} \approx 0.31$ bronze: $\frac{615}{2,219} \approx 0.28$

• Find the number of degrees for each section of the graph.

gold: $0.41 \cdot 360^\circ \approx 148^\circ$

silver: $0.31 \cdot 360^{\circ} \approx 112^{\circ}$

bronze: $0.28 \cdot 360^{\circ} \approx 101^{\circ}$

Because of rounding, the sum of the degrees is 361°.

• Draw the circle graph.

0.41 = 41%, 0.31 = 31%, 0.28 = 28%

Check After drawing the first two sections, you can measure the last section of a circle graph to verify that the angles have the correct measures.

CHECK Your Progress

b. OLYMPICS The number of Winter Olympic medals won by the U.S. from 1924 to 2002 is shown in the table. Display the data in a circle graph.

U.S. Winter Olympic Medals	
Туре	Number
Gold	69
Silver 72	
Bronze 52	
Source: answers.com	



Real-World Link The United States has won 2,219 Summer Olympic medals through 2004, the most for any country. Source: infoplease.com

Math The Extra Examples at <u>ca.gr6math.com</u>

Ion Feingersh/COBBIS

U.S. Summer Olympic Medals 6 Type Number Gold 907 Silver 697 Bronze 615

U.S. Summer

Olympic Medals

Silver 31%

Gold

Bronze

28%

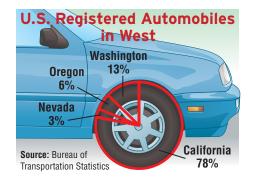
Source: infoplease.com

EXAMPLES Analyze a Circle Graph

AUTOMOBILES The graph shows the percent of automobiles registered in the western United States in a recent year.

3 Which state had the most registered automobiles?

> The largest section of the circle is the one representing California. So, California has the most registered automobiles.



If 24.0 million automobiles were registered in these states, how many more automobiles were registered in California than Oregon?

California: 78% of 24.0 million $\rightarrow 0.78 \times 24.0$, or 18.72 million Oregon: 6% of 24.0 million \rightarrow 0.06 × 24.0, or 1.44 million There were 18.72 million - 1.44 million, or 17.28 million more registered automobiles in California than in Oregon.

CHECK Your Progress

- c. Which state had the least number of registered automobiles? Explain.
- d. What was the total number of registered automobiles in Washington and Oregon?

2.

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Your Understanding

Examples 1, 2

(pp. 518-519)

1

Display each set of data in a circle grap	n.
---	----

Blood Types in the U.S.	
Blood Type	Percent
0	44%
A	42%
В	10%
AB	4%

Source: Stanford School of Medicine

Examples 3, 4 (p. 520)

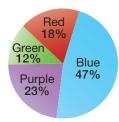
COLORS For Exercises 3 and 4, use the graph that shows the results of a survey.

- 3. What color is most favored?
- 4. If 400 people were surveyed, how many more people favored purple than red?

Population of U.S. by Region	
Region	Population (millions)
Northeast	54
Midwest	65
South	104
West	66

Source: U.S. Census Bureau, 2004

Favorite Color



TVOY TH

Check for Reasonableness To check Example 4, you can estimate and solve the problem

another way. $78\% - 6\% \approx 70\%$ 70% of 24 is 17

Since 17.28 is about 17. the answer is reasonable.

Exercises

HOMEWORK HELP	
For Exercises	See Examples
5–6	1
7–8	2
9–14	3,4

Display each set of data in a circle graph.

5.	U.S. Steel Roller Coasters		
	Туре	Percent	
	Sit down	86%	
	Inverted	8%	
	Other	6%	
		-	



7.	Endangered Species in U.S.					
	Species	Number of Species				
	Mammals	68				
	Birds	77				
	Reptiles	14				
	Amphibians	11				

Source: U.S. Fish and Wildlife Service

EDUCATION For Exercises 9–11, use the circle graph that shows the percent of students by grade level in U.S. schools.

- 9. In which grades are most students?
- **10.** About how many times more students are there in grades 1–8 than in grades 9–12?
- 11. There are about 75 million students in U.S. schools. How many students are in grades 9–12?

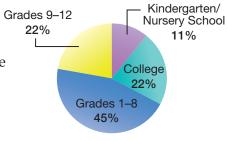
6.	New York City Commuters					
	Transportation	Percent				
	Driving Alone	24%				
	Carpool/Other	23%				
	Public Transit	53%				

Source: Time Almanac

8.	Speed Limits in U.S.					
	Speed Limit (mph)	Number of States				
	60	1				
	65	20				
	70	16				
	75	13				

Source: The World Almanac

Grade Level of U.S. Students



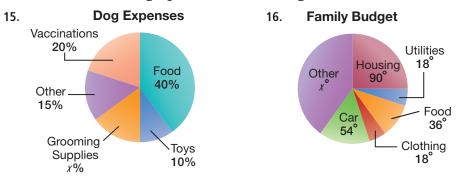
Source: U.S. Census Bureau

MONEY For Exercises 12–14, use the graph that shows the results of a survey about a common currency for North America.



- 12. What percent of Americans favor a common North American currency?
- **13**. Based on these results, about how many of the approximately 298 million Americans would say "Don't Know" in response to this survey?
- 14. About how many more Americans oppose a common currency than favor it?

DATA SENSE For each graph, find the missing values.



Select an appropriate type of graph to display each set of data: line graph, bar graph, or circle graph. Then display the data using the graph.

17.	Top 5 Presidential Birth States						
	Place Presidents						
	Virginia	8					
	Ohio	7					
	Massachusetts	4					
	New York	4					
	Texas	3					

18.	Tanya's Day						
	Activity Percent						
	School	25%					
	Sleep	33%					
	Homework	12%					
	Sports	8%					
	Other	22%					

Source: The World Book of Facts

GEOGRAPHY For Exercises 19–21, use the table.

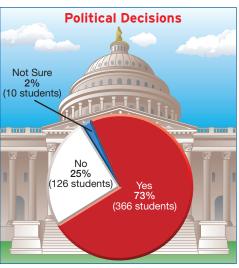
- **19**. Display the data in a circle graph.
- **20**. Use your graph to find which two lakes equal the size of Lake Superior.
- **21.** Compare the size of Lake Ontario to the size of Lake Michigan.

POLITICS For Exercises 22 and 23, use the graph and information below.

A group of students were asked whether people their age could make a difference in the political decisions of elected officials.

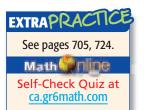
- **22.** How many students participated in the survey?
- **23**. Write a convincing argument explaining whether or not it is reasonable to say that 50% more students said they could make a difference than those who said they could not make a difference.

Sizes of U.S. Great Lakes				
Lake	Size (sq mi)			
Erie	9,930			
Huron	23,010			
Michigan	22,400			
Ontario	7,520			
Superior	31,820			



Source: momslife.com and Mothering Magazine

FIND THE DATA Refer to the California Data File on pages 16–19. Choose some data that can be displayed in a circle graph. Then display the data in a circle graph and write one statement analyzing the data.





H.O.T. Problems

25. CHALLENGE The graph shows the results of a survey about students' favorite school subject. About what percent of those surveyed said that math was their favorite subject? Explain your reasoning.

- **26. COLLECT THE DATA** Collect some data from your classmates that can be represented in a circle graph. Then create the circle graph and write one statement analyzing the data.
- 27. **WRITING IN MATH** The table shows the percent of people that like each type of fruit juice. Can the data be represented in a circle graph? Justify your answer.

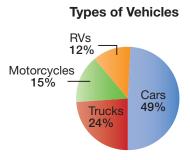


Fruit Juice	Percent
Apple	54%
Grape	48%
Orange	37%
Cranberry	15%

4

STANDARDS PRACTICE

28. The graph shows the type of vehicles that used Highway 82 during one month.



Which statement is true according to the circle graph shown?

- A More cars used the highway than RVs and trucks combined.
- **B** More than half the vehicles that used the highway were cars.
- **C** More RVs used the highway than trucks.
- **D** More trucks used the highway than cars.

Spiral Review

- **29. GEOMETRY** Refer to the diagram at the right. Identify a pair of vertical angles. (Lesson 10-1)
- **30. ALGEBRA** $\angle A$ and $\angle B$ are complementary. If $m \angle A = 15^{\circ}$, find $m \angle B$. (Lesson 10-2)



PREREQUISITE SKILL Solve each equation. (Lesson 3-2)

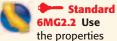
31. x + 112 = 180 **32.** 50 + t = 180 **33.** 180 = 79 + y **34.** 180 = h + 125

Triangles

Main IDEA

Identify and classify triangles.

-4.



of complementary and supplementary angles and the sum of the angles of a triangle to solve problems involving an unknown angle.

Standard 6MG2.3

Draw quadrilaterals and triangles from given information about them (e.g., a quadrilateral having equal sides but no right angles, a right isosceles triangle.)

NEW Vocabulary

triangle congruent segments acute triangle right triangle obtuse triangle scalene triangle isosceles triangle equilateral triangle

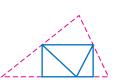
READING Math

Angle Measure The symbol *m*, used just before the name of an angle, refers to the measure of that angle.

MINI Lab

- **STUPI**) Use a straightedge to draw a triangle with three acute angles. Label the angles A, B, and C. Cut out the triangle.

- - **STEP2**) Fold $\angle A$, $\angle B$, and $\angle C$ so the vertices meet on the line between angles A and C.

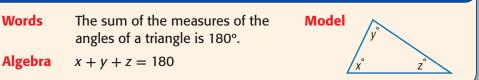


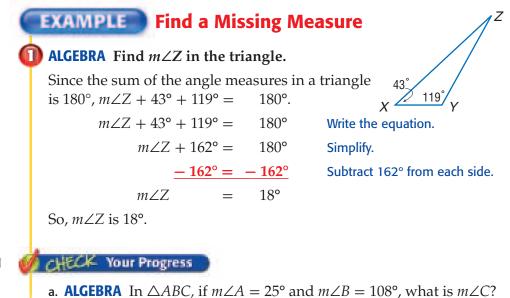
Angles of a Triangle

- 1. What kind of angle is formed where the three vertices meet?
- 2. Repeat the activity with another triangle. Make a conjecture about the sum of the measures of the angles of any triangle.

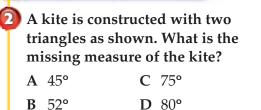
A **triangle** is a figure with three sides and three angles. The symbol for triangle is \triangle . There is a relationship among the three angles in a triangle.

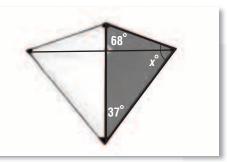
KEY CONCEPT





STANDARDS EXAMPLE





Read the Item

To find the missing measure, write and solve an equation.

Solve the Item

x + 68 + 37 = 180 The sum of the measures is 180. x + 105 = 180 Simplify. -105 = -105 Subtract 105 from each side. x = 75

The answer is C.

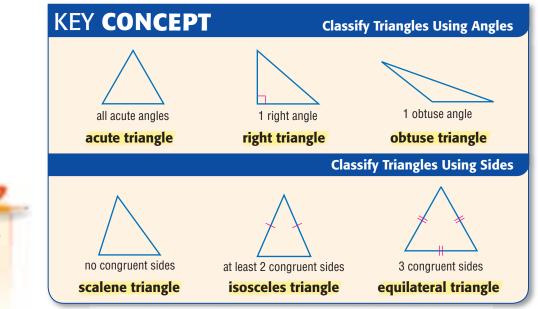
CHECK Your Progress

b. The frame of a bicycle shows a triangle. What is the missing measure?
F 31° H 45°
G 40° J 50°



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Every triangle has at least two acute angles. One way you can classify a triangle is by using the third angle. Another way to classify triangles is by their sides. Sides with the same length are **congruent segments**.





To check the results, add the three angle measures to see if they equal 180.

75 + 68 + 37 = 180 *I*he answer is correct.



Congruent Segments The marks on the sides of the triangle indicate that those sides are congruent.



Real-World Link There are two main types of roofs—flat and pitched. Most houses have pitched, or sloped, roofs. A

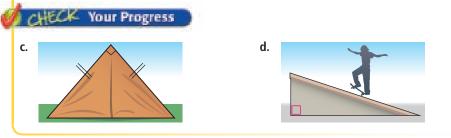
pitched roof generally lasts 15 to 20 years. **Source:** National Association of Certified Home Inspectors

Real-World EXAMPLE

3 Classify the marked triangle at the right by its angles and by its sides.



The triangle on the side of a house has one obtuse angle and two congruent sides. So, it is an obtuse, isosceles triangle.



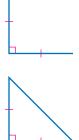
EXAMPLES Draw Triangles

Draw a triangle with one right angle and two congruent sides. Then classify the triangle.

Draw a right angle. The two segments should be congruent.

Connect the two segments

to form a triangle.



The triangle is a right isosceles triangle.

5 Draw a triangle with one obtuse angle and no congruent sides. Then classify the triangle.

Draw an obtuse angle. The two segments of the angle should have different lengths.

Connect the two segments to form a triangle.

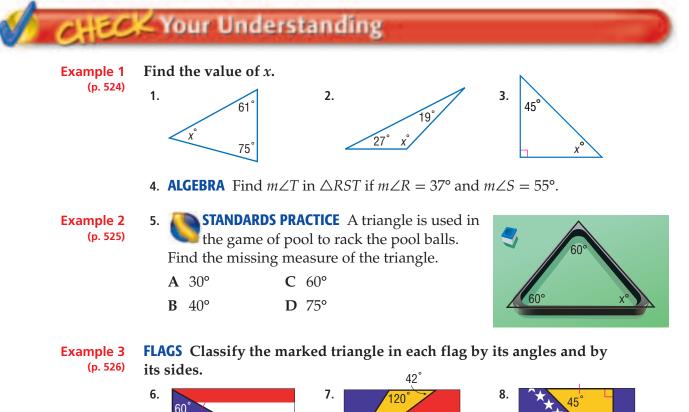


The triangle is an obtuse scalene triangle.

CHECK Your Progress

Draw a triangle that satisfies each set of conditions below. Then classify each triangle.

- e. a triangle with three acute angles and three congruent sides
- f. a triangle with one right angle and no congruent sides









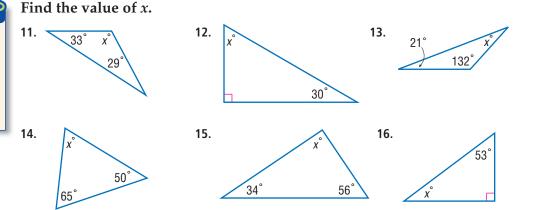
Bosnia-Herzegovina

Examples 4, 5 DRAWING TRIANGLES For Exercises 9 and 10, draw a triangle that satisfies each set of conditions. Then classify each triangle.

- 9. a triangle with three acute angles and two congruent sides
- **10**. a triangle with one obtuse angle and two congruent sides

Exercises

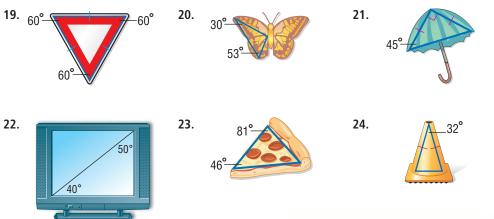
HOMEWO	F	
For Exercises	See Examples	1
11–18, 47, 48	1–2	
19–26	3	
27–30	4, 5	١,



17. ALGEBRA Find $m \angle Q$ in $\triangle QRS$ if $m \angle R = 25^{\circ}$ and $m \angle S = 102^{\circ}$.

18. ALGEBRA In $\triangle EFG$, $m \angle F = 46^{\circ}$ and $m \angle G = 34^{\circ}$. What is $m \angle E$?

Classify the marked triangle in each object by its angles and by its sides.



- **25. ART** The sculpture at the right is entitled *Texas Triangles*. It is located in Lincoln, Massachusetts. What type of triangle is shown: *acute*, *right*, or *obtuse*?
- •26. **ARCHITECTURE** Use the photo at the left to classify the side view of the Transamerica building by its angles and by its sides.



Source: DeCordova Museum and Sculpture Park

DRAWING TRIANGLES For Exercises 27–30, draw a triangle that satisfies each set of conditions. Then classify each triangle.

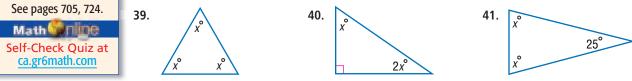
- **27**. a triangle with three acute angles and no congruent sides
- 28. a triangle with one obtuse angle and two congruent sides
- **29**. a triangle with three acute angles and three congruent sides
- 30. a triangle with one right angle and no congruent sides

Find the missing measure in each triangle with the given angle measures.

31 . 80°, 20.5°, <i>x</i> °	32 . 75°, <i>x</i> °, 50.2°	33. <i>x</i> °, 10.8°, 90°
34 . 45.5°, <i>x</i> °, 105.6°	35 . <i>x</i> °, 140.1°, 18.6°	36 . 110.2°, <i>x</i> °, 35.6°

- **37. ALGEBRA** Find the third angle measure of a right triangle if one of the angles measures 10°.
- **38. ALGEBRA** What is the third angle measure of a right triangle if one of the angle measures is 45.8°?

ALGEBRA Find the value of *x* in each triangle.

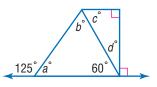




EXTRAPRACTIC

H.O.T. Problems **42. CHALLENGE** Apply what you know about triangles to find the missing angle measures in the figure.

43. OPEN ENDED Draw an acute scalene triangle. Describe the angles and sides of the triangle.

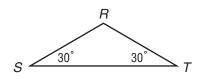


REASONING Determine whether each statement is *sometimes, always,* or *never* true. Justify your answer.

- 44. It is possible for a triangle to have two right angles.
- **45**. It is possible for a triangle to have two obtuse angles.
- **46**. **WRITING IN MATH** An equilateral triangle not only has three congruent sides, but also has three congruent angles. Based on this, explain why it is impossible to draw an equilateral triangle that is either right or obtuse.

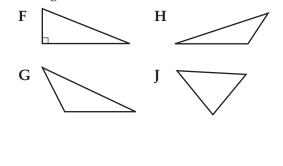
STANDARDS PRACTICE

47. How would you find $m \angle R$?



- A Add 30° to 180°.
- **B** Subtract 60° from 180°.
- C Subtract 30° from 90°.
- D Subtract 180° from 60°.

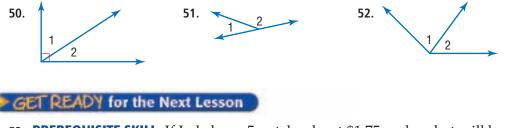
48. Which of the following is an acute triangle?





49. STATISTICS A circle graph shows that 41% of birdwatchers live in the Northeast region of the U.S. What is the measure of the angle of the Northeast section of the graph? (Lesson 10-3)

Classify each pair of angles as *complementary*, *supplementary*, or *neither*. (Lesson 10-2)



53. PREREQUISITE SKILL If Jade buys 5 notebooks at \$1.75 each, what will be the total cost of the notebooks; about \$6, \$7, or \$9? (Lesson 7-4)

Problem-Solving Investigation

MAIN IDEA: Solve problems by using logical reasoning.

Standard 6MR1.2 Formulate and justify mathematical conjectures based on a general description of the mathematical **question or problem posed. Standard 6MG2.3 Draw quadrilaterals and triangles from given information about them** (e.g., a quadrilateral having equal sides but no right angles, a right isosceles triangle).

P.S.I. TERM +

e-Mail: USE LOGICAL REASONING

YOUR MISSION: Use logical reasoning to solve the problem.

THE PROBLEM: Do the angles in an equilateral triangle have a special relationship?

Dion: It looks like the angles in an equilateral triangle are congruent. Is that true?

EXPLORE	Equilateral triangles have sides that are congruent. You need to find whether the angles are congruent.				
PLAN	Draw several equilateral triangles and measure the angles.				
SOLVE	$ \sum_{\text{sides} = 1 \text{ cm}} \sum_{\text{sides} = 2 \text{ cm}} \sum_{\text{sides} = 3 \text{ cm}} \sum_{\text{sides} = 4 \text{ cm}} $				
	Each angle of the triangles is 60°. So, it seems like the angles in an equilateral triangle are congruent.				
CHECK	Any triangle with angles measuring 60° is equilateral. If we try to draw a triangle with angle measures of 60° and different side lengths, the drawing would not be in the shape of a triangle.	_			
		9			

Analyze The Strategy

- 1. When you use *inductive reasoning*, you make a rule after seeing several examples. When you use *deductive reasoning*, you use a rule to make a decision. What type of reasoning did Dion use to solve the problem? Explain your reasoning.
- 2. Explain how the *look for a pattern* strategy is similar to inductive reasoning.

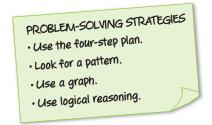
Mixed Problem Solving

For Exercises 3–5, use logical reasoning to solve the problem. Justify your response.

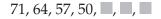
- **3. GEOMETRY** Draw several isosceles triangles and measure their angles. What do you notice about the measures of the angles of an isosceles triangle?
- 4. **BASKETBALL** Placido, Dexter, and Scott play guard, forward, and center on a team, but not necessarily in that order. Placido and the center drove Scott to practice on Saturday. Placido does not play guard. Who is the guard?
- 5. ALGEBRA Hannah was finding the relationship between the time it took a yo-yo to swing back and forth and its length. Predict the length of a yo-yo if it takes 5 seconds to swing back and forth.

Time (seconds)	Length (units)	
1	1	
2	4	
3	9	
4	16	

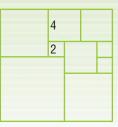
Use any strategy to solve Exercises 6–10. Some strategies are shown below.



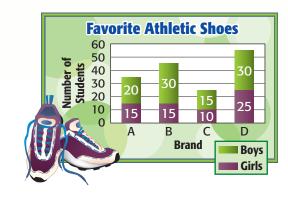
- 6. **GEOMETRY** Draw several rectangles and measure their diagonals. Find a relationship between the diagonals of a rectangle.
- **7. TRAVEL** Mrs. Petricca drove at an average speed of 55 miles per hour for three hours. After stopping for lunch, she drove at an average speed of 40 miles for 2.5 hours. How far did she drive?
- 8. **ALGEBRA** Find the next three numbers in the pattern below.



9. MEASUREMENT The large square has been divided into 9 squares. The lengths of the squares are given. Find the area of the entire square.



10. SHOES What can you conclude about the number of boys who favor brand C and the number of boys who prefer brand D?

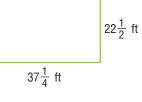


Select the Operation

For Exercises 11–13, select the appropriate operation(s) to solve the problem. Justify your selection(s) and solve the problem.

11. MEASUREMENT

Shelby wants to build a fence around her garden with the dimensions shown. How much fencing will she need?



- 12. **MEASUREMENT** Suppose you enlarge a drawing to 120% of its original size on the copy machine. If the drawing is 2 inches long and 3 inches wide, what are the dimensions of the copy?
- **13. STATISTICS** David has earned scores of 73, 85, 91 and 82 on the first four out of five math tests for the grading period. He would like to finish the grading period with a test average of at least 82. What is the minimum score David needs to earn on the fifth test in order to achieve his goal?



Geometry Lab Investigating Quadrilaterals

Main IDEA

Investigate the properties of special quadrilaterals.

Explore

10 - 6

Standard 6MR1.1 Analyze problems by identifying

relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns.

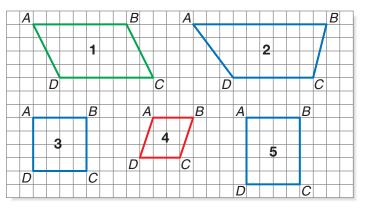
Standard 6MG2.3 Draw quadrilaterals and triangles from given information about them (e.g., a quadrilateral having equal sides but no right angles, a right isosceles triangle.)

Four-sided figures are called *quadrilaterals*. In this lab, you will explore the properties of different types of quadrilaterals.





STEP1 Draw the quadrilaterals shown on grid paper.



(STEP 2) Use a ruler and a protractor to measure the sides and angles of each quadrilateral. Record your results in a table.

Quadrilateral	m∠A	m∠B	m∠C	m∠D	AB	BC	CD	DA
1								
2								
\sim						h~~		hn

ANALYZE THE RESULTS

- 1. Describe any similarities or patterns in the angle measurements.
- 2. Describe any similarities or patterns in the side measurements.
- 3. MAKE A VENN DIAGRAM Cut out the quadrilaterals you drew in the activity. Then sort them into categories according to their similarities and differences. Arrange and record your categories in a two-circled Venn diagram. Be sure to label each circle with its category.
- 4. Create two other Venn diagrams illustrating two different ways of categorizing these quadrilaterals.
- 5. **WRITING IN MATH** Did you find shapes that did not fit a category? Where did you place these shapes? Did any shapes have properties allowing them to belong to more than one category? Could you arrange these quadrilaterals into a three-circled Venn diagram? If so, how?



Quadrilaterals

Main IDEA

Identify and classify quadrilaterals.



Standard 6MG2.3 Draw quadrilaterals and triangles from given information about them (e.g., a quadrilateral having equal sides but no right angles, a right isosceles triangle.)

NEW Vocabulary

quadrilateral parallelogram trapezoid rhombus

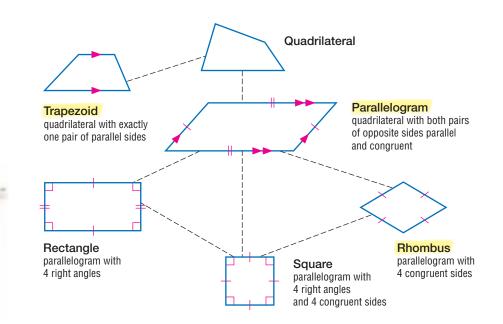
GET READY for the Lesson

VIDEO GAMES The general shape of a video game controller is shown.

- 1. Describe the angles inside the four-sided figure.
- 2. Which sides of the figure appear to be parallel?
- 3. Which sides appear to be congruent?



A **quadrilateral** is a closed figure with four sides and four angles. Quadrilaterals are named based on their sides and angles. The diagram shows how quadrilaterals are related. Notice how it goes from the most general to the most specific.



The name that *best* describes a quadrilateral is the one that is most specific.

- If a quadrilateral has all the properties of a parallelogram and a rhombus, then the *best* description of the quadrilateral is a rhombus.
- If a quadrilateral has all the properties of a parallelogram, rhombus, rectangle, and square, then the *best* description of the quadrilateral is a square.



are parallel.

Vaughn Youtz/ZLIMA/COBBIS

EXAMPLES Draw and Classify Quadrilaterals

Draw a quadrilateral that satisfies each set of conditions. Then classify each quadrilateral with the name that best describes it.

🚺 a parallellogram with four right angles and four congruent sides

Draw one right angle. The two segments should be congruent.

Draw a second right angle that shares one of the congruent segments. The third segment drawn should be congruent to the first two segments drawn.

Connect the fourth side of the quadrilateral. All four angles should be right angles, and all four sides should be congruent.





The figure is a square.

a quadrilateral with opposite sides parallel

Draw two parallel sides of equal length.

Connect the endpoints of these two sides so that two new parallel sides are drawn.

The figure is a parallelogram.

CHECK Your Progress

Draw a quadrilateral that satisfies each set of conditions. Then classify each quadrilateral with the name that best describes it.

- **a**. a quadrilateral with exactly one pair of parallel sides
- **b**. a parallelogram with four congruent sides

A quadrilateral can be separated into two triangles, A and B. Since the sum of the angle measures of each triangle is 180°, the sum of the angle measures of the quadrilateral is 2 • 180, or 360°.



KEY CONCEPTAngles of a QuadrilateralWordsThe sum of the measures of the
angles of a quadrilateral is 360°.ModelAlgebraw + x + y + z = 360

STUDY III

Check for Reasonableness Use a ruler and a protractor to measure the sides and angles to verify that your drawing satisfies the given conditions.

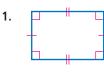
	Image: Second
TUDY TIP	WordsThe sum of the measures is 360° .VariableLet x represent the missing measure.Equation $85 + 73 + 59 + x = 360$
Check for Reasonableness Since $\angle x$ is an obtuse angle, $m \angle x$ should be between 90° and 180°. Since 90° < 143° < 180°, the answer is reasonable.	85 + 73 + 59 + x = 360 Write the equation. 217 + x = 360 Simplify. -217 = -217 Subtract 217 from each side. x = 143 So, the missing angle measure is 143°.
	c. ALGEBRA Find the value of <i>x</i> in the quadrilateral shown. 48° 157° x° 55°

CHECK Your Understanding

Examples 1, 2 (p. 534)

2 Classify each quadrilateral with the name that best describes it.

2.







4. **BOATS** The photo shows a sailboat called a schooner. What type of quadrilateral does the indicated sail best represent?

Example 3 (p. 535) 5. ALGEBRA In quadrilateral *DEFG*, $m \angle D = 57^{\circ}, m \angle E = 78^{\circ}, m \angle G = 105^{\circ}.$ What is $m \angle F$?



ALGEBRA Find the missing angle measure in each quadrilateral.

164

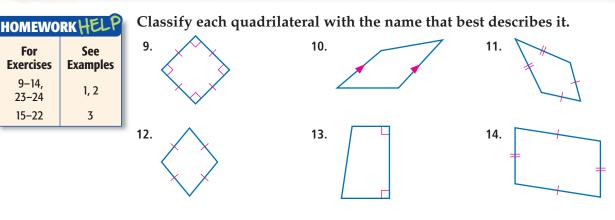
71

Exercises

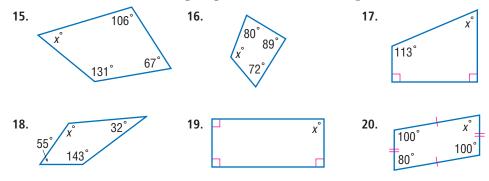
For

9-14,

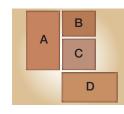
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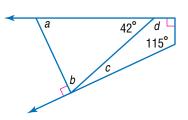
ALGEBRA Find the missing angle measure in each quadrilateral.



- **21. ALGEBRA** Find $m \angle B$ in quadrilateral *ABCD* if $m \angle A = 87^{\circ}$, $m \angle C = 135^{\circ}$, and $m \angle D = 22^{\circ}$.
- **22.** ALGEBRA What is $m \angle X$ in quadrilateral WXYZ if $m \angle W = 45^\circ$, $m \angle Y = 128^\circ$, and $\angle Z$ is a right angle?
- 23. LANDSCAPE Identify the shapes of the bricks used in the design at the right. Use the names that *best* describe the bricks.



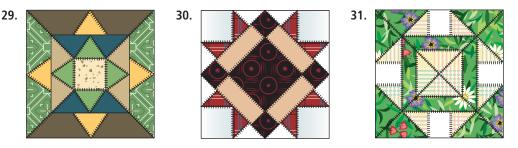
24. MEASUREMENT Find each of the missing angle measures *a*, *b*, *c*, and *d* in the figure at the right. Justify your answers.



Find the missing measure in each quadrilateral with the given angle measures.

25 . 37.5°, 78°, 115.4°, <i>x</i> °	26 . <i>x</i> °, 108.3°, 49.8°, 100°
27 . 25.5°, <i>x</i> °, 165.9°, 36.8°	28 . 79.1°, 120.8°, <i>x</i> °, 65.7°

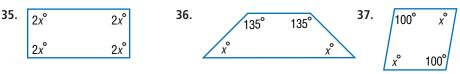
ART For Exercises 29–31, identify the types of triangles and quadrilaterals used in each quilt block pattern. Use the names that *best* describe the figures.



DRAWING QUADRILATERALS Determine whether each figure described below can be drawn. If the figure can be drawn, draw it. If not, explain why not.

- 32. a quadrilateral that is both a rhombus and a rectangle
- 33. a trapezoid with three right angles
- 34. a trapezoid with two congruent sides

ALGEBRA Find the value of *x* in each quadrilateral.



H.O.T. Problems

CHALLENGE For Exercises 38 and 39, refer to the table that gives the properties of several parallelograms. Property A states that both pairs of opposite sides are parallel and congruent.

Parallelogram	Properties
1	A, C
2	A, B, C
3	A, B

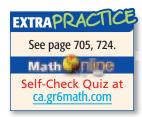
- **38**. If property C states that all four sides are congruent, classify parallelograms 1–3. Justify your response.
- **39**. If parallelogram 3 is a rectangle, describe Property B. Justify your response.

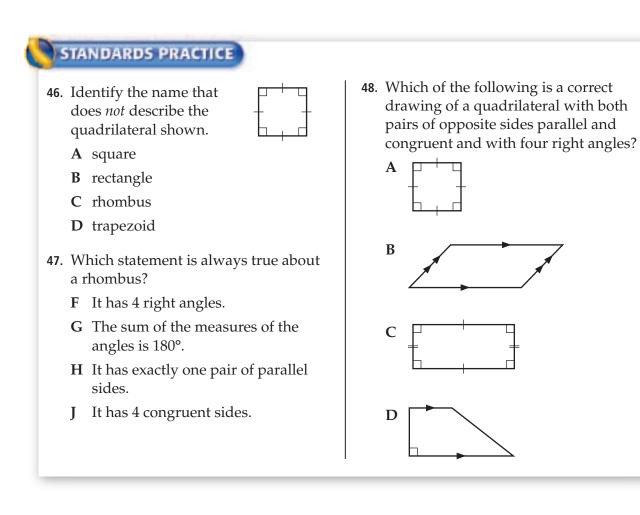
REASONING Determine whether each statement is *sometimes, always,* or *never* true. Explain your reasoning.

- **40**. A quadrilateral is a trapezoid. **41**. *A*
- 41. A trapezoid is a parallelogram.
- **42**. A square is a rectangle.
- **43**. A rhombus is a square.
- 44. **FIND THE ERROR** Isabelle and Justin are describing a square. Who is more accurate? Explain.



45. WRITING IN MATH The diagonals of a rectangle are congruent, and the diagonals of a rhombus are perpendicular. Based on this information, what can you conclude about the diagonals of a square? of a parallelogram? Explain your reasoning.

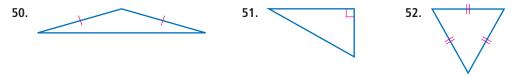






49. REASONING Neva, Sophie, and Seth have a turtle, a dog, and a hamster for a pet, but not in that order. Sophie's pet lives in a glass aquarium and does not have fur. Neva never has to give her pet a bath. Who has what pet? Use the *logical reasoning* strategy. (Lesson 10-5)

Classify each triangle by its angles and by its sides. (Lesson 10-4)



53. LETTERS How many permutations are possible of the letters in the word *Fresno?* (Lesson 9-4)

Find the sales tax or discount to the nearest cent. (Lesson 7-7)

54. \$54 jacket; 7% sales tax **55**. \$23 hat; 15% discount

GET READY for the Next Lesson

 PREREQUISITE SKILL Solve each proportion. (Lesson 6-4)

 56. $\frac{3}{5} = \frac{x}{75}$ 57. $\frac{a}{7} = \frac{18}{42}$ 58. $\frac{7}{9} = \frac{28}{m}$ 59. $\frac{3.5}{t} = \frac{16}{32}$ 60. $\frac{3}{6} = \frac{c}{5}$

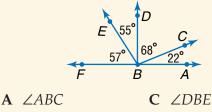
Mid-Chapter Quiz

Lessons 10-1 through 10-6

Name each angle in four ways. Then classify each angle as *acute*, *obtuse*, *right*, or *straight*. (Lesson 10-1)

CHAPTED

- 1. $G \stackrel{1}{=} E \stackrel{2.}{=} N \stackrel{M}{=} M$
- 3. **STANDARDS PRACTICE** Which angle is complementary to $\angle CBD$? (Lesson 10-2)

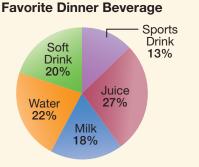


- **B** $\angle FBC$ **D** $\angle EBF$
- 4. **STATISTICS** Display the data in a circle graph. (Lesson 10-3)

Injuries of High School Girls' Soccer Players		
Position	Percent	
Halfbacks	37%	
Fullbacks 23%		
Forward Line	28%	
Goalkeepers	12%	

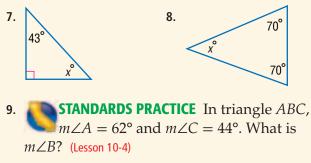
Source: National Athletic Trainers' Association

STATISTICS For Exercises 5 and 6, use the graph that shows the results of a survey. (Lesson 10-3)



- 5. What beverage is liked most by students?
- **6**. About how many more students drink juice than sport drinks with dinner?

ALGEBRA Find the value of *x*. (Lesson 10-4)



- F
 90°
 H
 64°

 G
 74°
 J
 42°
- **RACES** Norberto, Isabel, Fiona, Brock, and Elizabeth were the first five finishers of a race. From the given clues, find the order in which they finished. Use the *logical reasoning* strategy. (Lesson 10-5)
 - Norberto passed Fiona just before the finish line.
 - Elizabeth finished 5 seconds ahead of Norberto.
 - Isabel crossed the finish line after Fiona.
 - Brock was fifth at the finish line.

Classify the quadrilateral with the name that best describes it. (Lesson 10-6)



ALGEBRA Find the value of x in each quadrilateral. (Lesson 10-6)



15. ALGEBRA What is $m \angle A$ in quadrilateral *ABCD* if $m \angle B = 36^\circ$, $m \angle C = 74^\circ$, and $\angle D$ is a right angle? (Lesson 10-6)

Similar Figures

Main IDEA

Determine whether figures are similar and find a missing length in a pair of similar figures.



proportions to solve problems (e.g. determine the

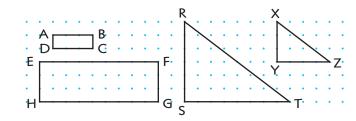
value of *n* if $\frac{4}{7} = \frac{n}{21}$, find the length of a side of a polygon similar to a known polygon). Use crossmultiplication as a method for solving such problems, understanding it as the multiplication of both sides of an equation by a multiplicative inverse.

NEW Vocabulary

similar figures corresponding sides corresponding angles indirect measurement

MINI Lab

The figures in each pair below have the same shape but different sizes. Copy each pair onto dot paper. Then find the measure of each angle using a protractor and the measure of each side using a centimeter ruler.

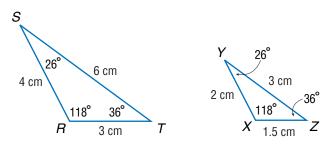


- AB on the smaller rectangle matches EF on the larger rectangle. Name all pairs of matching sides in each pair of figures. The notation AB means the segment with endpoints at A and B.
- 2. Write each ratio in simplest form.

The notation AB means the measu	re o	r segn	nent	AB.
a . $\frac{AB}{EF}$; $\frac{BC}{FG}$; $\frac{DC}{HG}$; $\frac{AD}{EH}$	h	$\frac{RS}{XY'}$;	ST.	RT
a. EF' FG' HG' EH	υ.	XY'	YZ'	XZ

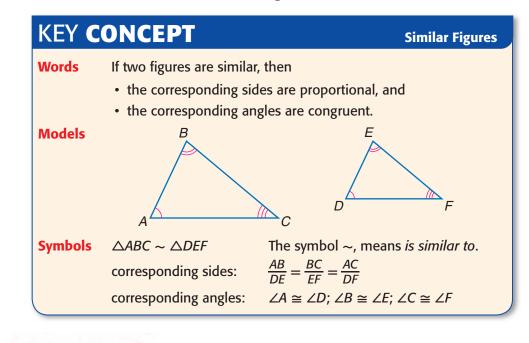
- 3. What do you notice about the ratios of matching sides?
- 4. Name all pairs of matching angles in the figures above. What do you notice about the measure of these angles?
- 5. **MAKE A CONJECTURE** about figures that have the same shape but not necessarily the same size.

Figures that have the same shape but not necessarily the same size are **similar figures**. In the figures below, triangle *RST* is similar to triangle *XYZ*. We write this as $\triangle RST \sim \triangle XYZ$.

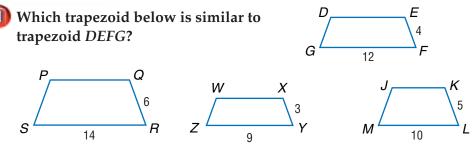


The matching sides are \overline{ST} and \overline{YZ} , \overline{SR} and \overline{YX} , and \overline{RT} and \overline{XZ} . The sides of similar figures that "match" are called **corresponding sides**. The matching angles are $\angle S$ and $\angle Y$, $\angle R$ and $\angle X$, and $\angle T$ and $\angle Z$. The angles of similar figures that "match" are called **corresponding angles**.

The Mini Lab illustrates the following statements.



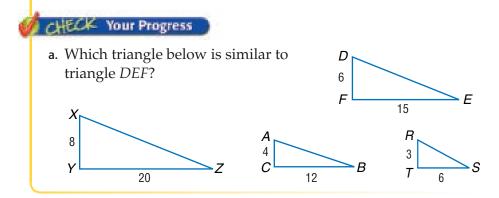
EXAMPLE Identify Similar Figures



Find the ratios of the corresponding sides to see if they form a constant ratio.

Trapezoid PQRS	Trapezoid WXYZ	Trapezoid <i>JKLM</i>
$\frac{EF}{QR} = \frac{4}{6} \text{ or } \frac{2}{3}$	$\frac{EF}{XY} = \frac{4}{3}$	$\frac{EF}{KL} = \frac{4}{5}$
$\frac{FG}{RS} = \frac{12}{14} \text{ or } \frac{6}{7}$ Not similar	$\frac{FG}{YZ} = \frac{12}{9} \text{ or } \frac{4}{3}$ Similar	$\frac{FG}{LM} = \frac{12}{10} \text{ or } \frac{6}{5}$ Not similar

So, trapezoid WXYZ is similar to trapezoid DEFG.





Geometry Symbols

 \sim is similar to

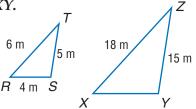
 \cong is congruent to



EXAMPLE Find Side Measures of Similar Triangles

2) If $\triangle RST \sim \triangle XYZ$, find the length of \overline{XY} .

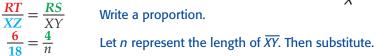
Since the two triangles are similar, the ratios of their corresponding sides are equal. Write and solve a proportion to find *XY*.



READING Math

Segment Measure

Just as the measure of angle A can be written as $m \angle A$, there is a special way to indicate the measure of a segment. The measure of \overline{AB} is written as AB, without the bar over it.



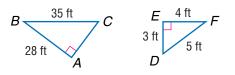
- Write a proportion.
- 6n = 18(4)Find the cross products.
- 6n = 72Simplify.

n = 12

Divide each side by 6. The length of \overline{XY} is 12 meters.

CHECK Your Progress

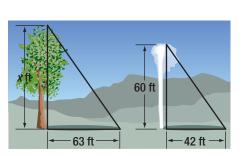
b. If $\triangle ABC \sim \triangle EFD$, find the length of \overline{AC} .



Indirect measurement uses similar figures to find the length, width, or height of objects that are too difficult to measure directly.

Real-World EXAMPLE

GEYSERS Old Faithful in Yellowstone National Park shoots water 60 feet into the air that casts a shadow of 42 feet. What is the height of a nearby tree that casts a shadow 63 feet long? Assume the triangles are similar.



Tree Old Faithful

 $\frac{x}{63} = \frac{60}{42}$ <-- height <-- shadow 42x = 60(63) Find the cross products. 42x = 3,780Simplify. x = 90Divide each side by 42.

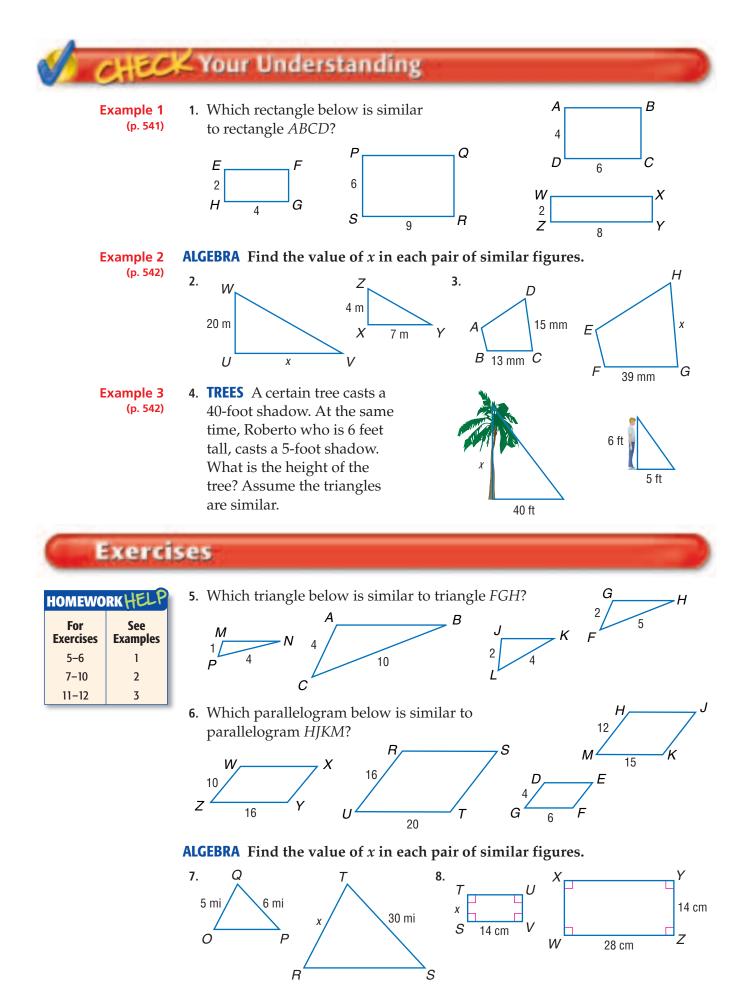
The tree is 90 feet tall.

CHECK Your Progress

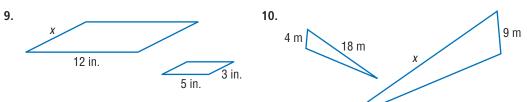
c. **PHOTOGRAPHY** Destiny wants to resize a 4-inch wide by 5-inch long photograph for the school newspaper. It is to fit in a space that is 2 inches wide. What is the length of the resized photograph?

Personal Tutor at ca.gr6math.com

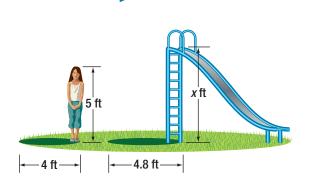


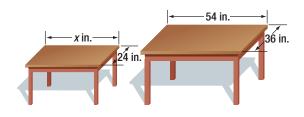


ALGEBRA Find the value of *x* in each pair of similar figures.

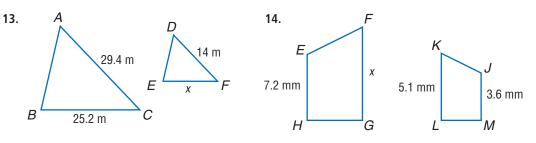


- 11. **PARKS** Ruth is at the park standing next to a slide. Ruth is 5 feet tall, and her shadow is 4 feet long. If the shadow of the slide is 4.8 feet long, what is the height of the slide? Assume the triangles are similar.
- 12. **FURNITURE** A child's desk is made so that it is a replica of a full-sized adult desk. Suppose the top of the full-size desk measures 54 inches long by 36 inches wide. If the top of a child's desk is 24 inches wide and is similar to the full-size desk, what is the length?





ALGEBRA Find the value of *x* in each pair of similar figures.



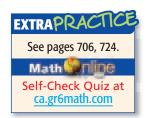
•• STATUES For Exercises 15 and 16 use the information below and at the left.

Alyssa has a miniature replica of the Statue of Liberty. The replica is 9 inches tall, and the length of the statue's right arm holding the torch is $1\frac{1}{4}$ inches.

- 15. About how long is the actual Statue of Liberty's right arm?
- **16.** Alyssa's friend has a smaller replica in which the length of the statue's right arm is $\frac{3}{4}$ inch. How tall is the smaller statue?
- **17. MEASUREMENT** The ratio of the length of square *A* to the length of square *B* is 3:5. If the length of square *A* is 18 meters, what is the perimeter of square *B*?



Real-World Link The Statue of Liberty stands 305 feet tall from the foundation of the pedestal to the top of the torch. **Source:** Staten Island Information and Services



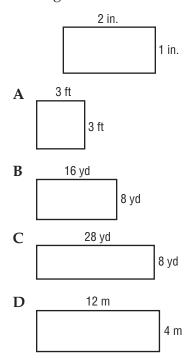
H.O.T. Problems CHALLENGE For Exercises 18 and 19, use the following information.

Two rectangles are similar. The ratio of their corresponding sides is 1:4.

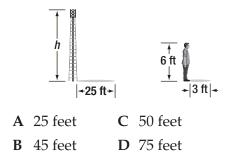
- **18**. Find the ratio of their perimeters.
- **19**. What is the ratio of their areas?
- 20. **WRITING IN MATH** Write a problem about a real-world situation that could be solved using proportions and the concept of similarity. Then use what you have learned in this lesson to solve the problem.

STANDARDS PRACTICE

21. Which rectangle is similar to the rectangle shown?



- **22**. Which of the following equations is a correct use of cross-multiplication in solving the proportion $\frac{12}{15} = \frac{m}{6}$?
 - $\mathbf{F} \quad 12 \boldsymbol{\cdot} m = 15 \boldsymbol{\cdot} 6$
 - $\mathbf{G} \quad 12 \boldsymbol{\cdot} 6 = m \boldsymbol{\cdot} 15$
 - $\mathbf{H} \ 12 \boldsymbol{\cdot} 15 = m \boldsymbol{\cdot} 6$
 - $J \quad 12 \div 6 = m \div 15$
 - **23**. Horatio is 6 feet tall and casts a shadow of 3 feet long. What is the height of a nearby tower if it casts a shadow 25 feet long at the same time?



GEOMETRY Classify the quadrilateral using the name that *best* describes it. (Lesson 10-6)



27. MEASUREMENT A triangular-shaped sail has angle measures of 44° and 67°. Find the measure of the third angle. (Lesson 10-4)

GET READY for	the Next Lessor		
PREREQUISITE SKIL	L Solve each equ	ation. (Lesson 3-3)	
28. 5 <i>a</i> = 120	29. $360 = 4x$	30. $940 = 8n$	31. 6 <i>t</i> = 720

Polygons and Tessellations

Main IDEA

Classify polygons and determine which polygons can form a tessellation.



Apply strategies and results from simpler problems to more complex problems. Standard 6AF3.2 Express in symbolic form simple relationships arising from geometry.

NEW Vocabulary

polygon pentagon hexagon heptagon octagon nonagon decagon regular polygon tessellation

GET READY for the Lesson

GEOGRAPHY The size and shape of each state in the United States is different. Analyze the shapes of the states in both groups at the right.

- **1**. Find the difference between the shapes of the states in Group 1 (blue states) and the shapes of the states in Group 2 (green states).
- 2. Why do most states have boundaries that are not straight line segments?



A **polygon** is a simple, closed figure formed by three or more straight line segments. A simple figure does not have lines that cross each other. You have drawn a *closed figure* when your pencil ends up where it started.

Polygons	Not Polygons
	$\mathbb{X} \square \bigcirc$
 Line segments are called sides. Sides meet only at their endpoints. Points of intersection are called vertices. 	 Figures with sides that cross each other. Figures that are open. Figures that have curved sides.

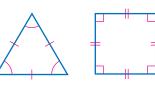
READING Math

Polygons The polygons shown at the right have special names. Most other polygons are named using a number. For example, a polygon with 11 sides is an 11-gon.

A polygon can be classified by the number of sides it has.

Words	pentagon	hexagon	heptagon	octagon	nonagon	decagon
Number of Sides	5	6	7	8	9	10
Models	\bigcirc	\sum	\square	\square	M	

A regular polygon has all sides congruent and all angles congruent. Equilateral triangles and squares are examples of regular polygons.





Determine whether each figure is a polygon. If it is, classify the polygon and state whether it is regular. If it is not a polygon, explain why.

READING Math

Regular Polygons Since regular polygons have *equal–sized angles*, they are also called *equiangular*.



The figure has 6 congruent sides and 6 congruent angles. It is a regular hexagon.



The figure is not a polygon since it has a curved side.

CHECK Your Progress

Determine whether each figure is a polygon. If it is, classify the polygon and state whether it is regular. If it is *not* a polygon, explain why.



The sum of the measures of the angles of a triangle is 180°. You can use this relationship to find the measures of the angles of regular polygons.

EXAMPLE Angle Measures of a Polygon

3 ALGEBRA Find the measure of each angle of a regular pentagon.

• Draw all of the diagonals from one vertex as shown and count the number of triangles formed.



• Find the sum of the angle measures in the polygon.

number of triangles formed \times 180° = sum of angle measures in polygon

 $3 \times 180^{\circ} = 540^{\circ}$

• Find the measure of each angle of the polygon. Let *n* represent the measure of one angle in the pentagon.

5n = 540 There are five congruent angles.

n = 108 Divide each side by 5.

The measure of each angle in a regular pentagon is 108°.

CHECK Your Progress

Find the measure of an angle in each polygon.

c. regular octagon d. equilateral triangle



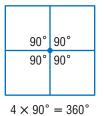
Angle Measures

The number of triangles formed is 2 less than the number of sides in the polygon. The equation (n - 2) $\times 180 = s$ gives the sum *s* of angle measures in a polygon with *n* sides.



A repetitive pattern of polygons that fit together with no overlaps or holes is called a **tessellation**. The surface of a chessboard is an example of a tessellations of squares.

The sum of the measures of the angles where the vertices meet in a tessellation is 360°.







Real-World Career. How Does a Landscape Architect Use Math? A landscape architect

uses math when arranging bricks to create a patio.



For more information, go to ca.gr6math.com.

Real-World EXAMPLE

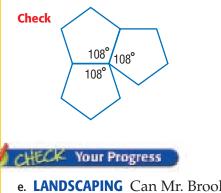
LANDSCAPING Mr. Brooks bought pentagonal-shaped bricks to create a patio. Can Mr. Brooks make a tessellation using the bricks?

The measure of each angle in a regular pentagon is 108°.

The sum of the measures of the angles where the vertices meet must be 360°. So, solve 108n = 360.

108n = 360	Write the equation.
$\frac{108n}{108} = \frac{360}{108}$	Divide each side by 108.
$n = 3.\overline{3}$	Use a calculator.

Since 108° does not divide evenly into 360°, the sum of the measures of the angles where the vertices meet is not 360°. So, Mr. Brooks cannot make a tessellation using the bricks.



e. LANDSCAPING Can Mr. Brooks use stones that are equilateral triangles to pave the patio? Explain.

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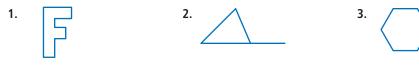


108

548 Chapter 10 Geometry: Polygons (I) Ariel Skelley/CORBIS, (r) Aaron Haupt

CHECK Your Understanding

Examples 1, 2
(p. 547)Determine whether each figure is a polygon. If it is, classify the polygon and
state whether it is regular. If it is *not* a polygon, explain why.



Example 3 Find the measure of an angle in each polygon if the polygon is regular.(p. 547) Round to the nearest tenth of a degree if necessary.

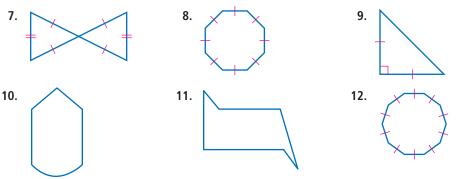
- 4. hexagon
- Example 4 (p. 548)
 6. ART In art class, Trisha traced and then cut several regular octagons out of tissue paper. Can she use the figures to create a tessellation? Explain.

Exercises

HOMEWORKHELP		
For Exercises	See Examples	
7–12	1,2	
13–16	3	
17–18	4	

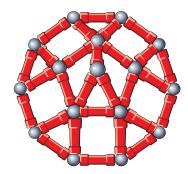
Determine whether each figure is a polygon. If it is, classify the polygon and state whether it is regular. If it is *not* a polygon, explain why.

5. heptagon

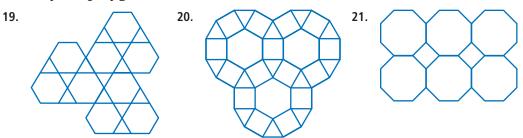


Find the measure of an angle in each polygon if the polygon is regular. Round to the nearest tenth of a degree if necessary.

- 13. decagon 14. nonagon 15. quadrilateral 16. 11-gon
- TOYS Marty used his magnetic building set to build the regular decagon at the right. Assume he has enough building parts to create several of these shapes. Can the figures be arranged in a tessellation? Explain.
- 18. COASTERS Paper coasters are placed under a beverage glass to protect the table surface. The coasters are shaped like regular heptagons. Can the coasters be arranged in a tessellation? Explain your reasoning.



Classify the polygons that are used to create each tessellation.



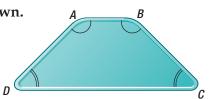
- 22. What is the perimeter of a regular nonagon with sides 4.8 centimeters?
- 23. Find the perimeter of a regular pentagon having sides $7\frac{1}{4}$ yards long.
- 24. ART The mosaic shown is decorated with handmade tiles from Pakistan. Name the polygons used in the tessellation.
- •25. **SIGNS** Refer to the photo at the left. Stop signs are made from large sheets of steel. Suppose one sheet of steel is large enough to cut nine signs. Can all nine signs be arranged on the sheet so that none of the steel goes to waste? Explain.



26. RESEARCH Use the Internet or another source to find the shape of other road signs. Name the type of sign, its shape, and state whether or not it is regular.

SCHOOL For Exercises 27–29, use the information below and the graphic of the cafeteria tray shown.

A company designs cafeteria trays so that four students can place their trays around a square table without bumping corners. The top and bottom sides of the tray are parallel.



- **27**. Classify the shape of the tray.
 - **28.** If $\angle A \cong \angle B$, $\angle C \cong \angle D$, and $m \angle A = 135^{\circ}$, find $m \angle B$, $m \angle C$, and $m \angle D$.
 - **29**. Name the polygon formed by the outside of four trays when they are placed around the table with their sides touching. Justify your answer.
 - **30. REASONING** *True* or *False*? Only a regular polygon can tessellate a plane.
 - **31. OPEN ENDED** Draw examples of a pentagon and a hexagon that represent real-world objects.
 - **32. CHALLENGE** You can make a tessellation with equilateral triangles. Can you make a tessellation with any isosceles or scalene triangles? If so, explain your reasoning and make a drawing.



All stop signs have the same shape and meaning. In Spanishspeaking countries, the signs read "ALTO" (halt) or "PARE" (stop).

EXTRAPRACTICE See pages 706, 724. Math Self-Check Quiz at <u>ca.gr6math.com</u>

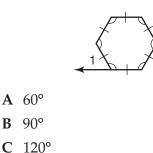
H.O.T. Problems

33. WRITING IN MATH Analyze the parallelogram at the right and then explain how you know the parallelogram can be used by itself to
make a tessellation.



STANDARDS PRACTICE

34. What is the measure of $\angle 1$?



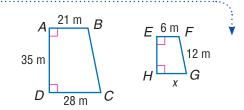
- **35**. Which statement is *not* true about polygons?
 - **F** A polygon is classified by the number of sides it has.
 - **G** The sides of a polygon overlap.
 - H A polygons is formed by 3 or more line segments.
 - J The sides of a polygon meet only at its endpoints.



D 150°

For Exercises 36 and 37, use the figures at the right.

36. ALGEBRA The quadrilaterals are similar. Find the value of *x*. (Lesson 10-7)



- **37. GEOMETRY** Classify figure *ABCD*. (Lesson 10-6)
- **38. PROBABILITY** Two students will be randomly selected from a group of seven to present their reports. If Carla and Pedro are in the group of 7, what is the probability that Carla will be selected first and Pedro selected second? (Lesson 9-4)
- **39. MEASUREMENT** How many $\frac{1}{2}$ -cup servings of ice cream are there in a gallon of chocolate ice cream? (Lesson 6-3)

Add or subtract. Write each sum or difference in simplest form. (Lesson 5-3) 40. $3\frac{2}{9} + 5\frac{4}{9}$ 41. $5\frac{1}{3} - 2\frac{1}{6}$ 42. $1\frac{3}{7} + 6\frac{1}{4}$ 43. $9\frac{4}{5} - 4\frac{7}{8}$

GET READY for the Next Lesson

PREREQUISITE SKILL Graph and label each point on the same coordinate
plane. (Lesson 2-3)44. A(-2, 3)45. B(4, 3)46. C(2, -1)47. D(-4, -1)

Geometry Lab Tessellations

Main IDEA

Create tessellations.

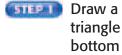
Extend

10 - 8

Preparation for Standard 7MG3.4 Demonstrate an understanding of conditions that indicate two geometrical figures are congruent and what congruence means about the relationships between the sides and angles of the two figures. Standard 6MR2.2 Apply strategies and results from simpler problems to more complex problems.

In this lab, you will create tessellations.

ACTIVITY

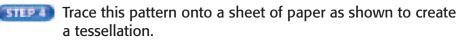


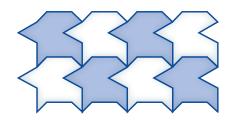
STEP 1 Draw a square on the back of an index card. Then draw a triangle on the inside of the square and a trapezoid on the bottom of the square as shown.

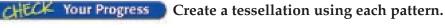
STIP2 Cut out the square. Then cut out the triangle and slide it from the right side of the square to the left side of the square. Cut out the trapezoid and slide it from the bottom to the top of the square.

STEP3 Tape the figures together to form a pattern.











ANALYZE THE RESULTS

- 1. Design and describe your own tessellation pattern.
- 2. MAKE A CONJECTURE Congruent figures have corresponding sides of equal length and corresponding angles of equal measure. Explain how congruent figures are used in your tessellation.



Translations

Main IDEA

Graph translations of polygons on a coordinate plane.



Preparation for Standard 7MG3.2

Understand and use coordinate graphs to plot simple figures, determine lengths and areas related to them, and determine their image under translations and reflections.

NEW Vocabulary

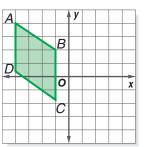
transformation translation congruent figures

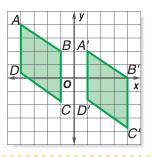
MINI Lab

COncepts in MOtion

Interactive Lab ca.gr6math.com

- Trace a parallelogram-shaped pattern block onto a coordinate grid. Label the vertices *ABCD*.
- Slide the pattern block over 5 units to the right and 2 units down.
- **STEP 3)** Trace the figure in its new position. Label the vertices *A'*, *B'*, *C'*, and *D'*.
- Trace the horizontal and vertical path between corresponding vertices. What do you notice?
- 2. Add 5 to each *x*-coordinate of the vertices of the original figure. Then subtract 2 from each *y*-coordinate of the vertices of the original figure. What do you notice?





A **transformation** maps one figure onto another. When you move the figure without turning it, the motion is called a **translation**.

When translating a figure, every point of the original figure is moved the same distance and in the same direction.

READING Math

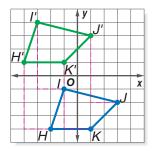
Prime Symbols Use prime symbols for vertices in transformed image.

 $A \rightarrow A'$ $B \rightarrow B'$ $C \rightarrow C'$ A' is read A prime.

EXAMPLE Graph a Translation

Translate quadrilateral HIJK 2 units left and 5 units up. Graph quadrilateral H'I'J'K'.

- Move each vertex of the figure 2 units left and 5 units up. Label the new vertices *H'*, *I'*, *J'*, and *K'*.
- Connect the vertices to draw the trapezoid. The coordinates of the vertices of the new figure are H'(-4, 1), I'(-3, 4), J'(1, 3), and K'(-1, 1).

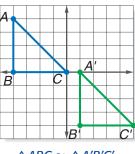


CHECK Your Progress

a. Translate quadrilateral *HIJK* 4 units up and 2 units right. Graph quadrilateral *H' I' J' K'*.

When a figure has been translated, the original figure and the translated figure, or *image*, are congruent. **Congruent figures** have the same size and same shape, and the corresponding sides and angles have equal measures.

You can increase or decrease the coordinates of the vertices of a figure by a fixed amount to find the coordinates of the translated vertices.



 $\triangle ABC \cong \triangle A'B'C'$

A *positive* integer describes a translation right or up on a coordinate plane. A *negative* integer describes a translation left or down.

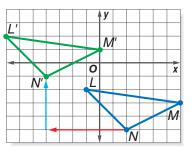
EXAMPLE Find Coordinates of a Translation

2 Triangle *LMN* has vertices L(-1, -2), M(6, -3), and N(2, -5). Find the vertices of $\Delta L'M'N'$ after a translation of 6 units left and 4 units up. Then graph the figure and its translated image.

The vertices can be found by adding -6 to the *x*-coordinates and 4 to the *y*-coordinates.

Add —6 to each <i>x</i> -coordinate.		Add 4 to each y-coordinate.
Vertices of △ <i>LMN</i>	(x+(-6),y+4)	Vertices of <i>△L'M'N'</i>
L(-1, -2)	(-1 + (-6), -2 + 4)	L'(-7, 2)
M(6, -3)	(6 + (-6), -3 + 4)	<i>M</i> ′(0, 1)
N(2, -5)	(2 + (-6), -5 + 4)	N′(−4, −1)

Use the vertices of $\triangle LMN$ and of $\triangle L'M'N'$ to graph each triangle.



CHECK Your Progress

b. Triangle *TUV* has vertices T(6, -3), U(-2, 0), and V(-1, 2). Find the vertices of $\Delta T'U'V'$ after a translation of 3 units right and 4 units down. Then graph the figure and its translated image.

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In Example 2, $\triangle LMN$ was translated 6 units left and 4 units up. This translation can be described using the ordered pair (-6, 4). In Check Your Progress b., $\triangle TUV$ was translated 3 units right and 4 units down. This translation can be described using the ordered pair (3, -4).

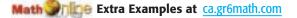


Integers Recall that to subtract an integer, add its opposite.



Check for Reasonableness After graphing the original figure and

original figure and its image on the same coordinate plane, check to see that the figures are congruent.

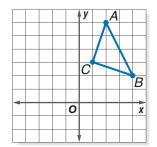


CHECK Your Understanding

Example 1 1. Translate $\triangle ABC$ 3 units left and 3 units down. Graph $\triangle A'B'C'$.

Example 2 Quadrilateral *DEFG* has vertices D(1, 0), E(-2, -2), (p. 554) F(2, 4), and G(6, -3). Find the vertices of D'E'F'G'after each translation. Then graph the figure and its translated image.

- 2. 4 units right, 5 units down 3. 6 units right
- 4. **GAMES** When playing chess, the rook can only move vertically or horizontally across a chessboard. The chessboard at the right shows the movement of a rook after two turns. Describe this translation in words and as an ordered pair.

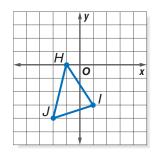




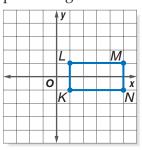
Exercises

HOMEWORKHELP		
For Exercises	See Examples	
5–6	1	
7–12	2	

5. Translate $\triangle HIJ$ 2 units right and 6 units down. Graph $\triangle H'I'J'$.



 Translate rectangle *KLMN* 1 unit left and 3 units up. Graph rectangle *K'L'M'N'*.



Triangle PQR has vertices P(0, 0), Q(5, -2), and R(-3, 6). Find the vertices of P'Q'R' after each translation. Then graph the figure and its translated image.

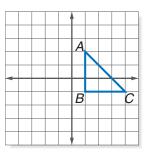
- 7. 6 units right, 5 units up
- 9. 3 units left

- 8. 8 units left, 1 unit down
- 10. 9 units down

MAPS Payat lives at the corner of Wabash and Ohio. His school is located at Huron and Dearborn. Describe each of the following as a translation and as an ordered pair of the number of blocks.

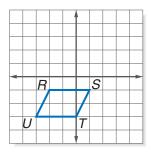
- 11. Payat's walk from school to home
- **12**. Payat's walk from home to school
- **E** Superior St W Superior St N State E Huron St W Huron St S Z Dearborn Wab W Erie St E Erie St E Ontario St 🏼 🎖 ŝ W Ontario St W Ohio St E Ohio St

 Triangle *ABC* is translated 2 units left and 3 units down. Then the translated figure is translated 3 units right. Graph the resulting triangle.



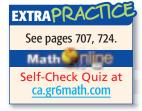
- **15. ART** Explain how translations and tessellations were used in *Horsemen*, created by M.C. Escher at the right.
- **16. RESEARCH** Use the Internet or another source to find other pieces of art that contain tessellations of translations. Describe how the artists incorporated both ideas into their work.
- **17.** Triangle *FGH* has vertices *F*(7, 6), *G*(3, 4), *H*(1, 5).Find the coordinates of $\triangle F'G'H'$ after a translation $1\frac{1}{2}$ units right and $3\frac{1}{2}$ units down. Then graph the figure and its translated image.

14. Parallelogram *RSTU* is translated 3 units right and 5 units up. Then the translated figure is translated 2 units left. Graph the resulting parallelogram.





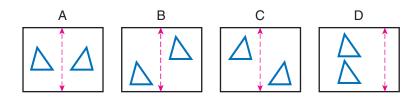
Horsemen by M.C. Escher. © Cordon Art-Baarn-Holland. All rights reserved.



H.O.T. Problems

REASONING The coordinates of a point and its image after a translation are given. Describe the translation in words and as an ordered pair.

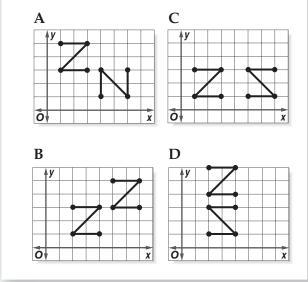
- **18.** $N(0, -3) \rightarrow N'(2, 2)$ **19.** $M(2, 4) \rightarrow M'(-3, 1)$ **20.** $P(-2, -1) \rightarrow P'(3, -2)$ **21.** $Q(-4, 0) \rightarrow Q'(1, 4)$
- **22. CHALLENGE** Is it possible to make a tessellation with translations of an equilateral triangle? Explain your reasoning.
- **23.** Which One Doesn't Belong? Identify the transformation that is not the same as the other three. Explain your reasoning.



24. **WRITING IN MATH** Triangle *ABC* is translated 4 units right and 2 units down. Then the translated image is translated again 7 units left and 5 units up. Describe the final translated image in words.

STANDARDS PRACTICE

25. Which graph shows a translation of the letter *Z*?

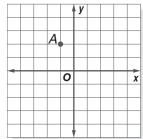


26. If point *A* is translated 4 units left and 3 units up, what will be the coordinates of point *A* in its new position?





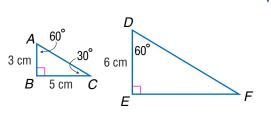
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27. **GEOMETRY** What is the name of a polygon with eight sides? (Lesson 10-8)

- **28. GEOMETRY** The triangles at the right are similar. What is the measure of $\angle F$? (Lesson 10-7)
- **29. FOOD** For dinner, you can choose one of two appetizers, one of four entrées, and one of three desserts. How many possible unique dinners can you choose? (Lesson 9-3)



For each set of data, describe how the range would change if the value 15 was added to the data set. (Lesson 8-1)

30 . {8, 17, 32}	31 . {22, 38, 41, 77}	32 . {10, 10, 19}	33 . {7, 11, 13}
Write each percen	t as a decimal. (Lesson 4-7)		
34. 83.8%	35. 56.7%	36. 3.8%	37. 102.6%
CET DE ADV (or	the Next Loccon		

GEI READY for the Next Lesson

PREREQUISITE SKILL Determine whether each figure can be folded in half so that one side matches the other. Write *yes* or *no*.



10-10 Reflections

Main IDEA

Identify figures with line symmetry and graph reflections on a coordinate plane.



Preparation for Standard 7MG3.2

Understand and use coordinate graphs to plot simple figures, determine lengths and areas related to them, and determine their image under translations and reflections.

NEW Vocabulary

line symmetry line of symmetry reflection line of reflection

MINI Lab

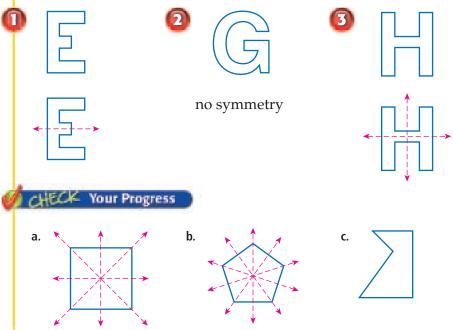
- Write your first name in capital letters on a sheet of paper.
- Use the geomirror to trace the reflection of the letters in your name.
- Write a classmate's name. Draw the reflection of the letters without using the geomirror.
- 1. Describe how you drew the reflection of your classmate's name.
- **2**. Explain why the line where the geomirror and paper meet is called the *line of symmetry*.

Figures that match exactly when folded in half have line symmetry. The figures at the right have line symmetry.

Each fold line is called a **line of symmetry**.

Real-World EXAMPLES

GRAPHIC DESIGN Determine whether each figure has line symmetry. If so, copy the figure and draw all lines of symmetry.





A **reflection** is a mirror image of the original figure. It is the result of a transformation of a figure over a line called a **line of reflection**.

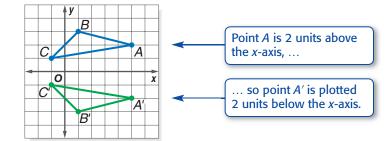
STUDY TIP

Congruent Figures As with translations, the original figure and the reflected image are congruent.

EXAMPLE Reflect a Figure Over the *x*-axis

Triangle *ABC* has vertices A(5, 2), B(1, 3), and C(-1, 1). Graph the figure and its reflected image over the *x*-axis. Then find the coordinates of the vertices of the reflected image.

The *x*-axis is the line of reflection. So, plot each vertex of A'B'C' the same distance from the *x*-axis as its corresponding vertex on *ABC*.



The coordinates are A'(5, -2), B'(1, -3), and C'(-1, -1).

CHECK Your Progress

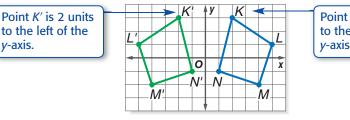
d. Rectangle *GHIJ* has vertices G(3, -4), H(3, -1), I(-2, -1), and J(-2, -4). Graph the figure and its image after a reflection over the *x*-axis. Then find the coordinates of the reflected image.

Personal Tutor at ca.gr6math.com

EXAMPLE Reflect a Figure Over the *y*-axis

5 Quadrilateral *KLMN* has vertices K(2, 3), L(5, 1), M(4, -2), and N(1, -1). Graph the figure and its reflected image over the *y*-axis. Then find the coordinates of the vertices of the reflected image.

The *y*-axis is the line of reflection. So, plot each vertex of *K'L'M'N'* the same distance from the *y*-axis and its corresponding vertex on *KLMN*.



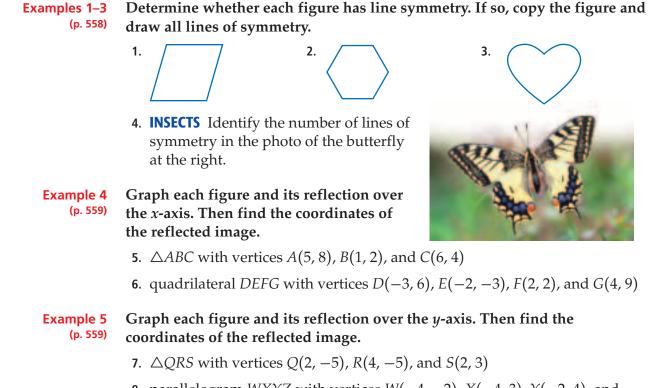
Point *K* is 2 units to the right of the *y*-axis.

The coordinates are K'(-2, 3), L'(-5, 1), M'(-4, -2), and N'(-1, -1).

CHECK Your Progress

e. Triangle *PQR* has vertices P(1, 5), Q(3, 7), and R(5, -1). Graph the figure and its reflection over the *y*-axis. Then find the coordinates of the reflected image.

Your Understanding

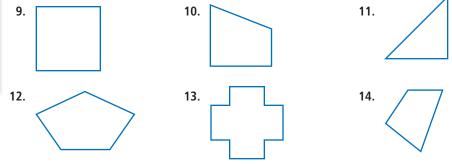


8. parallelogram *WXYZ* with vertices W(-4, -2), X(-4, 3), Y(-2, 4), and Z(-2, -1)

Exercises

HOMEWORKHELP					
For Exercises	See Examples				
9–14 23–24	1, 3				
15–18	4				
19–22	5				

Determine whether each figure has line symmetry. If so, copy the figure and draw all lines of symmetry.



Graph each figure and its reflection over the *x*-axis. Then find the coordinates of the reflected image.

- **15**. △*TUV* with vertices T(-6, -1), U(-2, -3), and V(5, -4)
- **16.** $\triangle MNP$ with vertices M(2, 1), N(-3, 1), and P(-1, 4)
- **17**. square *ABCD* with vertices *A*(2, 4), *B*(−2, 4), *C*(−2, 8), and *D*(2, 8)
- **18.** trapezoid *WXYZ* with vertices W(-1, -1), X(4, 1), Y(4, 5), and Z(1, 7)

Graph each figure and its reflection over the *y*-axis. Then find the coordinates of the reflected image.

- **19.** $\triangle RST$ with vertices R(-5, 3), S(-4, -2), and T(-2, 3)
- **20**. \triangle *GHJ* with vertices *G*(4, 2), *H*(3, -4), and *J*(1, 1)
- **21**. parallelogram *HIJK* with vertices H(-1, 3), I(-1, -1), J(2, -2), and K(2, 2)
- **22.** quadrilateral *DEFG* with vertices D(1, 0), E(1, -5), F(4, -1), and G(3, 2)
- 23. **BUILDINGS** Describe the location of the line(s) of symmetry in the photograph of the Taj Mahal, which is in India.
- 24. SIGNAL FLAGS International Marine Signal Flags are used by sailors to send messages at sea. The signal flags shown spell out the word MATH. Which flags have line symmetry? Draw all lines of symmetry.

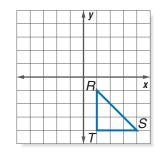




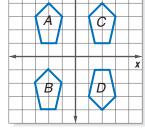
•25. **MUSIC** Use the photo at the left to determine how many lines of symmetry the body of a violin has.

For Exercises 26–29, use the graph shown at the right.

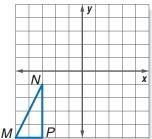
- **26**. Identify the pair(s) of figures for which the *x*-axis is the line of reflection.
- 27. For which pair(s) of figures is the line of reflection the *y*-axis?
- **28**. What type of transformation do figures *B* and *C* represent?
- **29**. Describe the possible transformation(s) required to move figure A onto figure D.
- **30**. $\triangle RST$ is reflected over the *x*-axis and then translated 3 units to the left and 2 units down. Graph the resulting triangle.

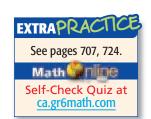


X ₿ Л



31. $\triangle MNP$ is translated 2 units right and 3 units up. Then the translated figure is reflected over the *y*-axis. Graph the resulting triangle.







Real-World Link . A violin is usually around 14 inches long.

The coordinates of a point and its image after a reflection are given. Describe the reflection as over the *x*-axis or *y*-axis.

32. $A(-3,5) \rightarrow A'(3,5)$	33. $M(3,3) \to M'(3,-3)$
34. $X(-1, -4) \rightarrow X'(-1, 4)$	35. $W(-4, 0) \rightarrow W'(4, 0)$

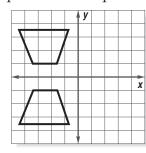
H.O.T. Problems

36. OPEN ENDED Make a tessellation using a combination of translations and reflections of polygons. Explain your method.

- **37. CHALLENGE** Triangle *JKL* has vertices J(-7, 4), K(7, 1), and L(2, -2). Without graphing, find the new coordinates of the vertices of the triangle after a reflection first over the *x*-axis and then over the *y*-axis.
- **38. WRITING IN MATH** Draw a figure on a coordinate plane and its reflection over the *y*-axis. Explain how the *x* and *y*-coordinates of the reflected figure relate to the *x* and *y*-coordinates of the original figure. Then repeat, this time reflecting the figure over the *x*-axis.

STANDARDS PRACTICE

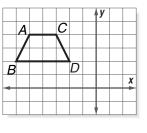
39. The figure shown was transformed from quadrant II to quadrant III.



This transformation best represents which of the following?

- A translation C reflection
- **B** tessellation **D** rotation

40. If *ABCD* is reflected over the *x*-axis and translated 5 units to the right, which is the resulting image of point *B*?



F

$$(-1, -2)$$
 H
 $(-1, 2)$

 G
 $(-11, 2)$
 J
 $(11, 2)$



- **41. GEOMETRY** Triangle *FGH* has vertices F(-3, 7), G(-1, 5), and H(-2, 2). Graph the figure and its image after a translation 4 units right and 1 unit down. Write the ordered pairs for the vertices of the image. (Lesson 10-9)
- **42. GEOMETRY** Melissa wishes to construct a tessellation for a wall hanging made only from regular decagons. Is this possible? Explain. (Lesson 10-8)

Estimate. (Lesson 5-1) **43.** $\frac{4}{9} + 8\frac{1}{9}$

44.
$$\frac{1}{9} \times \frac{2}{5}$$

45. $12\frac{1}{4} \div 5\frac{6}{7}$

10 Study Guide and Review



Download Vocabulary Review from ca.gr6math.com

OLDA BLES

Be sure the following Key Concepts are noted in your Foldable.

What I Know About Polygons	What I Need to Know	What I've Learned

GET READY to Study

Key Concepts

Angles (Lessons 10-1 and 10-2)

- Two angles are adjacent if they have the same vertex, share a common side, and do not overlap.
- Two angles are vertical if they are opposite angles formed by the intersection of two lines.
- Two angles are complementary if the sum of their measures is 90°.
- Two angles are supplementary if the sum of their measures is 180°.

Triangles (Lesson 10-4)

• The sum of the measures of the angles of a triangle is 180°.

Quadrilaterals (Lesson 10-6)

• The sum of the measures of the angles of a quadrilateral is 360°.

Similar Figures (Lesson 10-7)

• If two figures are similar then the corresponding sides are proportional and the corresponding angles are congruent.

Transformations (Lessons 10-9 and 10-10)

- When translating a figure, every point in the original figure is moved the same distance in the same direction.
- When reflecting a figure, every point in the original figure is the same distance from the line of reflection as its corresponding point on the original figure.

Key Vocabulary

acute angle (p. 511) angle (p. 510) circle graph (p. 518) complementary angles (p. 514) congruent angles (p. 511) congruent figures (p. 554) degrees (p. 510) hexagon (p. 546) indirect measurement (p. 542) line of symmetry (p. 558) line symmetry (p. 558) obtuse angle (p. 511) octagon (p. 546) parallelogram (p. 533)

pentagon (p. 546) polygon (p. 546) quadrilateral (p. 533) reflection (p. 559) regular polygon (p. 546) rhombus (p. 533) right angle (p. 511) similar figures (p. 540) straight angle (p. 511) supplementary angles (p. 514) tessellation (p. 548) transformation (p. 553) translation (p. 553) trapezoid (p. 533) triangle (p. 524) vertex (p. 510)

Vocabulary Check

State whether each sentence is *true* or *false*. If *false*, replace the underlined word or number to make a true sentence.

- Two angles whose measures add to 180° are called <u>complementary angles</u>.
- 2. A <u>hexagon</u> is a polygon with 6 sides.
- **3.** An angle whose measure is less than 90° is called a <u>right angle</u>.
- 4. The <u>vertex</u> is where the sides of angle meet.
- 5. The point (3, -2) when translated up 3 units and to the left 5 units becomes (6, -7).
- 6. A <u>trapezoid</u> has both pairs of opposite sides parallel.

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Study Guide and Review

Lesson-by-Lesson Review

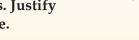


Angle Relationships (pp. 510–513)

7. Name the angle shown in four ways. Then classify the angle as *acute*, *right*, obtuse, or straight.

F G

For Exercises 8 and 9, refer to the figure at the right to identify each pair of angles. Justify your response.



- 8. a pair of vertical angles
- **9**. a pair of adjacent angles

Example 1 Name the angle in four ways.

The angle can be named

as $\angle JKL$, $\angle LKJ$, $\angle K$, or $\angle 5$.

∖67°

Example 2 Refer to the figure below. Identify a pair of vertical angles.



 $\angle 1$ and $\angle 4$ are opposite angles formed by the intersection of two lines.

 $\angle 1$ and $\angle 4$ are vertical angles.

10-2 Complementary and Supplementary Angles (pp. 514–517)

Classify each pair of angles as complementary, supplementary, or neither.

11.





x

Example 3 Find the value of *x*. x + 27 =

90 -27 = -2763



10-3 Statistics: Display Data in a Circle Graph (pp. 518–523)

12. SOFT DRINKS

SOFT DRINKS	Soft Drink	Percent		
The table shows	Cola	36%		
favorite soft dinks.	Diet Cola	28%		
Display the set	Root Beer	15%		
of data in a circle graph.	Lemon Lime	7%		
graph.	Other	14%		

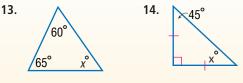
Example 3 Which season was chosen by about twice as many who chose fall?

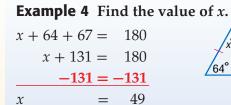
Spring, since **Favorite Season** 40% is about Winter about twice as 12% Spring 40% much as 22%. Fall 22% Summer 26%

10-4

Triangles (pp. 564–568)

ALGEBRA Find the value of *x*.







Mixed Problem Solving For mixed problem-solving practice, see page 724.

10-5

PSI: Logical Reasoning (pp. 530–531)

- 15. SPORTS Donnie, Jenna, Milo, and Barbara play volleyball, field hockey, golf, and soccer but not in that order. Use the clues given below to find the sport each person plays.
 - Donnie does not like golf, volleyball, or soccer.
 - Neither Milo nor Jenna likes golf.
 - Milo does not like soccer.
- FOOD Angelo's Pizza Parlor makes square pizzas. After baking, the pizzas are cut along one diagonal into two triangles. Classify the triangles made.

Example 5 Todd, Virginia, Elaine, and Peter are siblings. Todd was born after Peter, but before Virginia. Elaine is the oldest. Who is the youngest in the family?

Use logical reasoning to determine the youngest of the family.

You know that Elaine is the oldest, so she is first on the list. Todd was born after Peter, but before Virginia. So, Peter was second and then Todd was born. Virginia is the youngest of the family.

10-6

10-7

Quadrilaterals (pp. 533–539)

Classify the quadrilateral with the name that best describes it.



19. GEOMETRY What quadrilateral does not have opposite sides congruent?

Example 6 Classify the quadrilateral using the name that *best* describes it.

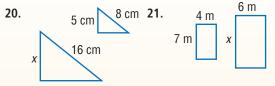


16 in.

The quadrilateral is a parallelogram with 4 right angles and 4 congruent sides. It is a square.

Similar Figures (pp. 540–545)

Find the value of *x* in each pair of similar figures.



22. FLAGPOLES Hiroshi is 1.6 meters tall and casts a shadow 0.53 meter in length. How tall is a flagpole if it casts a shadow 2.65 meters in length?

Example 7

Find the value of *x* in the pair of similar figures.

 $\frac{7}{28} = \frac{x}{16}$ $28 \cdot x = 7 \cdot 16$ 28x = 112 $\frac{28x}{28} = \frac{112}{28}$ x = 4

es. 28 in. Write a proportion. Find the cross products.



Divide each side by 28. Simplify.

So, the value of *x* is 4.





Polygons and Tessellations (pp. 546–551)

Determine whether each figure is a polygon. If it is, classify the polygon and state whether it is regular. If it is *not* a polygon, explain why.



25. ALGEBRA Find the measure of each angle of a regular 12-gon.

Example 8 Determine whether the figure is a polygon. If it is, classify the polygon and state whether it is regular. If it is *not* a polygon, explain why.



Since the polygon has 5 congruent sides and 5 congruent angles, it is a regular pentagon.

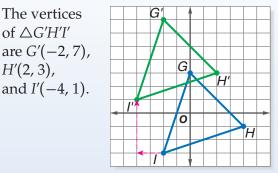
10-9

Translations (pp. 553–557)

Triangle *PQR* has coordinates P(4, -2), Q(-2, -3), and R(-1, 6). Find the coordinates of P'Q'R' after each translation. Then graph each translation.

- 26. 6 units left, 3 units up
- 27. 4 units right, 1 unit down
- 28. 3 units left
- 29. 7 units down

Example 9 Find the coordinates of $\triangle G'H'I'$ after a translation of 2 units left and 4 units up.



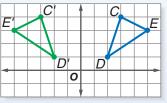
10-10 Reflections (pp. 558–562)

Find the coordinates of each figure after a reflection over the given axis. Then graph the figure and its reflected image.

- **30**. $\triangle RST$ with coordinates *R*(−1, 3), *S*(2, 6), and *T*(6, 1); *x*-axis
- **31**. parallelogram *ABCD* with coordinates *A*(1, 3), *B*(2, -1), *C*(5, -1), and *D*(4, 3); *y*-axis
- **32**. rectangle *EFGH* with coordinates *E*(4, 2), *F*(-2, 2), *G*(-2, -5), and *H*(4, -5); *x*-axis

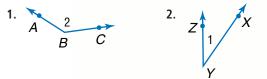
Example 10 Find the coordinates of $\triangle C'D'E'$ after a reflection over the *y*-axis. Then graph its reflected image.

The vertices of $\triangle C'D'E'$ are C'(-3, 4), D'(-2, 1), and E'(-5, 3).

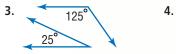


Practice Test

Name each angle in four ways. Then classify each angle as *acute*, *obtuse*, *right*, or *straight*.



Classify each pair of angles as *complementary*, *supplementary*, or *neither*.



CHAPTER



- **5. GEOMETRY** Classify the angle pair at the right as *vertical*, *adjacent*, or *neither*.
- 6. **STANDARDS PRACTICE** The table shows the results of a survey. The results are to be displayed in a circle graph. Which statement about the graph is *not* true?

Favorite Type of Books					
Type Students					
mystery	24				
science fiction	8				
sports	26				
romance	30				

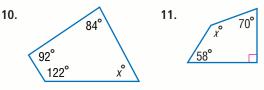
- A The science fiction section on the graph will have an angle measure of about 33°.
- **B** Romance books were preferred more than any other type of book.
- **C** About 30% of students chose sports books as their favorite.
- **D** The mystery and sports sections on the circle graph are supplementary angles.

ALGEBRA Find the missing measure in each triangle with the given angle measures.

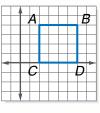
- **7**. 75°, 25.5°, *x*°
- **8**. 23.5°, *x*°, 109.5°

9. ALGEBRA Numbers ending in zero or five are divisible by five. Are the numbers 25, 893, and 690 divisible by 5? Use the *logical reasoning* strategy.

ALGEBRA Find the value of *x* in each quadrilateral.



- 12. GEOGRAPHY A map is drawn so that it is similar to a map in an atlas. The map in the atlas is 7 inches long and 10 inches wide. If the hand-drawn map has a length of 17.5 inches, what is its width?
- **13. GEOMETRY** Can a regular heptagon, with angle measures that total 900°, be used by itself to make a tessellation? Explain.
- 14. **STANDARDS PRACTICE** Which quadrilateral does *not* have opposite sides congruent?
 - FparallelogramHtrapezoidGsquareJrectangle
- ALGEBRA Square *ABCD* is shown. What are the vertices of *A'B'C'D'* after a translation 2 units right and 2 units down? Graph the translated image.



16. GEOMETRY Draw a figure with one line of symmetry. Then draw a figure with no lines of symmetry.

Math Chapter Test at ca.gr6math.com

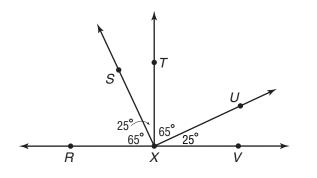


California Standards Practice Cumulative, Chapters 1–10



Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.

1 Which of the following two angles are complementary?



- **A** $\angle RXS$ and $\angle TXU$
- **B** $\angle SXT$ and $\angle TXU$
- **C** $\angle RXS$ and $\angle SXV$
- **D** $\angle SXR$ and $\angle SXV$
- 2 A square is divided into 9 congruent squares. Which of the following methods can be used to find the area of the larger square, given the area of one of the smaller squares?



- **F** Multiply the area of the larger square by 9.
- G Add 9 to the area of one of the smaller squares.
- **H** Multiply the area of one of the smaller squares by 9.
- J Add the area of the larger square to the sum of the areas of each of the 9 smaller squares.

3 Which of the following groups does *not* contain equivalent fractions, decimals, and percents?

A
$$\frac{9}{20}$$
, 0.45, 45%
B $\frac{3}{10}$, 0.3, 30%
C $\frac{7}{8}$, 0.875, 87.5%

D
$$\frac{1}{100}$$
, 0.1, 1%

The table below shows all the possible outcomes when tossing two fair coins at the same time.

1st Coin	2nd Coin
Н	Н
Н	Т
Т	Н
Т	Т

Which of the following must be true?

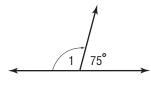
- **F** The probability that both coins have the same outcome is $\frac{1}{4}$.
- **G** The probability of getting at least one tail is higher than the probability of getting two heads.
- **H** The probability that exactly one coin will turn up heads is $\frac{3}{4}$.
- J The probability of getting at least one tail is lower than the probability of getting two tails.
- 5 Seth has \$858.60 in his savings account. He plans to spend 15% of his savings on a bicycle. Which of the following represents the amount Seth plans to spend on the bicycle?

A \$128.79	C \$182.79
B \$171.72	D \$122.79



More California Standards Practice For practice by standard, see pages CA1–CA39.

- 6 A manager took an employee to lunch. If the lunch was \$48 and she left a 20% tip, how much money did she spend on lunch?
 - **F** \$68.00
 - **G** \$57.60
 - H \$55.80
 - J \$38.40
- 7 What is the measure of ∠1 in the figure below?



- A 15°
 C 100°

 B 25°
 D 105°
- 8 Natasha wants to take a survey to determine which type of music is most popular at her school. Which of the following methods is the best way for her to choose a random sample of the students at her school?
 - F select members of the football team
 - ${\bf G}\,$ select members of the chess club
 - H select 20 students at random from each grade level
 - J select students who enjoy rap music

TEST-TAKING TIP

NEED EXTRA HELD?

Question 9 Sometimes, it is not necessary to perform any calculations in order to answer the question correctly. In Question 9, you can use number sense to eliminate certain answer choices. Not having to perform calculations can help save time during a test.

9 Josiah found the mean and median of the following list of numbers.

11, 17, 17

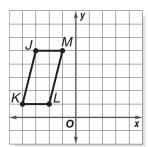
If the number 25 is added to this list, then which of the following statements would be true?

- A The mean would increase.
- **B** The mean would decrease.
- C The median would increase.
- **D** The median would decrease.

Pre-AP

Record your answers on a sheet of paper. Show your work.

10 Edmundo plotted the polygon *JKLM* on the coordinate plane to the right.



- a. Classify $\angle J$.
- **b.** Classify $\angle M$.
- c. Classify the polygon *JKLM* using the name that *best* describes it.
- **d.** Can polygon *JKLM* be used by itself to make a tessellation? Explain your reasoning.
- e. If polygon *JKLM* is translated 2 units right and 5 units down, what are the coordinates of the new figure?
- f. If polygon *JKLM* is reflected over the *x*-axis, what are the coordinates of the new figure?

NEED EATRA HELP:										
If You Missed Question	1	2	3	4	5	6	7	8	9	10
Go to Lesson	10-1	10-5	6-8	9-1	7-1	7-4	10-1	8-8	8-2	10-5
For Help with Standard	MG2.1	MG2.3	NS1.1	SDAP3.1	NS1.4	NS1.4	MG2.2	SDAP2.2	SDAP1.2	MG2.3



BIG Idea

Standard 6MG1.0 Deepen understanding of the measurement of plane and solid shapes and use this understanding to solve problems.

Key Vocabulary

circumference (p. 584) cylinder (p. 604) pyramid (p. 603) volume (p. 613)

Measurement: Two- and Three-Dimensional Figures



Real-World Link

Architecture If you visit the Transamerica Pyramid building in San Francisco, you will see examples of three-dimensional figures used in architecture.

OLDARIES dy Organizer

Measurement: Two- and Three-Dimensional Figures Make this Foldable to help you organize your notes. Begin with a sheet of $8\frac{1}{2}$ by 11" construction paper and two sheets of notebook paper.

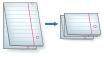
by side onto the

🕕 Fold the construction paper in half lengthwise. Label the chapter title on the outside. Chapter 11 ment o-& Threenensional

3 Open the notebook paper. Cut along the second folds to make four tabs.

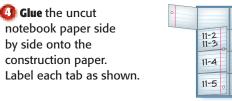


Poid the sheets of notebook paper in half lengthwise. Then fold top to bottom twice.



11-8

11-9 11-10



GET READY for Chapter 11

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 2

Math Online Take the Online Readiness Quiz at ca.gr6math.com.

Take the Quick Check below. Refer to the Quick Review for help.

OUICKCheck OUTOKReview Evaluate each expression. (Prior Grade) **Example 1** Find 1.2 • 3.4. **2**. 5.6 \times 9.8 -> 1.2 $\times 3.4$ **3.** $12 \times 4 \times 26$ **4.** $4.5 \times 3.2 \times 1.7$ 48 **5.** $\left(\frac{1}{2}\right)(11)(14)$ **6.** $\left(\frac{1}{2}\right)(8.8)(2.3)$ 36 4.08 7. **SHOPPING** Margo bought **Example 2** Find $(\frac{1}{2})(26)(19)$. 3 sweaters that originally cost \$27.78 each. If they were on sale

$\left(\frac{1}{2}\right)(26)(19) = (13)(19)$ Multiply $\frac{1}{2}$ by 26. Multiply 13 by 19. = 247

1 decimal place

+1 decimal place

2 decimal places

Evaluate each expression. (Lesson 1-2) **8**. 3² 9. 11 squared

for half the price, what was the

total cost of the sweaters, not including tax? (Prior Grade)

10. 5 to the third power

Option 1

1. 8 × 17

- **11**. 6 to the second power
- **12. CHESS** If a chessboard has 8^2 squares, how many squares is this? (Lesson 1-2)

Evaluate each expression. Use 3.14 for π . Round to the nearest tenth. (Prior Grade)

13. $\pi imes 4$	14. $\pi \times 13.8$
15. (2)(π)(5)	16. $(2)(\pi)(1.7)$
17. $\pi \times 9^2$	18 . $\pi \times 6^2$

Example 3 Evaluate 7³. $7^3 = 7 \cdot 7 \cdot 7$ or 343

Example 4 Evaluate 2 to the fourth power.

2 to the fourth power is written 2^4 .

 $2^4 = 2 \cdot 2 \cdot 2 \cdot 2 \text{ or } 16$

Example 5 Evaluate $\pi \times 5^2$. Use 3.14 for π . Round to the nearest tenth.

 $\pi \cdot 5^2 = \pi \cdot 25$ $5^2 = 25$ = 78.5 Multiply π by 25.

Area of Parallelograms

MINI Lab

Main IDEA

Find the areas of parallelograms.



describing geometric quantities (e.g., $P = 2w + 2\ell$,

 $A = \frac{1}{2}bh, C = \pi d$ —the formulas for the perimeter of a rectangle, the area of a triangle, and the circumference of a circle, respectively).

Standard 6AF3.2

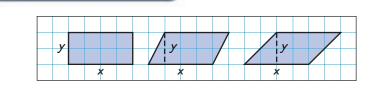
Express in symbolic form simple relationships arising from geometry.

NEW Vocabulary

sides parallel and congruent

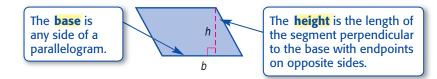
(Lesson 10-5)

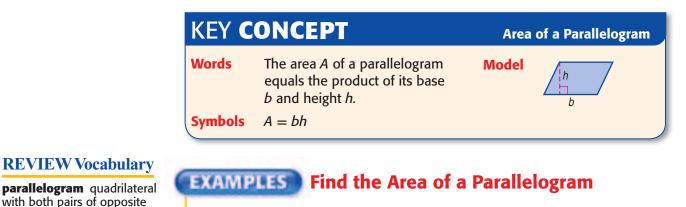
base height



- 1. What is the value of *x* and *y* for each parallelogram?
- 2. Count the grid squares to find the area of each parallelogram.
- **3**. On grid paper, draw three different parallelograms in which x = 5 units and y = 4 units. Find the area of each.
- 4. **MAKE A CONJECTURE** Explain how to find the area of a parallelogram if you know the values of *x* and *y*.

You can find the area of a parallelogram by using the values for the base and height, as described below.





Find the area of a parallelogram. Estimate $A = 13 \cdot 6$ or 78 cm² A = bh Area of a parallelogram $A = 13 \cdot 5.8$ Replace *b* with 13 and *h* with 5.8. A = 75.4 Multiply. The area is 75.4 square centimeters. Check for Reasonableness 75.4 \approx 78 \checkmark



Common Error

parallelogram, be sure to use the base

and the height, not the base and a side.

When finding

the area of a

2) Find the area of the parallelogram.

The base is 11 inches, and the height is 9 inches.

11 in. 9 in. 9¹/₂ in.

Estimate $A = 10 \cdot 10 \text{ or } 100 \text{ in}^2$

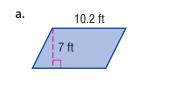
- A = bh Area of a parallelogram
- $A = 11 \cdot 9$ Replace *b* with 11 and *h* with 9.
- A = 99 Multiply.

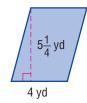
The area of the parallelogram is 99 square inches.

Check for Reasonableness 99 ≈ 100 ✓

CHECK Your Progress

Find the area of each parallelogram.





KNOX

b.



Real-World EXAMPLE

3 WEATHER The map shows the region of a state that is under a tornado warning. What is the area of this region?

Estimate $A = 30 \cdot 30 \text{ or } 900 \text{ mi}^2$

- A = bh Area of a parallelogram
- $A = 27.5 \cdot 30.6$ Replace *b* with 27.5 and *h* with 30.6.
- A = 841.5 Multiply.

The area of the region is 841.5 square miles.

Check for Reasonableness 841.5 ≈ 900 **✓**

CHECK Your Progress

c. **SAFETY** A street department painted the pavement markings shown at the right on the surface of a highway to reduce traffic speeds and crashes. What is the area inside one of the markings? 15.5 ft

ADAMS

LUCAS

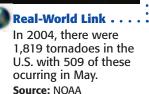
27.5 mi

30.6 mi

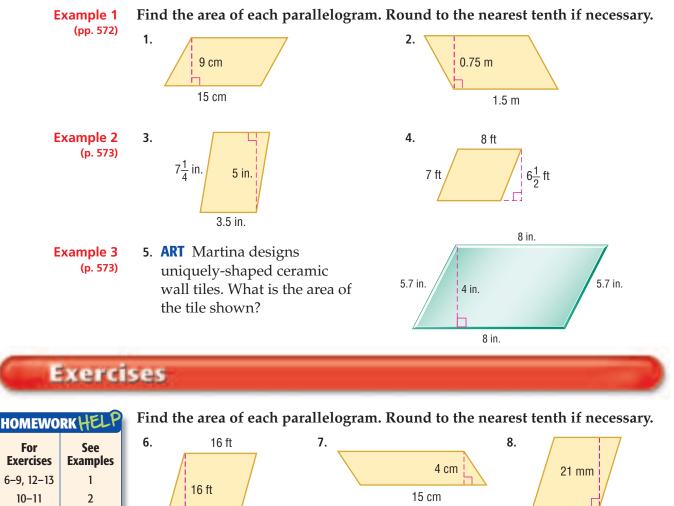
FOX

LAKE



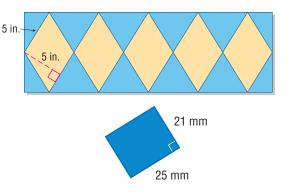


CHECK Your Understanding



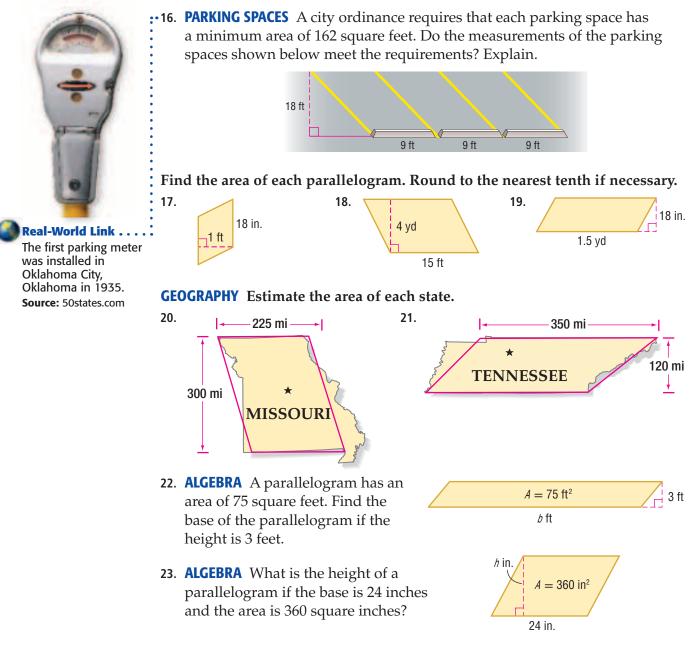
9. 0.3 cm 0.5 cm 10. 12 in. 14 in. $17\frac{1}{4} \text{ in.}$ 10 yd $5\frac{1}{2} \text{ yd}$ 10 yd $5\frac{1}{2} \text{ yd}$

- 12. What is the area of a parallelogram with base $10\frac{3}{4}$ yards and height 7 yards?
- **13**. Find the area of a parallelogram with base 12.5 meters and height 15.25 meters.
- 14. WALLPAPER The design of the wallpaper border at the right contains parallelograms. How much space on the border is covered by the parallelograms?
- **15. PATTERN BLOCKS** What is the area of the parallelogram-shaped pattern block shown at the right?



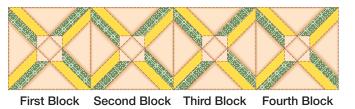
14-15

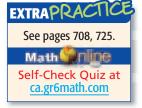
3



QUILTING For Exercises 24 and 25, use the four quilt blocks shown and following information.

Each quilt block uses eight parallelogram-shaped pieces of fabric that have a height of $3\frac{1}{3}$ inches and a base of $3\frac{3}{4}$ inches.





- **24**. Find the amount of fabric in square inches needed to make the parallelogram-shaped pieces for one quilt block.
- **25.** How much fabric is needed to make the parallelogram pieces for a quilt that is made using 24 blocks? Write in square feet. (*Hint*: $144 \text{ in}^2 = 1 \text{ ft}^2$)

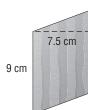
- **26. OPEN ENDED** Draw three different parallelograms, each with an area of 24 square units.
- **27. CHALLENGE** *True* or *False*? The area of a parallelogram doubles if you double the base and the height. Explain or give a counterexample to support your answer.

F

- 28. **WRITING IN MATH** Compare and contrast the formula for the area of
- a rectangle and a parallelogram.

STANDARDS PRACTICE

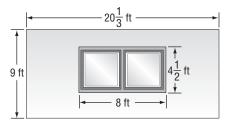
29. A scale drawing of a piece of land is shown below.



What is the actual area of the land if the scale on the drawing is 10 km = 1 cm? A 67.5 cm² C 675 km²

B 67.5 km^2 **D** $6,750 \text{ km}^2$

30. Ms. Cruz painted one wall in her living room. She did not paint the window.



Which of the following is closest to the painted area of the wall in square feet?

R

0

x

180 ft ²	Η	120 ft^2
150.62	т	24 (12

G 150 ft² **J** 34 ft²

Spiral Review

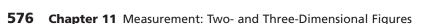
For Exercises 31 and 32, refer to $\triangle ABC$ at the right. Find the vertices of $\triangle A'B'C'$ after each transformation. Then graph the triangle and its reflected or translated image.

- **31**. $\triangle ABC$ reflected over the *y*-axis (Lesson 10-9)
- **32**. $\triangle ABC$ translated 5 units right and 1 unit up (Lesson 10-8)
- **33. GEOMETRY** Explain how to determine whether a regular octagon tessellates the plane. (Lesson 10-7)
- 34. **FRUIT** If 2 out of every 3 pieces of fruit in a fruit basket are oranges, how many oranges are there if the fruit basket has 18 pieces of fruit? (Lesson 6-5)

GET READY for the Next Lesson

PREREQUISITE SKILL Find each value. (Lesson 1-4)

35. 6(4+10) **36.** $\frac{1}{2}(8)(8)$ **37.** $\frac{1}{2}(24+15)$ **38.** $\frac{1}{2}(5)(13+22)$



Measurement Lab Triangles and Trapezoids

Main IDEA

Find the areas of parallelograms.

Standard 6AF3.2 Express in symbolic form simple relationships arising from geometry. Standard 6MR3.3 Develop generalizations of the results obtained and the strategies used and apply them in new problem situations.

Explore

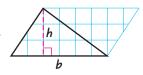
ACTIVITY

STEPI) On grid paper, draw a triangle with a base of 6 units and a height of 3 units. Label the base *b* and the height *h* as shown.

	h			
	Ŀ	2		

Fold the grid paper in half and cut out the triangle through both sheets so that you have two congruent triangles.

Turn the second triangle upside down and tape it to the first triangle.

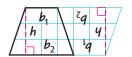


ANALYZE THE RESULTS

- 1. What figure is formed by the two triangles?
- 2. Write the formula for the area of the figure. Then find the area.
- 3. What is the area of each of the triangles? How do you know?
- 4. Repeat the activity above, drawing a different triangle in Step 1. Then find the area of each triangle.
- **5**. Compare the area of a triangle to the area of a parallelogram with the same base and height.
- 6. **MAKE A CONJECTURE** Write a formula for the area of a triangle with base *b* and height *h*.

For Exercises 7–10, refer to the information below.

On grid paper, cut out two identical trapezoids. Label the bases b_1 and b_2 , respectively, and label the heights h. Then turn one trapezoid upside down and tape it to the other trapezoid as shown.



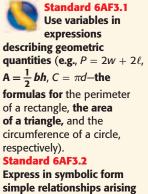
and tape it to the other trapezoid as shown.

- 7. Write an expression to represent the base of the parallelogram.
- **8.** Write a formula for the area *A* of the parallelogram using *b*₁, *b*₂, and *h*.
- **9.** How does the area of each trapezoid compare to the area of the parallelogram?
- **10. MAKE A CONJECTURE** Write a formula for the area *A* of a trapezoid with bases b_1 and b_2 , and height *h*.

Area of Triangles and Trapezoids

Main IDEA

Find the areas of triangles and trapezoids.



from geometry.

6 units and a height of 4 units. • Draw a diagonal as shown.

• Cut out the parallelogram.

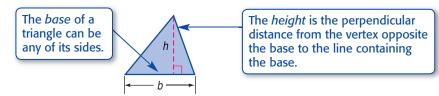
MINI Lab

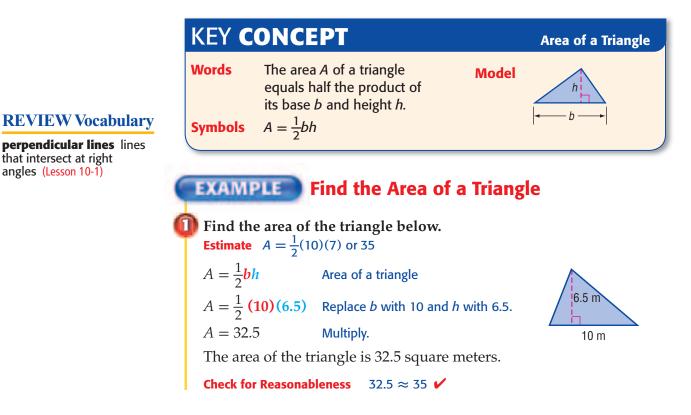
1. What is the area of the parallelogram?

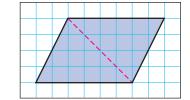
• Draw a parallelogram with a base of

- 2. Cut along the diagonal. What is true about the triangles formed?
- 3. What is the area of each triangle?
- **4**. If the area of a parallelogram is *bh*, then write an expression for the area *A* of each of the two congruent triangles that form the parallelogram.

You can find the area of a triangle by using the base and height.





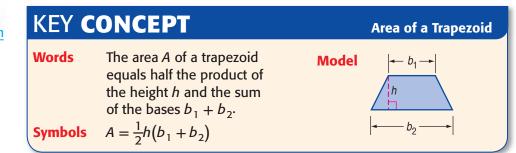




Find the area of each triangle. Round to the nearest tenth if necessary.



A trapezoid has two bases, b_1 and b_2 . The bases are always the two sides that are parallel. The height of a trapezoid is the perpendicular distance between the bases.



EXAMPLE Find the Area of a Trapezoid

5	Find the area of th	e trapezoid.	5 in.
	The bases are 5 incl The height is 7 inch		7 in.
	$A = \frac{1}{2}h(b_1 + b_2)$	Area of a trapezoid	12 in.
	$A = \frac{1}{2}(7)(5 + 12)$	Replace h with 7, b_1 with 5, a	nd b_2 with 12.
	$A = \frac{1}{2}(7)(17)$	Add 5 and 12.	
	A = 59.5	Multiply.	
	The area of the trar	ozoid is 59 5 square inches	

The area of the trapezoid is 59.5 square inches.



Find the area of each trapezoid. Round to the nearest tenth if necessary.



Concepts in Motion Interactive Lab ca.gr6math.com

READING Math

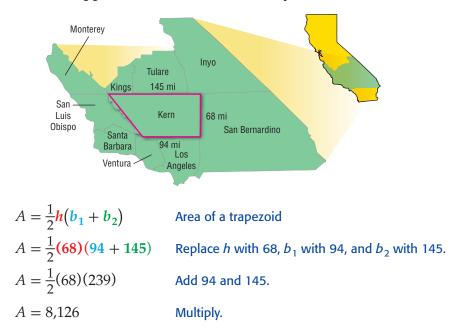
Subscripts Read b_1 as b sub 1. Read b_2 as b sub 2. The subscripts mean that b_1 and b_2 represent different variables.



Real-World Link Kern County, larger than Massachusetts, New Jersey, and Hawaii combined, is home to the wild and scenic Kern River which offers rapids, fishing, and camping. Source: visitkern.com

Real-World EXAMPLE

GEOGRAPHY The shape of Kern County resembles a trapezoid. Find the approximate area of this county.



The area of Kern County is approximately 8,126 square miles.

e. **GEOGRAPHY** The shape of the state of Arkansas resembles a trapezoid. Find the approximate area of Arkansas.



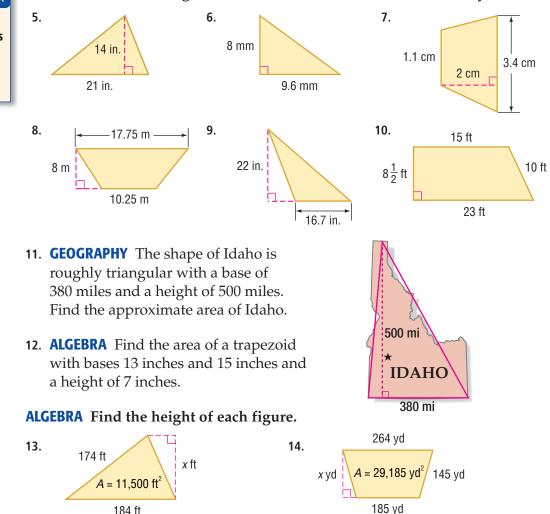
CHECK Your Understanding

Find the area of each figure. Round to the nearest tenth if necessary. Examples 1, 2 (pp. 578-579) 1. 2. 3. 7 ft 16.5 m 3 in. 8 ft 15.6 ft -12.8 m 4 in. 4. **GEOGRAPHY** Nevada has a shape 318 mi Example 3 (p. 580) that looks like a trapezoid, as 206 mi NEVADA shown at the right. Find the **Carson City** approximate area of Nevada. 478 mi

Exercises

HOMEWORKHELP		
For Exercises	See Examples	
5, 6, 9	1	
7, 8, 10	2	
11, 12	3	

Find the area of each figure. Round to the nearest tenth if necessary.



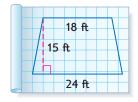
184 ft

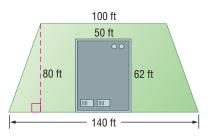
Draw and label each figure. Then find the area.

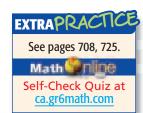
- **15**. a triangle with no right angles and an area less than 12 square centimeters
- **16.** a trapezoid with a right angle and an area greater than 40 square meters
- 17. a trapezoid with no right angles and an area less than 25 square feet
- **18. ARCHITECTURE** The blueprints for a patio are shown at the right. If the cost of the patio is \$4.50 per square foot, what will be the total cost of the patio?

LANDSCAPING For Exercises 19 and 20, use the diagram that shows the lawn that surrounds an office building.

- **19**. What is the area of the lawn?
- **20**. If one bag of grass seed covers 2,000 square feet, how many bags are needed to seed the lawn?

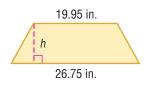






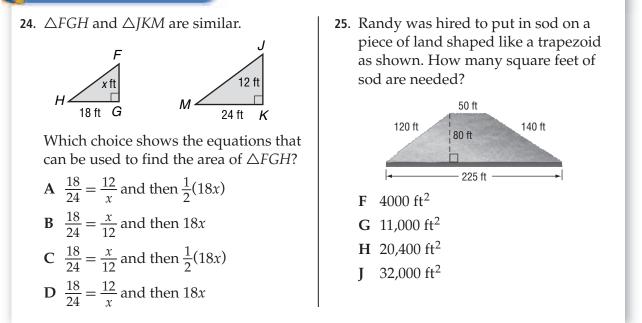


- **21. CHALLENGE** A triangle has height *h*. Its base is 4. Create an algebraic equation for the area of the triangle in terms of *h*.
- 22. **REASONING** Apply what you know about rounding to explain how to estimate the height *h* of the trapezoid shown if the area is 235.5 in^2 .



23. **WRITING IN MATH** Describe the relationship between the area of a parallelogram and the area of a triangle with the same height and base.

STANDARDS PRACTICE



Spiral Review

- **26. MEASUREMENT** Find the area of a parallelogram having a base of 2.3 inches and a height of 1.6 inches. Round to the nearest tenth. (Lesson 11-1)
- **27. GEOMETRY** Graph $\triangle JLK$ with vertices J(-1, -4), K(1, 1), and L(3, -2) and its reflection over the *x*-axis. Write the ordered pairs for the vertices of the new figure. (Lesson 10-9)

Find each number. Round to the nearest tenth if necessary. (Lesson 7-5)

- **28**. What number is 56% of 600?
- **29**. 24.5 is what percent of 98?
- **30**. 72 is 45% of what number?
- **31.** 62.5% of 250 is what number?

GET READY for the Next Lesson

PREREQUISITE SKILL Find each product to the nearest tenth. Use 3.14 for π .			
(Lesson 1-4)			
32 . π • 13	33 . π • 29	34 . $\pi \cdot 16^2$	35 . $\pi \cdot 4.8^2$

Explore 11-3

Main IDEA

Find a relationship between circumference and diameter.



the concept of a constant such as π ; know the formulas for the

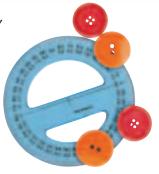
circumference and area of a circle. Standard 6MR3.3 Develop

generalizations of the results obtained and the strategies used and apply them in new problem situations.

Measurement Lab Circumference of Circles

In this lab, you will investigate how the *circumference*, or the distance around a circle, is related to its *diameter*, or the distance across a circle through its center.

ACTIVITY



Use a ruler to measure the diameter of a circular object. Record the measure in a table like the one shown below.

Object	Diameter (cm)	Circumference (cm)

- Make a small mark at the edge of the circular object. Place a measuring tape on a flat surface. Place the mark you made on the circular object at the beginning of the measuring tape. Roll the object along the tape for one revolution, until you reach the mark again.
- **STLP3** Record the length in the table. This is the circumference.
- **STEP 4** Repeat this activity with circular objects of various sizes.

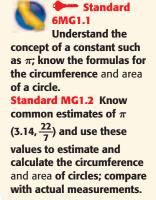
ANALYZE THE RESULTS

- 1. For each object, divide the circumference by the diameter. Add another column to your table and record the results. Round to the nearest tenth if necessary.
- 2. What do you notice about the ratio of each circumference to each diameter?
- **3.** Graph the ordered pair (diameter, circumference) on a coordinate plane for each object. What do you notice?
- 4. Use the graph to predict the circumference of a circular object that has a diameter of 18 centimeters.
- **5. MAKE A CONJECTURE** Write a rule describing how you would find the circumference *C* of a circle if you know the diameter *d*.
- **6.** Use your rule to approximate the circumference of a circular object that has a diameter of 45 centimeters.

-39 Circles and Circumference

Main IDEA

Find the circumference of circles.



NEW Vocabulary

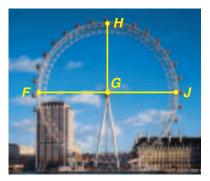
circle center diameter circumference radius π (pi)

GET READY for the Lesson

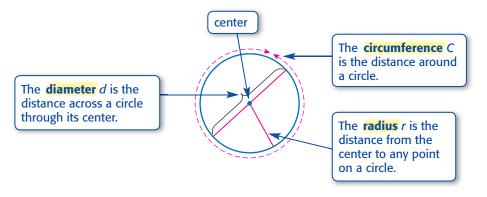
FERRIS WHEELS The London Eye Ferris wheel, in London, England, measures 450 feet across.

- 1. Which point appears to be the center of the Ferris wheel?
- 2. Is the distance from *G* to *F* greater than, less than, or equal to the distance from *G* to *J*?
- **3**. How does the distance from *G* to *H* compare to the distance from *F* to *J*?

4. Find the distance from *G* to *F*.



A **circle** is the set of all points in a plane that are the same distance from a given point, called the **center**.



The diameter of a circle is 2 times the radius, or d = 2r. Another relationship that is true of all circles is $\frac{C}{d} = 3.1415926...$. This nonterminating and nonrepeating number is represented by the Greek letter π (pi). An approximation often used for π is 3.14.

KEY CONCEPTCircumference of a CircleWordsThe circumference C of a circle is equal to its diameter d times
 π , or 2 times its radius r times π .Symbols $C = \pi d$ or $C = 2\pi r$

When finding the circumference of a circle, it is necessary to use an approximation of π since its exact value cannot be determined.



Estimation

To estimate the circumference of a circle, you can use 3 for π since $\pi \approx 3$.

Real-World EXAMPLE Find Circumference

FERRIS WHEELS Refer to the lesson opener. Find the circumference of the London Eye Ferris wheel.

Estimate $C = 3 \cdot 450 \text{ or } 1,350 \text{ ft}$		
$C = \pi d$	Circumference of a circle	
$C \approx 3.14(450)$	Replace π with 3.14 and d with 450.	
$C \approx 1,413$	Multiply.	

So, the distance around the Ferris wheel is about 1,413 feet.

Check for Reasonableness $1,413 \approx 1,350$

CHECK Your Progress

Find the circumference of each circle. Use 3.14 for π . Round to the nearest tenth if necessary.



Another approximation for π is $\frac{22}{7}$. Use this value when the radius or diameter is a multiple of 7 or has a multiple of 7 in its numerator if the radius is a fraction.

EXAMPLE Find Circumference

2 Find the circumference of a circle with a radius of 21 inches.

Since 21 is a multiple of 7, use $\frac{22}{7}$ for π . $C = 2\pi r$ Circumference of a circle $C \approx 2 \cdot \frac{22}{7} \cdot 21$ Replace π with $\frac{22}{7}$ and r with 21. $C \approx 2 \cdot \frac{22}{7} \cdot \frac{21}{1}$ Divide by the GCF, 7. $C \approx 132$ Simplify.

The circumference of the circle is about 132 inches.

CHECK Your Progress

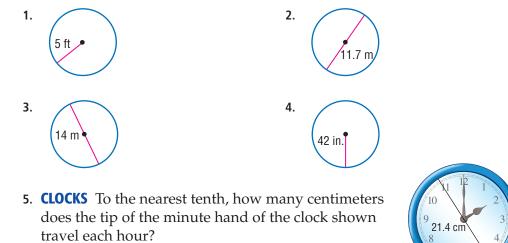
Find the circumference of each circle. Use $\frac{22}{7}$ for π . Round to the nearest tenth if necessary.



21 in

Your Understanding

Find the circumference of each circle. Use 3.14 or $\frac{22}{7}$ for π . Round to the Examples 1, 2 (p. 585) nearest tenth if necessary.



Exercises

HOMEWO For Exercises 6–9, 14–15 20–21 10–13, 16–19	See Examples	Find the circumference of nearest tenth if necessar 6.	of each circle. Use 3.14 or ery. 7.	$\frac{22}{7} \text{ for } \pi. \text{ Round to the}$ 8. 5.8 km
10 15		9.	10.	11.
		12. radius = $1\frac{3}{4}$ in.	13. diameter $= 10\frac{1}{2}$ in.	14 . diameter = 15.1 m
		15 . diameter = 10.8 km	16. radius = $2\frac{5}{8}$ in.	17. diameter = $12\frac{1}{4}$ mi
		18. SPORTS A flying disc	has a diameter of $9\frac{5}{8}$ inche	es. Find its circumference.
		19. WHEELS A hamster waturn in one revolution		ches. How far will the wheel
			Guard military patch has a ence to the nearest tenth?	a diameter of 2.5 inches.
		swimming pool that	ily owns an above-ground has walls made of aluminu num surrounding the pool	um. Find

if the radius is 15 feet. Round to the nearest tenth.

LABELS Determine the length of each can's label.



MEASUREMENT For Exercises 25–28, perform each of the following steps.

- a. Use a centimeter ruler to measure the diameter of each circular object listed.
- **b.** Estimate to find the approximate circumference of each circle. State which approximation of π you used.
- c. Calculate the circumference of each circle. Use 3.14 for π .
- d. Cut a piece of string the length of the circumference of each circle. Use a centimeter ruler to measure the length of the string to the nearest tenth of a centimeter. Compare this actual length to the calculated length.

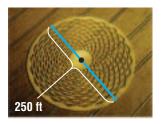
25 . soup can lid	26. quarter
27. CD or DVD	28. button

ALGEBRA Find the diameter or radius of each circle. Use 3.14 for π . Round to the nearest tenth if necessary.

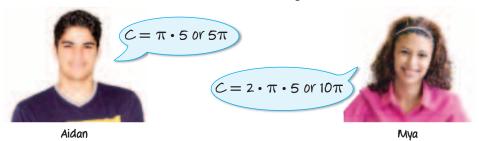
- **29**. C = 25 ft, diameter = ft **31**. C = 30 yd, radius = yd
 - ft**30.** C = 54 cm, diameter = \Box cmyd**32.** C = 48 km, radius = \Box km

:-33. **UNICYCLES** A unicycle wheel has a radius of 10 inches. How many feet will the unicycle travel in 5 revolutions? Explain how you solved this problem.

34. CROPS The crop circle shown was created in England in a single night by an unknown source. About how many strides would it take for a person to walk around the circle if each stride is 3 feet?



- **35**. **FIND THE DATA** Refer to the California Data File on pages 16–19. Choose some data and write a real-world problem in which you would find the circumference of a circle.
- **36. OPEN ENDED** Select a real-world situation in which finding the circumference of a circle would be useful.
- **37. FIND THE ERROR** Aidan and Mya are finding the circumference of a circle with a radius of 5 inches. Who is correct? Explain.





Real-World Link . . . The record for the longest unicycle ride is 9,126 miles. Source: Guinness World Records

EXTRAPRACTICE
See pages 708, 725.
Math 🗐 🗐 🗇 🖯
Self-Check Quiz at <u>ca.gr6math.com</u>

H.O.T. Problems

CHALLENGE For Exercises 38 and 39, use the circle at the right.

- **38**. How many lengths *x* will fit on the circle's circumference?
- **39**. If the value of *x* is doubled, what effect will this have on the diameter? on the circumference? Explain your reasoning.



40. WRITING IN MATH A *constant* is a quantity whose value never changes. In the formula for the circumference of a circle, identify any constants. Justify your response.

.....

STANDARDS PRACTICE

41. Malik's bike tire has a radius of 8 inches. Which equation could be used to find the circumference of the tire in inches?

$$\mathbf{A} \quad C = \boldsymbol{\pi} \cdot \mathbf{4} \qquad \qquad \mathbf{C} \quad C = \boldsymbol{\pi} \cdot \mathbf{16}$$

B
$$C = \pi \cdot 16 \times 2$$
 D $C = \pi \cdot 8$

42. Each wheel on Nina's car has a diameter of 18 inches. Which expression could be used to find the circumference of the wheel?

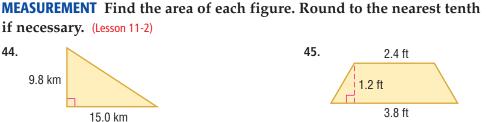
F	$2 \times 9 \times \pi$	Η	$9 \times 9 \times \pi$
G	$2 \times 18 \times \pi$	J	$18 \times 18 \times \pi$

43. The distance around a tree trunk is the girth of the tree. Which measure is *closest* to the girth of the cross-section of the tree shown below?



A34.5 in.C138.2 in.B69.1 in.D380.0 in.

Spiral Review



- **46. MEASUREMENT** Find the area of a parallelogram with base 6.5 meters and height 7.0 meters. (Lesson 11-1)
- **47. PROBABILITY** Jorge rolled a number cube several times and recorded the results in the table shown. Find the experimental probability that an odd number turned up. (Lesson 9-7)

GET READY for the Next Lesson

PREREQUISITE SKILL Use a calculator to find each product to the nearest tenth. Use 3.14 for π . (Lesson 1-4) 48. $\pi \cdot 5^2$ 49. $\pi \cdot 7^2$ 50. $\pi \cdot (2.4)^2$

Outcome	Frequency
1	₩1
2	III
3	JHT
4	₩I
5	
6	

51. $\pi \cdot (4.5)^2$



Area of Circles

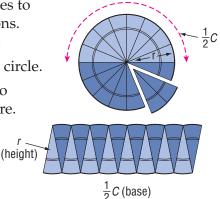
Main IDEA

Find the areas of circles.

Standard 6MG1.1 Understand the concept of a constant such as π ; know the formulas for the circumference and area of a circle. **Standard 6MG1.2** Know common estimates of π (3.14, $\frac{2}{27}$) and use these values to estimate and calculate the circumference and area of circles; compare with actual measurements.

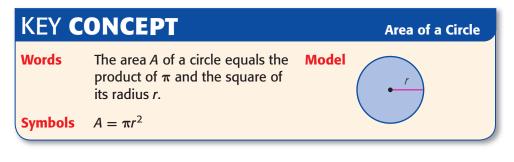
MINI Lab

- Fold a paper plate in half four times to divide it into 16 equal-sized sections.
- Label the radius *r* as shown. Let *C* represent the circumference of the circle.
- Cut out each section; reassemble to form a parallelogram-shaped figure.
- 1. What is the measurement of the base and the height?
- **2**. Substitute these values into the formula for the area of a parallelogram.



3. Replace *C* with the expression for the circumference of a circle, $2\pi r$. Simplify the equation and describe what it represents.

In the Mini Lab, the formula for the area of a parallelogram was used to develop a formula for the area of a circle.



EXAMPLE Find the Area of a Circle

Find the area of the circle.

$A = \pi r^2$	Area of a circle
$A = \pi \cdot 2^2$	Replace π with 3.14 and r with 2.
$A \approx 12.6$	Multiply.

2 in.

The area of the circle is approximately 12.6 square inches.

CHECK Your Progress

a. Find the area of a circle with a radius of 3.2 centimeters. Round to the nearest tenth.

Real-World EXAMPLE

2) COINS Find the area of the face of the California quarter shown.

The diameter of the quarter is 24 millimeters,

so the radius is $\frac{1}{2}(24)$ or 12 millimeters. $A = \pi r^2$ Area of a circle $A = \pi \cdot 12^2$ Replace π with 3.14 and r with 12.

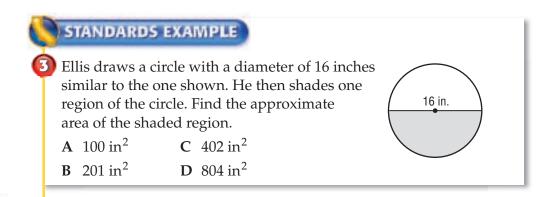
 $A \approx 452.2$ Multiply.

The area is approximately 452.2 square millimeters.



CHECK Your Progress

b. POOLS The bottom of a circular swimming pool with diameter 30 feet is painted blue. How many square feet are blue?



Read the Item

Since the segment in the figure is a diameter, you know that the shaded region represents half of the area of the circle. To find the area of the shaded region, you can find the total area of the circle and then divide by 2.

Solve the Item

 $A = \pi r^2$ Area of a circle

 $A = \pi \cdot 8^2$ Replace *r* with 16 ÷ 2 or 8.

 $A \approx 200$ Multiply. Use 3.14 for π .

Half of the total area is approximately $\frac{1}{2}(200)$ or 100 square inches. The answer is A.

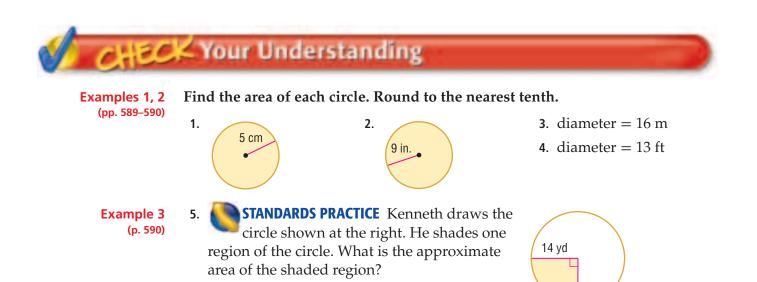
CHECK Your Progress

c. Ray drew one circle with a radius of 7 centimeters and another circle with a radius of 10 centimeters. Find the approximate difference between the areas of the circles.



Test-Taking Tip

Identifying What is Given Before finding area, be sure to read the question carefully and identify if the radius or diameter is given.



C 310 yd^2

D 615 yd^2

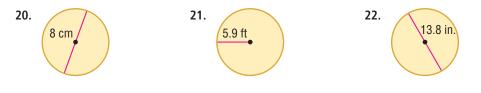
Exercises

A 88 yd^2

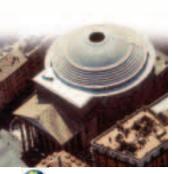
B 154 yd^2

HOMEWO	RKHELP	Find the area of each c	ircle. Round to the nearest	tenth.
For Exercises 6–7, 10–11, 14–15, 19 8–9, 12–13,	See Examples 1 2	6. 8 cm	7. <u>3 in.</u>	8. • 11 ft
16–18 36–37	3	9. 17 cm	10. 2.4 m	11. <u>3.2 mm</u>
		12 . diameter = 8.4 m	13 . diameter = 12.6 cm	14. radius = $4\frac{1}{2}$ in.
		15. radius = $3\frac{3}{4}$ ft	16. diameter = $9\frac{1}{4}$ mi	17. diameter = $20\frac{3}{4}$ yd
			rea of the Girl Scout patch ter is 1.25 inches. Round	ST WITH THE LAND
		30 feet. To the neare	that sprays water in a adjusted to spray up to est tenth, what is the awn that can be watered	GRL SCOUTS

ESTIMATION Estimate to find the approximate area of each circle.







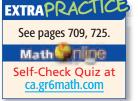
Real-World Math The Roman Pantheon has a diameter of 142 feet. Source: Great **Building Online**

For Exercises 23–26, use a compass to draw the circle shown on centimeter grid paper.

- **23**. Count the number of squares that lie completely within the circle. Then count the number of squares that lie completely within or contain the circle.
- 24. Estimate the area of the circle by finding the mean of the two values you found in Exercise 23.
- **25**. Find the area of the circle by using the area formula.
- 26. How do the areas you found in Exercises 24 and 25 compare to one another?
- 27. A *semicircle* is half a circle. Find the area of the semicircle to the nearest tenth.



- 28. Which has a greater area, a triangle with a base of 100 feet and a height of 100 feet or a circle with diameter of 100 feet? Justify your selection.
- **:-29. ARCHITECTURE** The Roman Pantheon is a circular structure that was completed about 126 A.D. Use the information at the left to find the approximate area of the floor in square yards. (*Hint*: 1 sq ft \approx 0.1 sq yd)

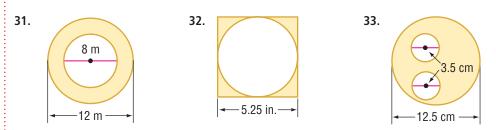


30. LANDSCAPE DESIGN A circular stone path is to be installed around a birdbath with radius 1.5 feet, as shown. What is the area of the path? (*Hint*: Find the area of the large circle minus the area of the small circle.)

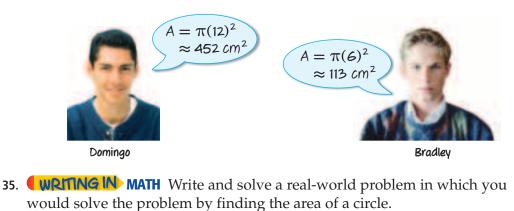


H.O.T. Problems

CHALLENGE Find the area of the shaded region in each figure. Round to the nearest tenth.



34. **FIND THE ERROR** Domingo and Bradley are finding the area of a circle that has a diameter of 12 centimeters. Who is correct? Explain.





STANDARDS PRACTICE

36. The radius of the half dollar in centimeters is given below.

← 1.95 cm →

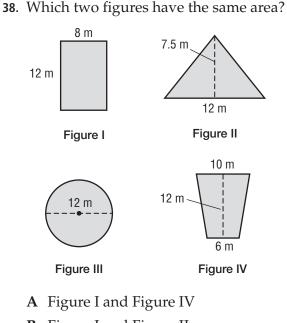
Which of the following is closest to the area of the face of the half dollar?

A 12 cm^2 **C** 28 cm^2

B 15 cm^2 **D** 735 cm^2

37. Which equation could be used to find the area in square inches of a circle with a radius of 12 inches?

F
$$A = 6 \times \pi$$
 H $A = 12 \times \pi$
C $A = \pi \times 6^2$ **I** $A = \pi \times 12^2$

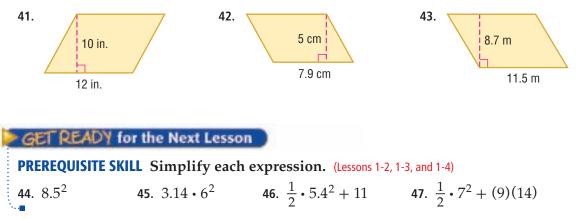


- **B** Figure I and Figure II
- **C** Figure II and Figure IV
- **D** Figure II and Figure III

Spiral Review

- **39. MEASUREMENT** What is the circumference of a circle that has a radius of 8 yards? Use 3.14 for π and round to the nearest tenth if necessary. (Lesson 11-3)
- **40. MEASUREMENT** Find the area of a triangle with a base of 21 meters and a height of 27 meters. (Lesson 11-2)

Find the area of each parallelogram. Round to the nearest tenth if necessary. (Lesson 11-1)



Problem-Solving Investigation

MAIN IDEA: Solve problems by solving a simpler problem.

Standard 6MR1.3 Determine when and how to break a problem into simpler parts. **Standard 6MR2.2** Apply strategies and results from simpler problems to more complex problems. **Standard 6NS2.1** Solve problems involving addition, ... multiplication, ... of positive fractions and explain why ..., was used for a given situation.

P.S.L TERM +

e-Mail: SOLVE A SIMPLER PROBLEM

YOUR MISSION: Solve the problem by solving a simpler problem.

Liam: The diagram shows the backdrop for our fall play. We need to find the total area of the backdrop.

THE PROBLEM: How much wallpaper is needed to cover the entire front of the backdrop?

	EXPLORE	You know that the backdrop is made of one large rectangle and two semicircles, which equal an entire circle.	4 ft 4 ft † 7 ft	
	PLAN	Find the areas of the rectangle and the circle, and then add.	$ \bullet - 8 \text{ ft} \rightarrow \bullet - 8 \text{ ft} \rightarrow $	
	SOLVE	$A = \ell W \qquad \qquad A :$		-
	CHECK	The backdrop is 16 feet long and 11 feet high. However, it is less than a complete rectangle, so the area should be less than 16 • 11 or 176 feet. Since 162.2 is less than 176, the answer is reasonable.		
-	and the second second	-	11	/

Analyze The Strategy

- 1. Why is breaking this problem into simpler parts a good strategy to solve it?
- 2. Describe another way that the problem could have been solved by breaking it into simpler parts.
- 3. **WRITING IN MATH** Write a problem that can be solved by breaking it into simpler parts. Solve the problem and explain your answer.

Mixed Problem Soluing



Solve Exercises 4–5. Use the *solve a simpler problem* strategy.

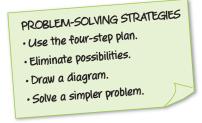
4. **MEASUREMENT** Mr. James is installing a circular sidewalk around a flower bed, as shown. What is the area, in square feet, of the sidewalk? Use 3.14 for π .



5. **COMMUNICATION** According to a recent report, one city has 2,945,000 phone lines assigned to three different area codes. Approximately how many of the phone lines are assigned to each area code?

Area Code	Percent
888	44.3%
777	23.7%
555	31.5%

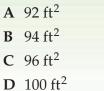
Use any strategy to solve Exercises 6–9. Some strategies are shown below.

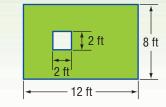


6. SALES Dee needs to sell \$3,000 in ads for the school newspaper. The prices of the ads and the number of ads that she has sold are shown in the table. Which is the smallest single ad she could sell in order to meet her quota?

Ad Size	Cost per Ad	Number Sold
quarter-page	\$75	15
half-page	\$125	8
full-page	\$175	4

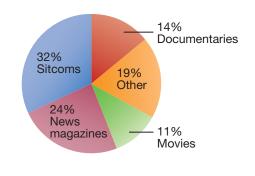
7. MEASUREMENT Morgan is painting one wall in her room, as shown by the shaded region below. What is the area that she is painting?





- 8. **MUSIC** On Mondays, you practice piano for 45 minutes. For each successive day of the week, you practice $\frac{1}{3}$ hour more than the day before. How many hours and minutes do you practice the piano on Saturdays?
- **9. TELEVISION** The graph shows the results of a survey in which 365,750 people were asked to name their favorite television programs. About how many people chose sitcoms as their favorite?

Favorite TV Shows



Select the Operation

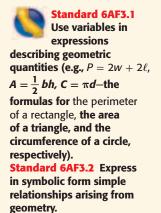
For Exercises 10 and 11, select the appropriate operation(s) to solve the problem. Justify your selection(s) and solve the problem.

- 10. **THEATER** Mr. Marquez is purchasing new fabric for curtains for a theatrical company. The front of the stage is $15\frac{1}{2}$ yards wide and $5\frac{3}{4}$ yards high. The fabric is sold on bolts that are 60 inches wide and 20 yards long. How many bolts are needed to make the curtains?
- 11. WORK For every 150 hours Clark works, he receives 10 hours of vacation time. How many hours has he worked if he has 108 vacation hours?

–(5) Area of Complex Figures

Main IDEA

Find the areas of complex figures.



NEW Vocabulary

complex figure semicircle



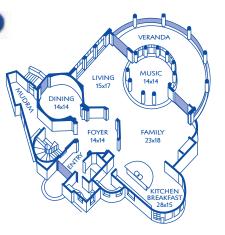
Everyday Use a whole made up of distinct parts

Math Use a figure made of triangles, quadrilaterals, semicircles, and other two-dimensional figures

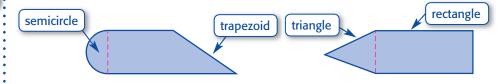
GET READY for the Lesson

ARCHITECTURE Rooms in a house are not always square or rectangular, as shown in the diagram.

- **1**. Describe the shape of the kitchen.
- 2. How could you determine the area of the kitchen?
- **3**. How could you determine the total square footage of a house with rooms shaped like these?



• A **complex figure** is made of triangles, quadrilaterals, semicircles, and other two-dimensional figures. A **semicircle** is half of a circle.



To find the area of a complex figure, separate it into figures with areas you know how to find, and then add those areas.

EXAMPLE Find the Area of a Complex Figure

Find the area of the figure at the right.

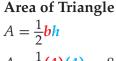
The figure can be separated into a rectangle and a triangle. Find the area of each.

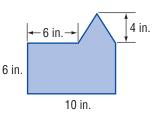






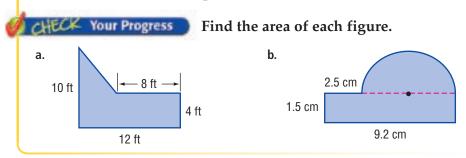






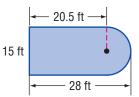
 $A = \frac{1}{2}(4)(4)$ or 8 The base of the triangle is 10 - 6 or 4 inches.

The area is 60 + 8 or 68 square inches.



Real-World EXAMPLE

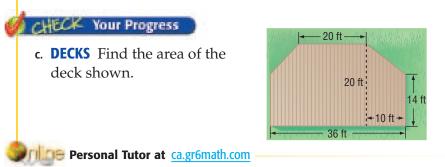
2 **ARCHITECTURE** Refer to the diagram of the house at the beginning of the lesson. The kitchen is 28 feet by 15 feet, as shown at the right. Find the area of the kitchen. Round to the nearest tenth.



The figure can be separated into a rectangle and a semicircle.

Area of Rectangle	Area of Semicircl	le
$A = \ell w$	$A = \frac{1}{2}\pi r^2$	
$A = 20.5 \cdot 15$	$A = \frac{1}{2}\pi(7.5)^2$	Use 3.14 for π .
A = 307.5	$A \approx \frac{2}{88.3}$	

The area is approximately 307.5 + 88.4 or 395.9 square feet.

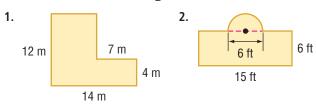


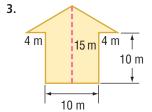
CHECK Your Understanding



(p. 596)

le 1 Find the area of each figure. Round to the nearest tenth if necessary.

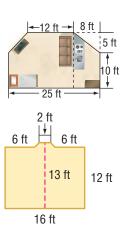




Example 2

(p. 597)

- 4. **APARTMENTS** The manager of an apartment complex will install new carpeting in a studio apartment. The floor plan is shown at the right. What is the total area that needs to be carpeted?
 - **5. TILING** A kitchen, shown at the right, has a bay window. If the entire kitchen floor is to be tiled, including the section by the bay window, how many square feet of tile are needed?



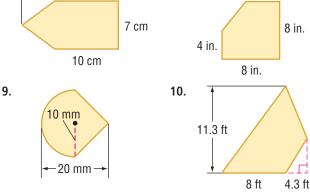
Exercises

6.

HOMEWORKHELP		
For Exercises	See Examples	
6-11	1	
12-13	2	

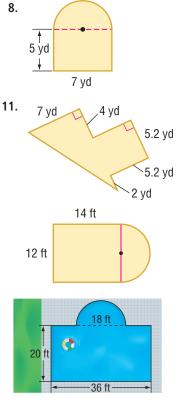
Find the area of each figure. Round to the nearest tenth if necessary.

5.3 in.



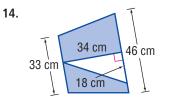
7.

- **12. BLUEPRINTS** On a blueprint, a rectangular room 14 feet by 12 feet has a semicircular sitting area attached with a diameter of 12 feet. What is the total area of the room and the sitting area?
- **13. POOLS** The diagram at the right gives the dimensions of a swimming pool. If a cover is needed for the pool, what will be the approximate area of the cover?

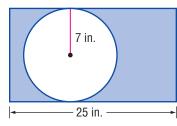


Find the area of the shaded region. Round to the nearest tenth if necessary.

15.



15 cm -

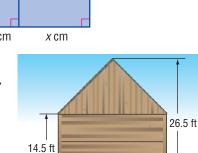


For each figure, write an algebraic expression that represents the area in square centimeters of the shaded region.

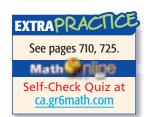


PAINTING For Exercises 18 and 19, use the diagram that shows one side of a storage barn.

- This side of the storage barn needs to be painted. Find the total area to be painted.
- **19**. Each gallon of paint costs \$20 and covers 350 square feet. Find the total cost to paint this side once. Justify your answer.

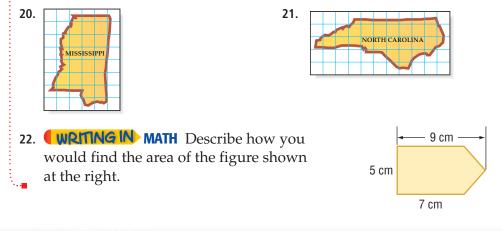


22.8



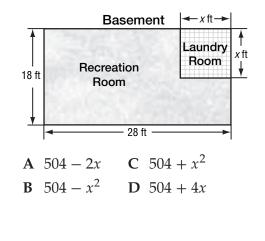
H.O.T. Problems

CHALLENGE Describe the figures each state can be separated into. Then use these figures to estimate the area of each state if one square unit equals 1,900 square miles. Justify your answer.

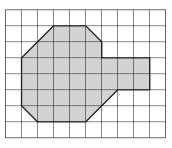


STANDARDS PRACTICE

23. Which expression represents the area, in square feet, of the recreation room in terms of *x*?



24. The shaded part of the grid represents the plans for a fish pond.



If each square on the grid represents 5 square feet, what is the approximate area of the fish pond?

F	175 ft ²	Η	150 ft^2
G	165 ft^2	J	33 ft ²



25. MONEY Over the weekend, Mrs. Lobo spent \$534. Of that, about 68% was spent on groceries. About how much money was *not* spent on groceries? Use the *solve a simpler problem* strategy. (Lesson 11-5)

Find the area of each circle. Round to the nearest tenth. (Lesson 11-4)

26. radius = 4.7 cm

27. radius = 12 in.

28. diameter = 15 in.

GET READY for the Next Lesson

PREREQUISITE SKILL Sketch each object.

- **29**. ice cream cone
- 30. shoe box

31. drinking straw

Measurement Lab Nets and Surface Area

Main IDEA

Nets and Surface Area

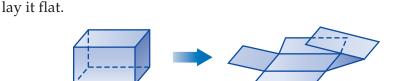
Extend

11-6

Preparation for Standard 7MG3.5 Construct two-

dimensional patterns for three-dimensional models, such as cylinders, prisms, and cones.

Standard 6MR3.3 Develop generalizations of the results obtained and the strategies used and apply them in new problem situations.

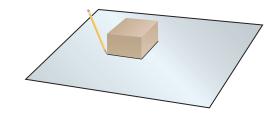


Suppose you cut a cardboard box along its edges, open it up, and

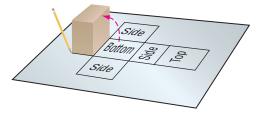
The result is a complex figure called a **net**. A net can help you see the regions or faces that make up the surface of a figure.

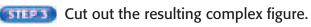


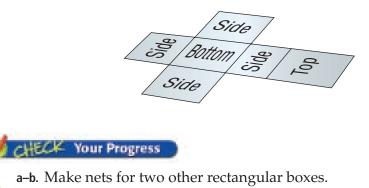
STEP 1) Place the box in the middle of a large sheet of paper as shown. Trace the outline of the bottom of the box.



Roll the box onto its right side and label the outline you traced "Bottom". Trace and label each of the sides and top in this same way as shown below.







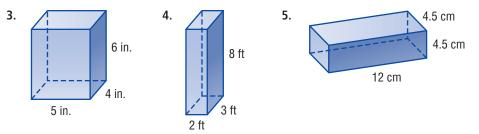
STUDY TIP

Check Your Net To check that you have created a correct net for a figure, cut out the net, fold it, and tape it together to form the figure.

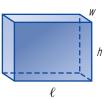
ANALYZE THE RESULTS

- 1. The net shown in the Activity is made of rectangles. How many rectangles are in the net?
- 2. Explain how you can find the total area of the rectangles.

Draw a net for each figure. Find the area of the net.



6. The *surface area* of a prism is the total area of its net. Write an equation that shows how to find the surface area of the prism below using the length *ℓ*, width *w*, and height *h*.



- **7.** Find the surface areas of cubes whose edges are 1 unit, 2 units, and 3 units and graph the ordered pairs (side length, surface area) on a coordinate plane. Describe the graph.
- **8. MAKE A CONJECTURE** Describe what happens to the surface area of a cube as its dimensions are doubled? tripled?

Draw a net for each figure.



- **11**. Explain how the net of a tetrahedron differs from the net of a square-based pyramid.
- 12. Describe how you could find the surface area of a tetrahedron.
- **13**. Describe how you could find the surface area of a square-based pyramid.
- 14. Find the surface area of a square-based pyramid if the square base has a side length of 8 centimeters and the height of each triangular side of the pyramid has a height of 5 centimeters.

Mid-Chapter Quiz

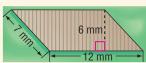
Lessons 11-1 through 11-6

Find the area of each parallelogram. Round to the nearest tenth if necessary. (Lesson 11-1)

1. base = 7 cm2. base = 4.3 in.

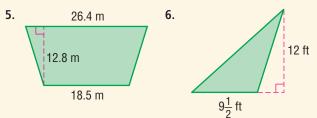
CHAPTER

- height = 4 cmheight = 9 in.
- 3. base = $11\frac{3}{4}$ ft
- height = $8\frac{1}{3}$ ft
- **STANDARDS PRACTICE** A scale drawing 4. of a deck is shown. What is the actual area of deck if the scale drawing is 10 m = 1 mm? (Lesson 11-1)



- **A** 7,200 m²
- **B** 720 m²
- $C 720 \text{ mm}^2$
- **D** 24 m^2

Find the area of each figure. Round to the nearest tenth if necessary. (Lesson 11-2)



7. **ALGEBRA** Find the area of a triangle with a base of 23 centimeters and a height of 18 centimeters. (Lesson 11-2)

Find the circumference of each circle. Use 3.14 or $\frac{22}{7}$ for π . Round to the nearest tenth if necessary. (Lesson 11-3)

8. radius =
$$10\frac{7}{8}$$
 in. **9.** diameter = 21 ft



12. **STANDARDS PRACTICE** Which expression could be used to find the circumference of a circular patio table with a diameter of 8.9 feet? (Lesson 11-3)

$$F 2 \times \pi \times 8.9$$
$$G \pi \times 8.9$$

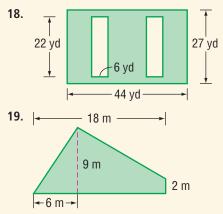
H $\pi \times 8.9 \times 8.9$

I $\pi \times 4.45 \times 4.45$

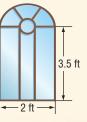
Find the area of each circle. Round to the nearest tenth. (Lesson 11-4)

- **13.** radius = $4\frac{1}{4}$ cm **14.** diameter = $6\frac{4}{5}$ ft **15.** diameter = 14.6 m **16.** radius = $7\frac{3}{4}$ yd
- 17. SALES A manager at the local cell phone store reported to his employees that sales had increased 19.5% over last month's total of \$25,688. About how much did the store sell this month? Use the solve a simpler problem strategy. (Lesson 11-5)

For Exercises 18 and 19, find the area of the shaded region for each figure. (Lesson 11-6)



20. MEASUREMENT How many square feet of glass is needed to make the window shown? Round to the nearest tenth. (Lesson 11-6)



22 yd



Three-Dimensional Figures

Main IDEA

Build three-dimensional figures given the top, side, and front views.



Preparation for Standard 7MG3.6 Identify

elements of threedimensional geometric objects (e.g., diagonals of rectangular solids) and describe how two or more objects are related in space (e.g., skew lines, the possible ways three planes might intersect).

NEW Vocabulary

three-dimensional figure face edge lateral face vertex (vertices) prism base pyramid cone cylinder sphere center



Three-Dimensional Figures In threedimensional figures, dashed lines are used to indicate edges that are hidden from view.

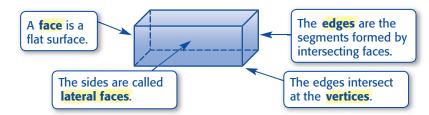
GET READY for the Lesson

Study the shape of each common object below. Then compare and contrast the properties of each object.





Many common shapes are **three-dimensional figures**. That is, they have length, width, and depth (or height). Some terms associated with three-dimensional figures are shown below.



Two types of three-dimensional figures are prisms and pyramids.

KEY CON	ICEPT Prisms and Pyramids		
Figure	Properties		
Prism	 Has at least three lateral faces that are parallelograms. The top and bottom faces, called the bases, are congruent parallel polygons. The shape of the base tells the name of the prism. Rectangular prism prism or cube 		
Pyramid	 Has at least three lateral faces that are triangles. Has only one base, which is a polygon. The shape of the base tells the name of the pyramid. Triangular pyramid 		

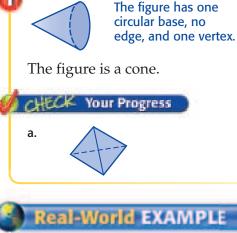
Some three dimensional figures have curved surfaces.

KEY CO	NCEPT Cones, Cylinders, and Spheres
Figure	Properties
Cone	 Has only one base. The base is a circle. Has one vertex.
Cylinder	 Has only two bases. The bases are congruent circles. Has no vertices and no edges.
Sphere	 All of the points on a sphere are the same distance from the center. No faces, bases, edges, or vertices.

Prisms and Pyramids Prisms and pyramids are examples of polyhedra, or solids with flat surfaces that are polygonal regions. Cones, cylinders, and spheres are not examples of polyhedra.

EXAMPLES Classify Three-Dimensional Figures

For each figure, identify the shape of the base(s). Then classify the figure.





The base and all other faces are squares.

The figure is a square prism or cube.



Real-World EXAMPLE

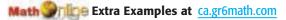
CAMERAS Classify the shape of the body of the digital camera, not including the lens, as a three-dimensional figure.

The body of the camera is a rectangular prism.

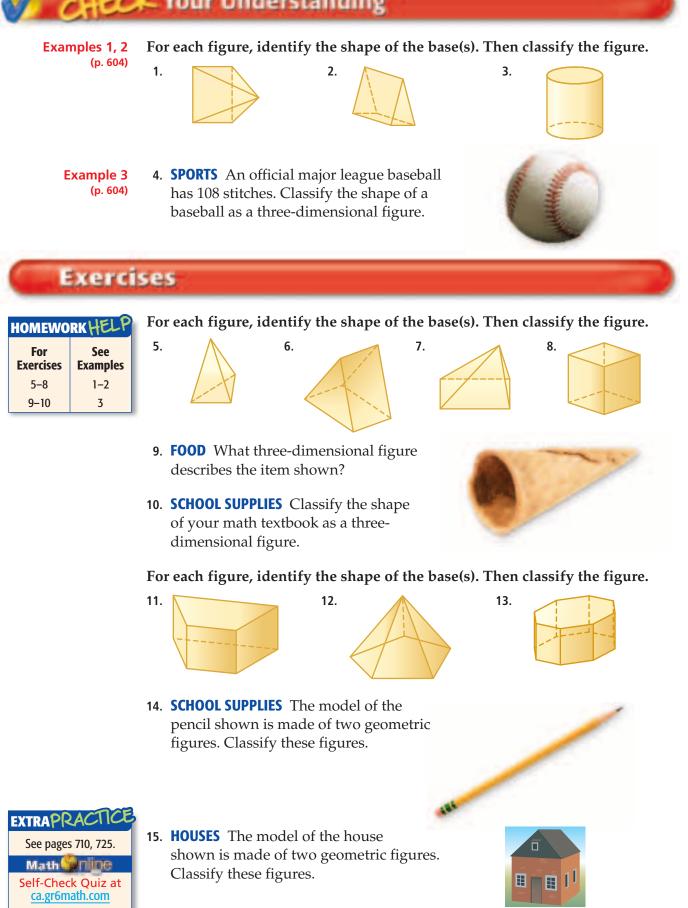
CHECK Your Progress

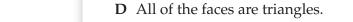
c. Classify the shape of the zoom lens as a three-dimensional figure.

Personal Tutor at <u>ca.gr6math.com</u>



K Your Understanding





triangular prisms?

segments.

STANDARDS PRACTICE

20. Which statement is true about all

B There are exactly 6 faces.

A All of the edges are congruent line

C The bases are congruent triangles.

Spiral Review

- 22. **MEASUREMENT** Find the area of the figure shown at the right if each triangle has a height of 3.5 inches and the square has side lengths of 4 inches. (Lesson 11-6)
- **23. MEASUREMENT** Find the area of a circle with a radius of 5.7 meters. Round to the nearest tenth. (Lesson 11-4)

ALGEBRA Find the missing angle measure in each quadrilateral. (Lesson 10-5)

606 Chapter 11 Measurement: Two- and Three-Dimensional Figures

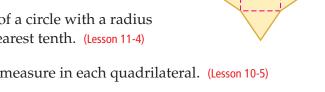
H.O.T. Problems **16. REASONING** Two sets of figures were sorted according to a certain rule. The figures in Set A follow the rule and the figures in Set B do not follow the rule. Describe the rule.

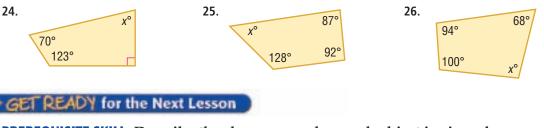
Set A	Prism	Pyramid	Cube
Set B	Cylinder	Cone	Sphere

- **17. CHALLENGE** What figure is formed if only the height of a cube is increased? Draw a figure to justify your answer.
- **18. OPEN ENDED** Select one three-dimensional figure in which you could use the term *congruent* to describe the bases of the figure. Then write a sentence using *congruent* to describe the figure.
- 19. WRITING IN MATH Apply what you know about the properties of geometric figures to compare and contrast cones and pyramids.

21. Which figure is shown?

- **F** triangular pyramid
- **G** square pyramid
- H rectangular pyramid
- triangular prism T





PREREQUISITE SKILL Describe the shape seen when each object is viewed from the top.

27. number cube **28**. cereal box 29. soup can



Explore

Geometry Lab Three-Dimensional Figures

Main IDEA

Build three-dimensional figures given the top, side, and front views.

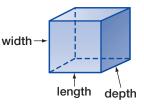


Preparation for Standard 7MG3.6 Identify

elements of threedimensional geometric objects (e.g., diagonals of rectangular solids) and describe how two or more objects are related in space (e.g., skew lines, the possible ways three planes might intersect).

Standard 6MR2.4

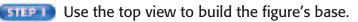
Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning. Cubes are examples of three-dimensional figures because they have length, width, and depth. In this lab, you will use centimeter cubes to build other three-dimensional figures.



ACTIVITY

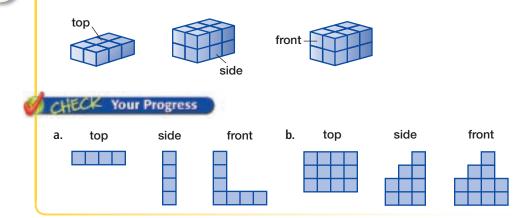
The top view, side view, and front view of a three-dimensional figure are shown below. Use centimeter cubes to build the figure. Then make a sketch of the figure.

top	side	front



STEP3 Use the side view to complete the figure.

STEP3) Use the front view to check the figure.



ANALYZE THE RESULTS

- 1. Explain how you began building the figures in Exercises a and b.
- **2**. Determine whether there is more than one way to build each model. Explain your reasoning.
- **3.** Build two different models that would look the same from two views, but not the third view. Draw a top view, side view, and front view of each model.
- 4. Describe a real-world situation where it might be necessary to draw a top, side, and front view of a three-dimensional figure.

Drawing Three-Dimensional Figures

Main IDEA

Draw a three-dimensional figure given the top, side, and front views.



Reinforcement of Standard 5MG2.3

Visualize and draw two-dimensional views of three-dimensional objects made from rectangular solids.

Standard 6MR2.4 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.

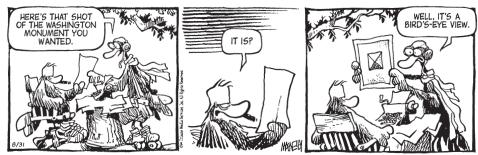
GET READY for the Lesson

Concepts in Motion Interactive Lab ca.gr6math.com

front

COMICS For Exercises 1 and 2, refer to the comic below.

SHOE



- 1. Which view of the Washington Monument is shown in the comic?
- **2**. Find a photograph of the Washington Monument and draw a side view.

You can draw different views of three-dimensional figures. The most common views drawn are the top, side, and front views.

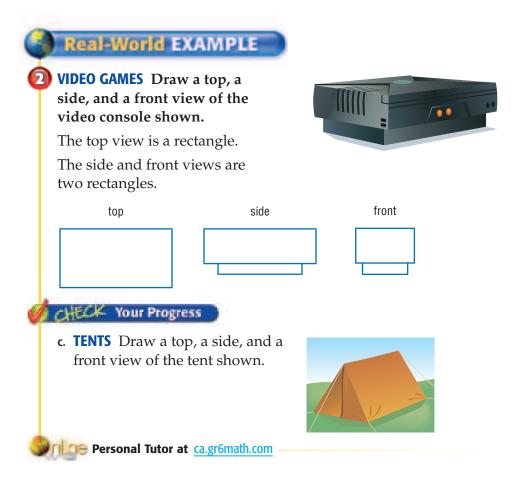
EXAMPLE Draw a Three-Dimensional Figure

 Draw a top, a side, and a front view of the figure at the right. The top view is a triangle. The side and front view are rectangles.
 top side front
 top Progress
 Draw a top, a side, and a front view of each solid.
 a.

Plane Figures In geometry, threedimensional figures are *solids* and twodimensional figures such as triangles, circles, and squares

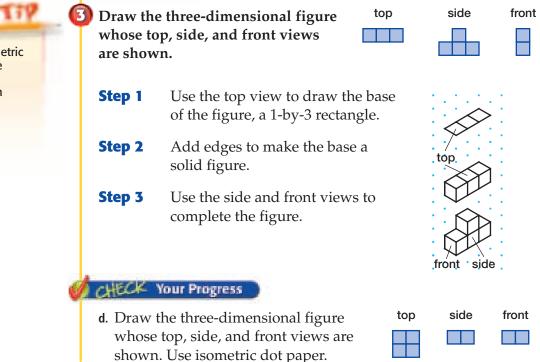
are plane figures.

UDY TI



The top, side, and front views of a three-dimensional figure can be used to draw the figure.

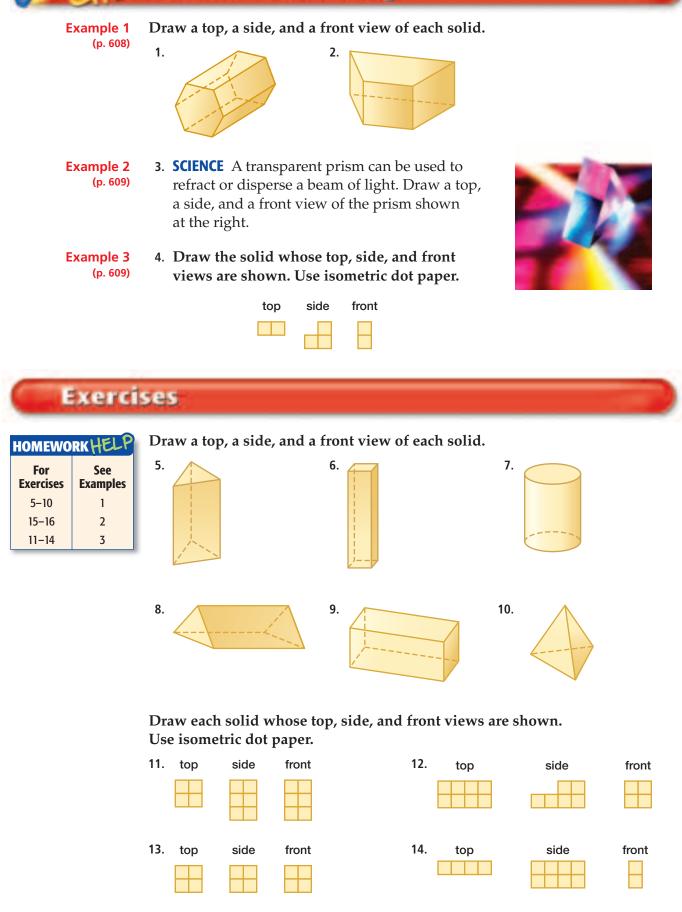
EXAMPLE Draw a Three-Dimensional Figure



Paper Use isometric dot paper for the drawings in this lesson, as shown at the right.

Math Control Extra Examples at ca.gr6math.com

C Your Understanding



610 Chapter 11 Measurement: Two- and Three-Dimensional Figures

15. SCHOOL Draw a top, a side, and a front view of the eraser shown.



16. TABLES Draw a top, a side, and a front view of a square table.

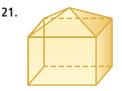
Draw each solid whose top, side, and front views are shown. Use isometric dot paper.



- **19. ARCHITECTURE** The Quetzalcoatl pyramid in Mexico is the largest pyramid in the world. Use the photo at the left to sketch views from the top, side, and front of the pyramid.
- **20. RESEARCH** Use the Internet or another source to find a photograph of the only Wonder of the Ancient World existing today, the Great Pyramid of Giza. Draw a top view, a side view, and a front view of the pyramid.

Draw a top, a side, and a front view of each solid.

22.



24. **TRANSPORTATION** Sketch views of the top, side, and front of the school bus shown at the right.

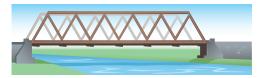


23.

- **25. CHALLENGE** Draw a three-dimensional figure in which the front and top views each have a line of symmetry but the side view does not. (*Hint*: Refer to Lesson 10-10 to review line symmetry).
 - **26.** Which One Doesn't Belong? Identify the figure that does not have the same characteristic as the other three. Explain your reasoning.

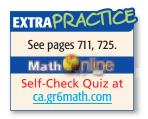


- **27. OPEN ENDED** Choose an object in your classroom or in your home. Sketch any view of the object. Choose among a top, a side, or a front view.
- 28. **WRITING IN MATH** Apply what you have learned about views of three-dimensional figures to write a problem about the bridge shown.

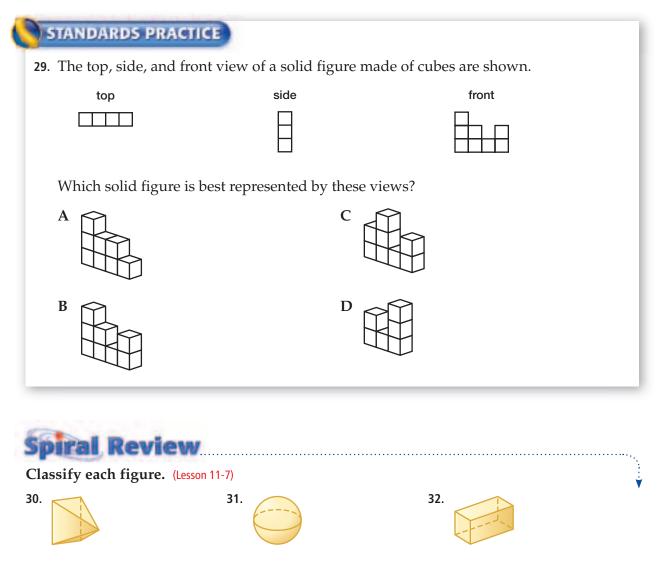




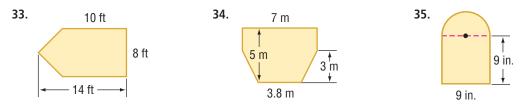
Real-World Link . . . The Quetzalcoatl pyramid is about 30 meters tall. It was constructed by the Mayans 1000–1200 A.D. Source: Guinness World Records



H.O.T. Problems ...



MEASUREMENT Find the area of each figure. Round to the nearest tenth if necessary. (Lesson 11-6)



- **36. STATISTICS** Jordan buys a soccer ball for \$15, a baseball for \$8, a basketball for \$18, and a football for \$19. Find the mean amount spent. (Lesson 8-2)
- **37. SAVINGS** Ernesto deposited \$75 into a savings account earning 4.25% annual interest. What is his balance 9 months later if he makes no withdrawals or no more deposits? Round to the nearest cent. (Lesson 7-8)

GET READY F	or the Next Lesson		
PREREQUISITE SK	ILL Multiply. (Lesson 5-5)		
38. $7\frac{1}{2} \cdot 6$	39. $8 \cdot 2\frac{3}{4}$	40. $\frac{5}{6} \cdot 1\frac{4}{5}$	41. $10\frac{1}{5} \cdot 6\frac{2}{3}$



Volume of Prisms

Main IDEA

Find the volumes of rectangular and triangular prisms.

Standard 6MG1.3 Know and use the formulas for the

volume of triangular prisms and cylinders (area of base × height); compare these formulas and explain the similarity between them and the formulas for the volume of a rectangular solid.

NEW Vocabulary

volume rectangular prism triangular prism

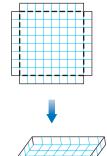


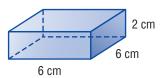
Everyday Use bulk or mass, as in shipping a large volume of merchandise

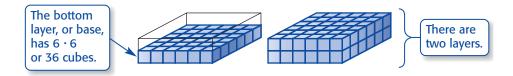
Math Use measure of space occupied by a three-dimenional figure

MINI Lab

- On a piece of grid paper, cut out a square that is 10 centimeters on each side.
- Cut a 1-centimeter square from each corner. Fold the paper and tape the corners together to make a box.
- What is the area of the base, or bottom, of the box? What is the height of the box?
- 2. How many centimeter cubes fit in the box?
- **3.** What do you notice about the product of the base area and the height of the box?
- The **volume** of a three-dimensional figure is the measure of space occupied by it. It is measured in cubic units such as cubic centimeters (cm³) or cubic inches (in³). The volume of the figure at the right can be shown using cubes.

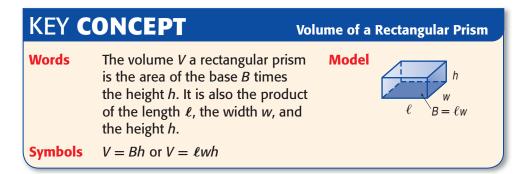






It takes $36 \cdot 2$ or 72 cubes to fill the box. So, the volume of the box is 72 cubic centimeters.

The figure above is a rectangular prism. A **rectangular prism** is a prism that has rectangular bases.

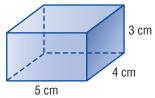


You can use the formula V=Bh or V = lwh to find the volume of a rectangular prism.

EXAMPLE Volume of a Rectangular Prism

Find the volume of the rectangular prism.

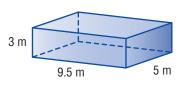
$$V = \ell wh$$
Volume of a prism $V = 5 \cdot 4 \cdot 3$ $\ell = 5, w = 4, and h$ $V = 60$ Multiply.



The volume is 60 cubic centimeters or 60 cm^3 .

CHECK Your Progress

a. Find the volume of the rectangular prism at the right.



Real-World EXAMPLE

MARKETING A company needs to decide which size box to use to package its new cereal. Which box shown will hold more cereal?

= 3



Find the volume of each box. Then compare.

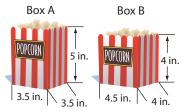
Box A

$V = \ell w h$	Volume of a rectangular prism
$V = 7.5 \cdot 2.5 \cdot 12$	ℓ = 7.5, w = 2.5, and h = 12
$V = 225 \text{ in}^3$	Multiply.
Box B	
$V = \ell w h$	Volume of a rectangular prism
$V = 8 \cdot 2.5 \cdot 11.5$	$\ell = 8, w = 2.5, and h = 11.5$
$V = 230 \text{ in}^3$	Multiply.

Since 230 in³ > 225 in³, Box B will hold more cereal.

CHECK Your Progress

b. PACKAGING A movie theater serves popcorn in two different container sizes. Which container holds more popcorn? Justify your answer.



READING in the Content Area

For strategies in reading this lesson, visit ca.gr6math.com.

a. Fin pri

Real-World Career ...

Market researchers use tools such as statistics, surveys, focus groups, and product tests to determine what drives people to buy a product.

Math

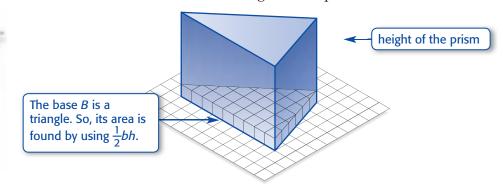
For more information, go to <u>ca.gr6math.com</u>.

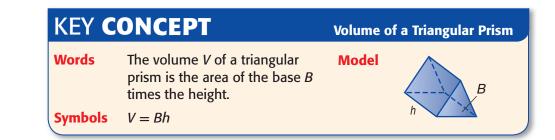
614 Chapter 11 Measurement: Two- and Three-Dimensional Figures Charles Gupton/CORBIS

A **triangular prism** is a prism that has triangular bases. The diagram below shows that the volume of a triangular prism is also the product of the area of the base B and the height of the prism h.



Height Do not confuse the height of the triangular base with the height of the prism.





EXAMPLE Volume of a Triangular Prism



Base Before finding the volume of a prism, identify the base. In Example 3, the base is a triangle so you replace *B* with $\frac{1}{2}bh$. **3** Find the volume of the triangular prism shown.

The area of the triangle is $\frac{1}{2} \cdot 6 \cdot 8$ so replace *B* with $\frac{1}{2} \cdot 6 \cdot 8$.

$$V = Bh$$

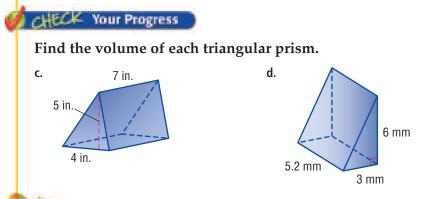
$$V = \left(\frac{1}{2} \cdot 6 \cdot 8\right)h$$

$$V = \left(\frac{1}{2} \cdot 6 \cdot 8\right)h$$

$$V = \left(\frac{1}{2} \cdot 6 \cdot 8\right)9$$

$$V = 216$$

The volume is 216 cubic feet or 216 ft³.



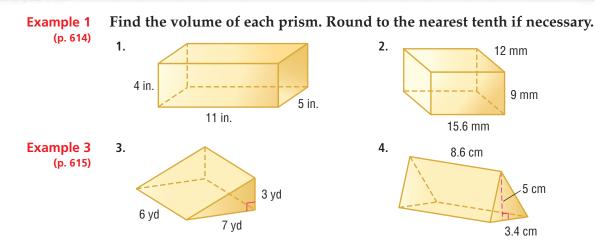
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6 ft

8 ft

9 ft

Heck Your Understanding

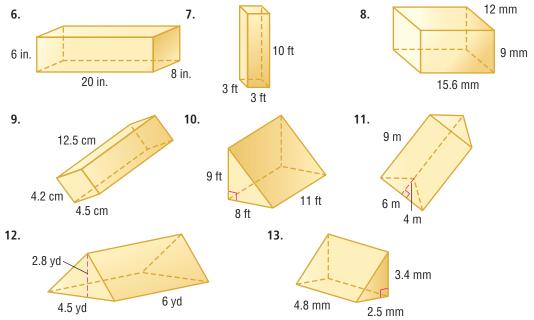


- Example 2 (p. 614)
- 5. **STORAGE** One cabinet measures 3 feet by 2.5 feet by 5 feet. A second measures 4 feet by 3.5 feet by 4.5 feet. Which cabinet has the greater volume?

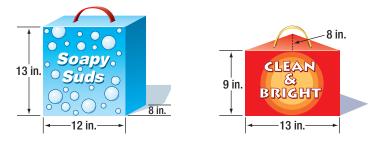
Exercises

HOMEWORKHELP				
For Exercises	See Examples			
6–9	1			
14–15	2			
10–13	3			

Find the volume of each prism. Round to the nearest tenth if necessary.



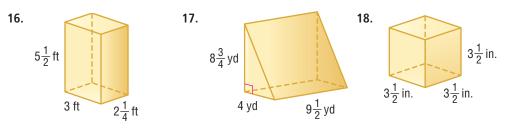
14. **PACKAGING** A soap company sells laundry detergent in two different containers. Which container holds more detergent? Justify your answer.



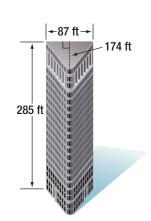


Real-World Math.....? The Flatiron Building in New York City resembles a triangular prism. Source: greatbuildings.com **15. TOYS** A toy company makes rectangular sandboxes that measure 6 feet by 5 feet by 1.2 feet. A customer buys a sandbox and 40 cubic feet of sand. Did the customer buy too much or too little sand? Justify your answer.

Find the volume of each prism.



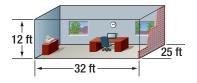
- •ARCHITECTURE For Exercises 19 and 20, use the diagram at the right that shows the approximate dimensions of the Flatiron Building in New York City.
 - **19**. What is the approximate volume of the Flatiron Building?
 - **20**. The building is a 22-story building. Estimate the volume of each story.
 - 21. **ALGEBRA** The base of a rectangular prism has an area of 19.4 square meters and a volume of 306.52 cubic meters. Write an equation that can be used to find the height *h* of the prism. Then find the height of the prism.



ESTIMATION Estimate to find the approximate volume of each prism.



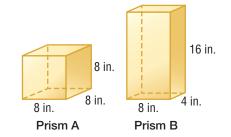
24. MONEY The diagram shows the dimensions of an office. It costs about 11¢ per year to air condition one cubic foot of space. On average, how much does it cost to air condition the office for one month?



- EXTRAPRACTICE See pages 711, 725. Math Self-Check Quiz at ca.gr6math.com
- **25. MEASUREMENT** The Garrett family is building a pool in the shape of a rectangular prism in their backyard. The pool will cover an area 18 feet by 25 feet and will hold 2,700 cubic feet of water. If the pool is equal depth throughout, find that depth.



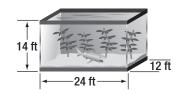
- 26. CHALLENGE How many cubic inches are in a cubic foot?
- 27. NUMBER SENSE Without calculating, determine whether the volumes of the two prisms are equal. If so, explain your reasoning. If not, tell which has the greater volume.



28. **WRITING IN MATH** Explain the similarities and differences in finding the volume of a rectangular prism and a triangular prism.

STANDARDS PRACTICE

29. A fish aquarium is shown below.



What is the volume of the aquarium?

- **C** 2,016 ft^3 **A** 168 ft^3
- **B** 342 ft^3 **D** $4,032 \text{ ft}^3$

30. Use a ruler to measure the dimensions of the paper clip box in centimeters.



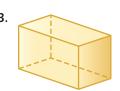
Which is closest to the volume of the box?

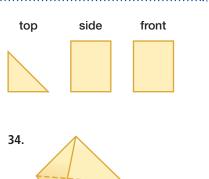
F 1.5 cm^3 H 4.5 cm³ **G** 2.5 cm^3 $I 5.5 \text{ cm}^3$



31. GEOMETRY The top, side, and front view of top side front a geometric figure are shown at the right. Make a sketch of the geometric figure. (Lesson 11-8) For each figure, identify the shape of the base(s). Then classify the figure. (Lesson 11-7) 32. 33.







35. RATES A car travels 180 miles in 3.6 hours. What is the average rate of speed in miles per hour? (Lesson 6-2)

GET READY I	or the Next Lesson		
PREREQUISITE SK	ILL Estimate. (page 674)		
36 . 3.14 • 6	37 . $5 \cdot 2.7^2$	38 . 9.1 • 8.3	39. $3.1 \cdot 1.75^2 \cdot 2$

11-10

-10 Volume of Cylinders

Main IDEA

Find the volumes of cylinders.



Standard 6MG1.3 Know and use the

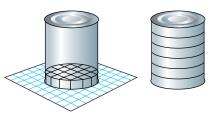
formulas for the volume of triangular prisms and cylinders (area of base × height); compare these formulas and explain the similarity between them and the formulas for the volume of a rectangular solid.

MINI Lab

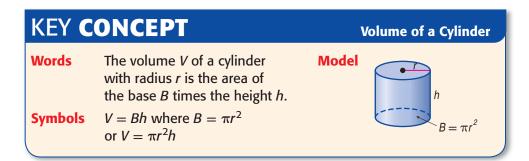
Set a soup can on a piece of grid paper and trace around the base, as shown at the right.

- Estimate the number of centimeter cubes that would fit at the bottom of the can. Include parts of cubes.
- **2**. If each layer is 1 centimeter high, how many layers would it take to fill the cylinder.
- **3. MAKE A CONJECTURE** How can you find the volume of the soup can?





As with prisms, the area of the base of a cylinder tells the number of cubic units in one layer. The height tells how many layers there are in the cylinder.



Check for Reasonableness Use estimation to check for reasonableness. $\pi(5)^2(8.3) \approx 3(5)^2(8)$ ≈ 600 Since 600 ≈ 651.9 , the answer is reasonable.

EXAMPLE Find the Volume of a Cylinder

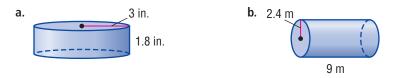
ĺ,	🔰 Find the volume o	f the cylinder.	Γ. οιτο
	Round to the near	est tenth.	5 cm
	$V = \pi r^2 h$	Volume of a cylinder	8.3
	$V = \pi(5)^2(8.3)$	Replace r with 5 and h with 8.3.	0.0
	$V \approx 3.14 (5^2)(8.3)$	Use 3.14 for π .	
	$V \approx 651.6$	Multiply.	

The volume is about 651.6 cubic centimeters.

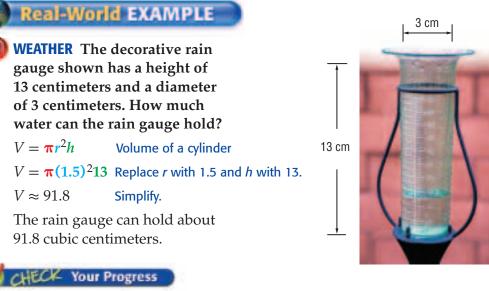
3 cm

CHECK Your Progress

Find the volume of each cylinder. Round to the nearest tenth.



Circles Recall that the radius is half the diameter.



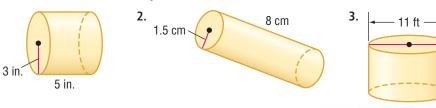
c. PAINT Find the volume of a cylinder-shaped paint can that has a diameter of 4 inches and a height of 5 inches.

Personal Tutor at ca.gr6math.com

CAL Your Understanding

Find the volume of each cylinder. Round to the nearest tenth.

Example 1 1. (p. 619)



6.5 ft

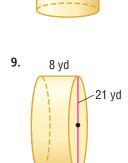
Example 2 (p. 620) 4. HOCKEY An official hockey puck has a diameter of 3 inches and a height of 1 inch. What is the volume of the hockey puck?

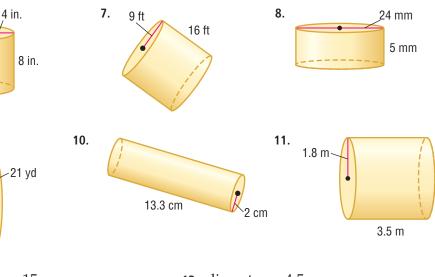
5. **CANDLES** A scented candle is in the shape of a cylinder. The radius is 4 centimeters and the height is 12 centimeters. Find the volume of the candle.

Exercises

6.

HOMEWORKHELP				
For Exercises	See Examples			
6-15	1			
16, 17	2			





12. diameter = 15 mm13. diameter = 4.5 mheight = 4.8 mmheight = 6.5 m

Find the volume of each cylinder. Round to the nearest tenth.

14. radius = 6 ft height = $5\frac{1}{3}$ ft

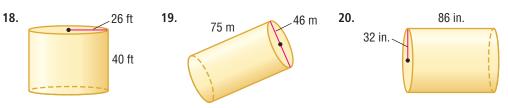
```
height = 6.5 \text{ m}

15. radius = 3\frac{1}{2} in.

height = 7\frac{1}{2} in.
```

- **16. FOOD** What is the volume of a can of potato chips that has a radius of $1\frac{1}{2}$ inches and a height of 8 inches?
- **•17.** SCIENCE The Hubble Space Telescope is cylinder-shaped. Use the information at the left to find its volume to the nearest tenth.

Find the volume of each cylinder. Round to the nearest tenth.



ESTIMATION Match each cylinder with its approximate volume.

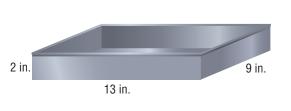
21 . radius = 4.1 ft, height = 5 ft	a. 91 ft^3
22 . diameter = 8 ft; height = 2.2 ft	b. 48 ft^3
23 . diameter = 6.2 ft, height = 3 ft	c. 111 ft ³
24. radius = 2 ft, height = 3.8 ft	d. 264 ft^3

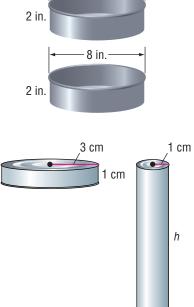
25. PACKAGING A cylinder-shaped popcorn tin has a height of 1.5 feet and a diameter of 10 inches. Find the volume to the nearest cubic inch. Use 3.14 for π .



Real-World Link . . .

The Hubble Space Telescope has a diameter of 4 meters and a height of 13 meters. **Source:** howstuffworks.com **26. BAKING** Which will hold more cake batter, the rectangular pan, or the two round pans? Explain.





8 in.

27. PACKAGING The two cans at the right have the same volume. What is the value of *h*?

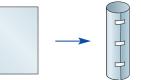
MEASUREMENT For Exercises 28 and 29, use the following information.

Firewood is usually sold by a unit of measure called a *cord*. A cord is a stack of wood that is 8 feet long, 4 feet wide, and 4 feet high.

EXTRAPRACTICE
See pages 712, 725.
Math 🗐 nine
Self-Check Quiz at <u>ca.gr6math.com</u>

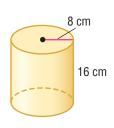
H.O.T. Problems

- **28**. What is the volume of a cord of wood?
- **29**. Suppose a tree has a diameter of 2 feet. Find the height of the tree trunk that would produce about 1 cord of firewood.
- **30. CHALLENGE** Two equal-size sheets of paper are rolled along the length and along the width, as shown. Which cylinder do you think has the greater volume? Explain.





- **31. OPEN ENDED** Draw and label a cylinder that has a larger radius, but less volume than the cylinder shown at the right.
- **32. NUMBER SENSE** What is the ratio of the volume of a cylinder to the volume of a cylinder having twice the height but the same radius?



- **33. NUMBER SENSE** Suppose cylinder A has the same height but twice the radius of cylinder B. What is the ratio of the volume of cylinder B to cylinder A?
- **34. WRITING IN MATH** Explain how the formula for the volume of a cylinder is similar to the formula for the volume of a rectangular prism.

STANDARDS PRACTICE

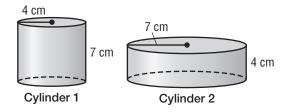
35. The oatmeal container shown has a diameter of $3\frac{1}{2}$ inches and a height of 9 inches.



Which is closest to the number of cubic inches it will hold when filled?

- **A** 32
- **B** 42.78
- C 75.92
- **D** 86.55

36. Which statement is true about the volumes of the cylinders shown?



- **F** The volume of cylinder 1 is greater than the volume of cylinder 2.
- **G** The volume of cylinder 2 is greater than the volume of cylinder 1.
- H The volumes are equal.
- J The volume of cylinder 1 is twice the volume of cylinder 2.



37. MEASUREMENT Find the volume of a rectangular prism with a length of 6 meters, a width of 4.9 meters, and a height of 5.2 meters. (Lesson 11-9)

Make a sketch of each geometric figure using the top, side, and front views
shown. (Lesson 11-8)



PROBABILITY A coin is tossed and a number cube is rolled. Find the probability of each of the following. (Lesson 9-8)

- **40**. *P*(heads and 4)
- ----
- 41. *P*(tails and an odd number)

42. *P*(heads and *not* 5)

- **43**. *P*(*not* tails and not 2)
- 44. **TEST SCORES** The list gives the scores on a recent history test. Find each measure of central tendency and range. Round to the nearest tenth if necessary. Then state which measure best represents the data. Explain your reasoning. (Lesson 8-2)

History Test Scores									
78,	92,	83,	88,	89,	91,	96,	72,	74,	99
81,	88,	86,	95,	73,	97,	78,	78,	60	
84,	85,	90,	92,	98,	74,	76,	80,	83	

Graphing Calculator Lab Graphing Geometric Relationships

Main IDEA

Use technology to graph data in order to demonstrate geometric relationships.

Extend

11-10



Express in symbolic form simple relationships arising

from geometry. Standard 6MR1.2 Formulate and justify mathematical conjectures based on a general description of the mathematical question or problem posed.

In this lab, you will use a TI-83/84 Plus graphing calculator to analyze geometric relationships among the base, height, and area of several parallelograms.

ACTIVITY



STEP 1 Draw five parallelograms that each have a height of 4 centimeters on centimeter grid paper.



- **GITERED** Copy and complete the table shown for each parallelogram.
- STEP 3 Next enter the data into your graphing calculator. Press STAT 1 and enter the length of each base in L1. Then enter the area of each parallelogram in L2.

Base (cm)	Height (cm)	Area (cm²)
	4	
	4	
	4	
	4	
	4	

4 cm

- STLP 1 Turn on the statistical plot by pressing 2nd [STAT PLOT] ENTER ENTER . Select the scatter plot and enter or confirm L1 as the Xlist and L2 as the Ylist.
- Graph the data by pressing ZOOM 9. Use the Trace feature STEP 5 and the left and right arrow keys to move from one point to another.

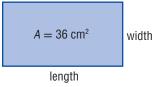
ANALYZE THE RESULTS

- 1. What does an ordered pair on your graph represent?
- 2. Sketch and describe the shape of the graph.
- 3. MAKE A CONJECTURE Write an equation for your graph. Check your equation by pressing Y = 1, entering your equation into Y1, and then pressing **GRAPH**. What does this equation mean?
- 4. As the length of the base of the parallelogram increases, what happens to its area? Does this happen at a constant rate? How can you tell this from the table? from the graph?





- Draw five rectangles that each have an area of 36 square centimeters on centimeter grid paper. The length should be greater than or equal to its width.
- STEP2) Copy and complete the table shown for each rectangle.
- Clear list L1 and L2 by pressing <u>STAT</u> 4 <u>2nd</u> [L1], <u>2nd</u> [L2] <u>ENTER</u>.Then press <u>STAT</u> 1 and enter the length of each rectangle in L1 and the width of each rectangle in L2.



Length (cm)	Width (cm)	Area (cm²)
		36
		36
		36
		36
		36

STEP 4) Follow Steps 4 and 5 of Activity 1 to graph the data.

ANALYZE THE RESULTS

- 5. What does an ordered pair on your graph represent?
- 6. Sketch and describe the shape of the graph.
- **7. MAKE A CONJECTURE** Write an equation for your graph. Use the calculator to graph and check your equation. What does this equation mean?
- **8**. As the length of the rectangle increases, what happens to its width? Does this happen at a constant rate? How can you tell this from the table? from the graph?
- **9. MAKE A PREDICTION** Draw five cubes with different edge lengths. Predict the shape of the graph of the relationship between the edge length and volume of the cube.
- **10**. Create a table to record the edge length and volume of each cube. Then graph the data to show the relationship between the edge length and volume of the cube. Sketch and describe the shape of the graph.
- **11. MAKE A CONJECTURE** Write an equation for your graph. Use the calculator to graph and check your equation. What does this equation mean?
- **12**. As the length of the cube's edge increases, what happens to the volume?

CHAPTER Study Guide and Review

ET READY to Study



Download Vocabulary Review from ca.gr6math.com

Key Vocabulary

Be sure the following Key Concepts are noted in your Foldable.	
Key Concepts	
Area (Lessons 11-1, 11-2, and 11-6)	
$ \begin{array}{c c} $	
parallelogram triangle trapezoid	
$A = bh$ $A = \frac{1}{2}bh$ $A = \frac{1}{2}h(b_1 + b_2)$	
Circles (Lessons 11-3 and 11-4) • circumference $C = \pi d \text{ or } C = 2\pi r$ • area $A = \pi r^2$	
Volume (Lessons 11-9 and 11-10)	
$ \begin{array}{c} $	
rectangular triangular cylinder prism prism	
$V = Bh$ $V = Bh$ or $\pi r^2 h$	

base (p. 572)	$\pi\left(pi ight)$ (p. 584)
center (p. 584)	prism (p. 603)
circle (p. 584)	pyramid (p. 603)
circumference (p. 584)	radius (p. 584)
complex figure (p. 596)	rectangular prism (p. 613)
cone (p. 604)	semicircle (p. 596)
cylinder (p. 604)	sphere (p. 604)
diameter (p. 584)	three-dimensional figure
edge (p. 603)	(p. 603)
face (p. 603)	triangular prism (p. 615)
height (p. 572)	vertex (p. 603)
lateral face (p. 603)	volume (p. 613)

Vocabulary Check

Choose the correct term or number to complete each sentence.

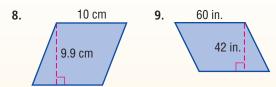
- 1. A (rectangular prism, rectangle) is a threedimensional figure that has three sets of parallel congruent sides.
- 2. The (volume, surface area) of a threedimensional figure is the measure of the space occupied by it.
- 3. $A = \frac{1}{2}h(b_1 + b_2)$ is the formula for the area of a (triangle, trapezoid).
- 4. Volume is measured in (square, cubic) units.
- 5. A (cylinder, prism) is a three-dimensional figure that has two congruent, parallel circles as its bases.
- 6. The volume of a rectangular prism is found by (adding, multiplying) the length, the width, and the height.
- 7. The formula for the area of a (square, circle) is $A = \pi r^2$.



Lesson-by-Lesson Review

11-1 Area of Parallelograms (pp. 572–576)

Find the area of each parallelogram. Round to the nearest tenth if necessary.



10. ALGEBRA A parallelogram has an area of 57 square inches. Find the base of the parallelogram if the height is 6 inches.

Example 1 Find the area of a parallelogram if the base is 15 inches and the height is 8 inches. A = bh

 $A = 15 \cdot 8$ A = 120 in.



- Multiply.
- Area of a parallelogram Replace *b* with 15 and *h* with 8.

11.

11-2

Area of Triangles and Trapezoids (pp. 578–582)

Find the area of each figure. Round to the nearest tenth if necessary.

12.

5 in.

5 in.

10 in.



13. trapezoid: bases 22 yd and 35 yd height 18.5 yd

14. **ALGEBRA** The area of a triangle is 26.9 square inches. If the base is 9.6 inches, what is the height of the triangle?

Example 2 Find the area of a triangle with a base of 8 meters and a height of 11.2 meters.

$$A = \frac{1}{2}bh$$
 Area of a triangle

 $A = \frac{1}{2}(8)(11.2)$ or 44.8 m²
 $b = 8, h = 11.2$
Example 3 Find the area of the trapezoid.
 -10 in. -10 in

11-3 Circles and Circumference (pp. 584–588)

Find the circumference of each circle. Use 3.14 or $\frac{22}{7}$ for π . Round to the nearest tenth if necessary.

- **15**. radius = 12 in. 16. diameter = 28 m
- **17.** diameter = $8\frac{2}{5}$ ft **18.** radius = 4.4 cm

19. LIFE SCIENCE A circular nest built by bald eagles has a diameter of $9\frac{1}{2}$ feet. Find the nest's circumference. **Example 4** Find the circumference of a circle with a diameter of 12.2 meters.



$C = \pi d$	Circumference of a circle
$C\approx 3.14(12.2)$	$\pi \approx 3.14$ and $d = 12.2$
$C \approx 38.3$	Multiply.
The circumferer	ce is about 38.3 meters.



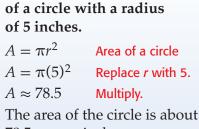


11-5

Area of Circles (pp. 589–593)

Find the area of each circle. Round to the nearest tenth.

- **20**. radius = 11.4 in.
- **21**. diameter = 44 cm
- 22. **GARDENING** A lawn sprinkler can water a circular area with a radius of 20 feet. Find the area that can be watered. Round to the nearest tenth.



Example 5 Find the area

78.5 square inches.

PSI: Solve a Simpler Problem (pp. 594–595)

- **23. BAKING** The local baker can make 10 cakes in 2 days. How many cakes can 8 bakers make working at the same rate in 20 days?
- 24. **TRAVEL** Mrs. Whitmore left Chicago at 6:45 A.M. and arrived in St. Louis at 11:15 A.M., driving a distance of approximately 292 miles. Find her approximate average speed.
- **25. SHOPPING** Mercedes spent \$175.89 over the weekend. Of the money she spent, 40% was spent on shoes. About how much money was *not* spent on shoes?

Example 6 A total of 950 residents voted on whether to build a neighborhood playground. Of those that voted, 70% voted for the playground. How many residents voted for the playground?

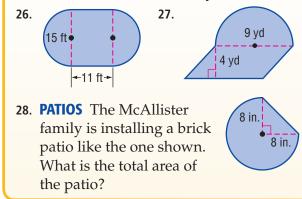
5 in.

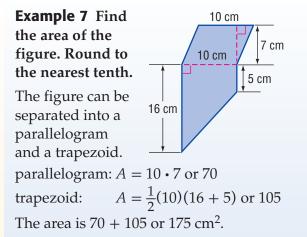
Find 10% of 950 and then use the result to find 70% of 950. 10% of 950 = 95 Since there are seven 10%s in 70%,

multiply 95 by 7. So, 95 \times 7 or 665 residents voted for the playground.

11-6 Area of Complex Figures (pp. 596–599)

Find the area of each figure. Round to the nearest tenth if necessary.



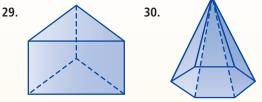


Mixed Problem Solving For mixed problem-solving practice, see page 725.

11-7

Three-Dimensional Figures (pp. 603–606)

For each figure, identify the shape of the base(s). Then classify the figure.

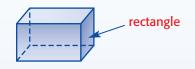


31. **VEGETABLES** Classify the shape of a can of green beans.

DOGHOUSES For Exercises 32 and 33, use the figure of the doghouse shown.

- **32**. What geometric figure is represented by the main part of the doghouse?
- **33**. Identify the top figure of the doghouse.

Example 8 For the figure, identify the shape of the base(s). Then classify the figure.



Since the figure has 6 rectangular faces, parallel bases, and a rectangular base, the figure is a rectangular prism.

Example 9 Classify the shape of a basketball.

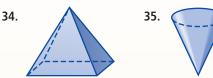
The figure has no faces, bases, edges, or vertices. The figure is a sphere.



11-8

Drawing Three-Dimensional Figures (pp. 608–612)

Draw a top, a side, and a front view of each solid.



36. Draw a solid using the top, side, and front views shown. Use isometric dot paper.

side

front

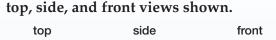


37. CRAFTS Alejandra put

top

all of her craft supplies in the box shown. Draw a top, a side,

and a front view of the box.



Example 10 Draw the solid by using the



The side view is a square. The top and front views are rectangles.



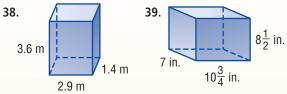
The figure drawn is a rectangular prism.





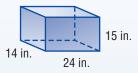
Volume of Prisms (pp. 613–618)

Find the volume of each prism. Round to the nearest tenth if necessary.



- **40. POOLS** A competition swimming pool is 25 yards long and has 8 lanes that are each 3 yards wide. The pool is filled to a depth of 6 feet. Find the number of cubic feet of water in the pool.
- **41. TRUCKS** The dimensions of the bed of a dump truck are length 20 feet, width 7 feet, and height $9\frac{1}{2}$ feet. What is the volume of the bed of the dump truck?

Example 11 A local city provides residents with a rectangular container for recycling products. Find the volume of the rectangular container.



 $V = \ell wh$ Volume of a rectangular prismV = (24)(14)(15)Replace ℓ with 24, w with
14 and h with 15.V = 5,040Multiply.

The volume of the rectangular container is 5,040 cubic inches.

11-10

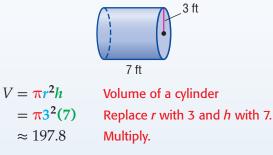
Volume of Cylinders (pp. 619–623)

Find the volume of each cylinder. Round to the nearest tenth.



- 44. **POTTERY** In his art class, Benjamin made a vase in the shape of a cylinder. The diameter is 5 inches, and the height is 10 inches. Find the maximum volume of water the vase can hold.
- **45. COOKIES** Mrs. Delagado stores cookies in a cylinder-shaped jar that has a height of 12 inches and a diameter of 10 inches. Find the volume to the nearest cubic inch. Use 3.14 for π .

Example 12 Marquez stores his toys in a cylinder-shaped can like the one shown below. Find the volume of the cylinder-shaped can. Round to the nearest tenth.

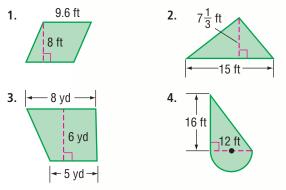


The volume of the cylinder-shaped can is 197.8 cubic feet.

Practice Test

Find the area of each figure. Round to the nearest tenth if necessary.

CHAPTER



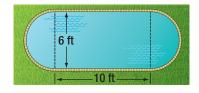
5. **MEASUREMENT** Mrs. Torres has a circular rug underneath her dining room table. What is the approximate circumference of the rug if it has a radius of $3\frac{1}{2}$ yards?

Find the area of each circle. Round to the nearest tenth.

- 6. radius = 9 ft 7. diameter = 5.2 m
- 8. **STANDARDS PRACTICE** A fountain is in the shape of a circle. If the fountain has a diameter of 8.8 meters, which equation could be used to find the area of the base of the fountain?

$\mathbf{A} \ A = \pi \times 8.8^2$	C $A = 2 \times \pi \times 4.4$
B $A = \pi \times 4.4^2$	D $A = \pi \times 8.8$

9. MEASUREMENT The Gruseser family wants to build a swimming pool like the one shown below. If they have 85 square feet of land available for the pool, do they have enough space for the swimming pool? Justify your response.



For each figure, identify the shape of the base(s). Then classify the figure.

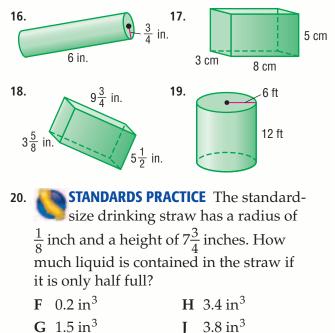


- **12. GEOMETRY** Classify the shape of a roll of paper towels.
- **13. GEOMETRY** Which geometric shape has at least three lateral faces that are triangles and only one base?

Draw a top, a side, and a front view of each solid.



Find the volume of each prism and cylinder. Round to the nearest tenth.



Chapter Test at ca.gr6math.com

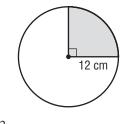
California Standards Practice Cumulative, Chapters 1–11



CHAPTER

Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.

1 Stephanie shaded part of a circle like the one shown below. What is the approximate area of the shaded region?



- **A** 113 cm²
- **B** 364 cm^2
- $C 452 \text{ cm}^2$
- **D** 728 cm²

TEST-TRACING TIP

Question 1 Many tests include a Mathematics Chart in the test booklet. Refer to the chart for area and volume formulas.

2 The circular floor rug shown has a diameter of 6 feet. Which expression can be used to find its circumference, *C*, in feet?



- **F** $C = 3 \times \pi$
- **G** $C = 3^2 \times \pi$
- H $C = 6 \times \pi$
- J $C = 2 \times 6 \times \pi$

- **3** Angle *D* and angle *E* are complementary angles. If $\angle D$ is 35°, what is the measure of $\angle E$?
 - **A** 35° **C** 90°
 - **B** 55° **D** 145°
- 4 If the corresponding angles of 2 trapezoids are congruent and the lengths of the corresponding sides of the trapezoids are proportional, the trapezoids are
 - F regular H symmetric
 - G congruent J similar
- 5 Which description shows the relationship between a term and *n*, its position in the sequence?

Position	1	2	3	4	5	n
Value of Term	2	5	8	11	14	

- A Add 1 to n
- **B** Multiply *n* by 2 and add 3
- **C** Multiply *n* by 3 and subtract 1
- **D** Add 9 to *n*
- **6** A metal toolbox has a length of 11 inches, a width of 5 inches, and a height of 6 inches. What is the volume of the toolbox?

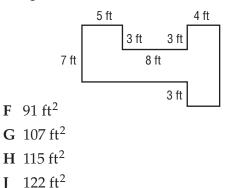
F	22 in ³	Η	210 in^3
G	121 in ³	J	330 in^3

7 A bag contains 5 red, 2 yellow, and 8 blue marbles. Xavier removed one blue marble from the bag and did not put it back. He then randomly removed another marble. What is the probability that the second marble removed was blue?

A $\frac{8}{14}$	$C \frac{1}{2}$
B $\frac{8}{15}$	D $\frac{7}{15}$

More California Standards Practice For practice by standard, see pages CA1–CA39.

8 In the figure shown, all the corners form right angles. What is the area of the figure in square feet?



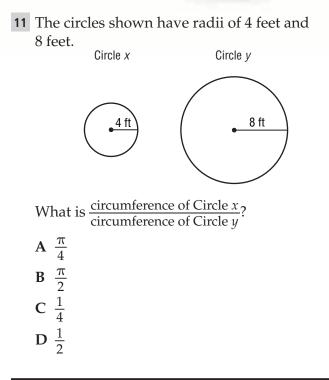
9 Ms. Williams recorded the time it took six of her top students to complete a math quiz. The results are shown in the table below. What is the median time for these six students?

Math Quiz Times					
Student Time (minutes)					
1	12.8				
2	23.1				
3	19.6				
4	15.7				
5	27.3				
6	20.5				

- A 12.8 minutes C 20.05 minutes
- **B** 16 minutes **D** 27.3 minutes
- **10** Katie has 3 apples to serve to her friends. If Katie serves each friend $\frac{1}{3}$ of a whole apple, how many friends can she serve?

F	1	Η	9
G	3	J	12

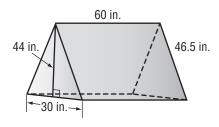
NEED EVTDA HELD



Pre-AP

Record your answers on a sheet of paper. Show your work.

12 Suppose you bought a new tent with the dimensions shown below.



- **a.** Is the area of the parallelogram-shaped side of the tent greater than or less than the area of the floor? Explain.
- **b.** The front and back triangular regions are covered with screens. What is the total area of the screens?

If You Missed Question	1	2	3	4	5	6	7	8	9	10	11	12
Go to Lesson	11-4	11-6	10-1	10-6	1-9	11-9	9-1	11-6	8-2	5-7	11-3	11-2
For Help with Standard	MG1.2	AF3.1	MG2.2	NS1.3	AF1.2	MG1.3	SDAP3.3	AF3.1	SDAP1.1	NS2.2	MG1.2	AF3.1



BIG Idea

Preparation for Standard 7MG3.3 Know the Pythagorean Theorem and deepen the understanding of plane and solid geometric shapes by constructing figures that meet given conditions and by identifying attributes of figures.

Key Vocabulary

hypotenuse (p. 640) irrational number (p. 637) Pythagorean Theorem (p. 640) surface area (p. 650)

Real-World Link

SPAGHETTI The shape of many spaghetti boxes are rectangular prisms, and the shape of many cans are cylinders. You can use the formula S = 2lw + 2lh + 2wh to find the surface area of a box of spaghetti given the length *I*, the width *w*, and the height *h* of the box.

FOLDABLES

Geometry and Measurement Make this Foldable to help you organize your notes. Begin with a piece of 11" by 17" paper.

Looking Ahead to

Grade 7: Geometry

and Measurement

Fold the paper in fourths lengthwise. Open and fold a 2" tab along the short side. Then fold the rest in half.

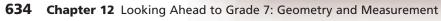




Draw lines along the folds and label as shown.

THIN SPAGHET

Ch. 12	Rectangular Prisms	Cylinders
Draw Examples		
Find Volume		
Find Surface Area		



Horizons Companies

GET READY for Chapter 12

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 2

Math Take the Online Readiness Quiz at ca.gr6math.com.

Take the Quick Check below. Refer to the Quick Review for help.

Option 1

OUIICKCheck OUICKReview Evaluate each expression. (Lesson 1-2) **Example 1** 7² 24² Evaluate $3^2 + 5^2$. **1**. 4² $3^2 + 5^2 = 9 + 25$ Evaluate 3^2 and 5^2 . **3**. 13² = 34 Add 9 and 25. **5.** $5^2 + 8^2$ **6.** $10^2 + 6^2$ **7.** $9^2 + 12^2$ **8.** $15^2 + 17^2$ **9. AGES** Samuel's mother is 7² years old, and his grandmother is 9^2 years old. Find the sum of their ages. (Lesson 1-2) **Evaluate the expression** Example 2 2ab + 2bc + 2ac for each value of the **Evaluate the expression** variables indicated. (Lesson 1-4) 2ab + 2bc + 2ac for a = 3, b = 5, b = 5and c = 6. **10**. a = 4, b = 5, c = 82ab + 2bc + 2ac**11**. a = 2, b = 7, c = 11= 2(3)(5) + 2(5)(6) + 2(3)(6) Replace *a* with 3, **12**. a = 3.1, b = 2.4, c = 9.9b with 5, and c with 6. **13**. a = 2.1, b = 1.7, c = 4.6= 30 + 60 + 36Multiply. = 126Add.

Evaluate each expression below. Round to the nearest tenth. Use 3.14 for π . (Lesson 11-3) 14. (2)(π)(3²) + (2)(π)(3)(8) 15. (2)(π)(7²) + (2)(π)(7)(5) Example 3 Evaluate $(2)(\pi)(4^2) + (2)(\pi)(4)(6)$. Round to the nearest tenth. Use 3.14 for π . $(2)(\pi)(4^2) + (2)(\pi)(4)(6)$

 $= (2)(\pi)(1) + (2)(\pi)(1)(6)$ = (2)(\pi)(16) + (2)(\pi)(4)(6) Evaluate 4². = (32)(3.14) + (48)(3.14) Multiply. \approx 251.2 Multiply and add.

Estimating Square Roots

Main IDEA

Estimate square roots.

Preparation for Standard 7NS2.4 Use the inverse relationship between raising to a power and extracting the root of a perfect square; for an integer that is not square, determine without a calculator the two integers between which its square root lies and explain why.

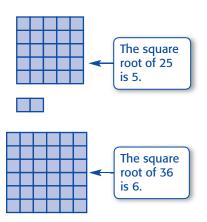
NEW Vocabulary

irrational number

MINI Lab

Estimate the square root of 27.

- Arrange 27 tiles into the largest square possible. You will use 25 tiles and 2 will remain.
- Add tiles to make the next larger square. So, add 9 tiles to make a square with 36 tiles.
- The square root of 27 is between 5 and 6. Since 27 is much closer to 25 than 36, we can expect that the square root of 27 is closer to 5 than 6.



Use algebra tiles to estimate the square root of each number to the nearest whole number.

- **1**. 40 **2**. 28 **3**. 85 **4**. 62
- **5**. Describe another method that you could use to estimate the square root of a number.

The square root of a perfect square is an integer. You can estimate the square root of a number that is *not* a perfect square.

EXAMPLE Estimate a Square Root

1 Estimate $\sqrt{78}$ to the nearest whole number.

List some perfect squares.

1, 4, 9, 16, 25, 36, 49, 64, 81, ...

78 64 < 78 < 81 78 is between the perfect squares 64 and 81. $\sqrt{64} < \sqrt{78} < \sqrt{81}$ Find the square root of each number. $8 < \sqrt{78} < 9$ $\sqrt{64} = 8 \text{ and } \sqrt{81} = 9$

So, $\sqrt{78}$ is between 8 and 9. Since 78 is much closer to 81 than to 64, the best whole number estimate is 9. Verify with a calculator.

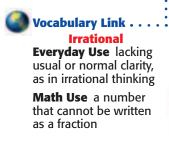
CHECK Your Progress

a. Estimate $\sqrt{50}$ to the nearest whole number.

Personal Tutor at <u>ca.gr6math.com</u>

READING in the Content Area

For strategies in reading this lesson, visit ca.gr6math.com.



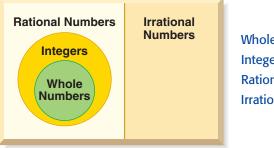
••• A number that cannot be written as a fraction is an irrational number.

Irrational Numbers $\sqrt{2}$, π , 0.636336333...

The square root of any number that is not a perfect square is an irrational number. You can use a calculator to estimate square roots that are irrational numbers.

EXAMPLE	raph Square	Roots on a Number Line
2 Graph $\sqrt{42}$ on a r	number line.	
2nd $\left[\sqrt{} ight]$ 42 ENTE	R 6.480740698	
$\sqrt{42} \approx 6.5$		
- 1 2 3 4 5	$\begin{array}{c c} \sqrt{42} \\ \hline 6 & 7 & 8 \end{array}$	Check for Reasonableness $6^2 = 36$ and $7^2 = 49$. Since 42 is between 36 and 49, the answer, 6.5, is reasonable.
💋 CHECK Your Prog	ress	
Graph each squar	re root on a num	ber line.
b. $\sqrt{6}$	c. $\sqrt{23}$	d. $\sqrt{309}$

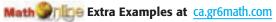
The Venn diagram shows the relationship among sets of numbers.



Whole Numbers: 0, 1, 2, 3, ... Integers: ..., -2, -1, 0, 1, 2, ... Rational Numbers: $\frac{1}{2}$, 0.25, -0.2, 0.333... Irrational Numbers: π , $\sqrt{2}$, 0.124543...

CHECK Your Understanding

Example 1	Estimate each square root on a number line.				
(p. 636)	1 . √39	2 . $\sqrt{106}$	3 . $\sqrt{90}$	4. $\sqrt{140}$	
Example 2	Graph each s	quare root on a num	ber line.		
(p. 637)	5. $\sqrt{7}$	6. $\sqrt{51}$	7 . $\sqrt{135}$	8 . $\sqrt{462}$	
	9. MEASUREMENT The diagram at the right shows the floor plan of a square kitchen. What is the approximate length of one side of the kitchen floor to the nearest tenth?		$\frac{\text{Area}}{95 \text{ cm}^2} x$		
				X	



Exercises

OMEWO	RKHELP		-	nearest whole numb	
For	See	10. $\sqrt{11}$		12 . $\sqrt{35}$	13 . $\sqrt{65}$
xercises	Examples	14. $\sqrt{89}$	15 . $\sqrt{116}$	16. $\sqrt{137}$	17. $\sqrt{409}$
10–17, 26, 27	1	Graph each square root on a number line.			
18–25	2		19. $\sqrt{8}$		21. $\sqrt{89}$
			23. $\sqrt{573}$		25 . $\sqrt{2,798}$
		baking pan inches. Wh of one side 27. ALGEBRA W	ENT The bottom of has an area of 67 s at is the approximation of the pan? What whole number $\overline{m-n}$ if $m = 45$ and	quare te length	
				-	and the providence of the prov
			-	nearest whole numb	
		28 . $\sqrt{925}$	29 . $\sqrt{2,480}$	30 . $\sqrt{1,610}$	31. $\sqrt{6,500}$
		Estimate each	square root to the		
		32 . $\sqrt{0.25}$	33. $\sqrt{0.49}$	34 . $\sqrt{1.96}$	35 . $\sqrt{2.89}$
		ALGEBRA For E tenth if $a = 8$ a 36. $\sqrt{a+b}$		evaluate each expression evaluate each	ession to the nearest
		STAMPS For Fy	ercises 38 and 39	use the information	helow
	STAMPS For Exercises 38 and 39, use the information below. The Special Olympics' commemorative stamp is square in shape with an are of 1,008 square millimeters.				
		1		the postage stamp to	the nearest tenth.
			length of one side		
EXTRAPRACTICE See pages 712, 726. Math		 40. ALGEBRA The formula D = 1.22 × √h can be used to estimate the distance D in miles you can see from a point h feet above Earth's surface. Use the formula to find the distance D in miles you can see from the top of a 120-foot hill. Round to the nearest tenth. 41. FIND THE DATA Refer to the California Data File on pages 16–19. 			
Self-Cheo <u>ca.gr6m</u>	ca.gr6math.com Choose some data and write a real-world problem in which you would estimate a square root.			blem in which you	
U.I. Pro	oblems	42. Which One Doesn't Belong? Identify the number that does not have the same characteristic as the other three. Explain your reasoning.			
		:			

- **43. OPEN ENDED** Select three numbers with square roots between 4 and 5.
- 44. **NUMBER SENSE** Explain why 7 is the best whole number estimate for $\sqrt{51}$.

CHALLENGE A cube root of a number is one of its three equal factors. Estimate the cube root of each of the following to the nearest whole number.

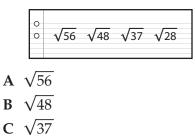
45. $\sqrt[3]{9}$ **46.** $\sqrt[3]{26}$ **47.** $\sqrt[3]{120}$ **48.** $\sqrt[3]{500}$

49. WRITING IN MATH Apply what you know about numbers to explain why $\sqrt{30}$ is an irrational number.

5

STANDARDS PRACTICE

50. Reina wrote four numbers on a piece of paper. She then asked her friend Tyron to select the number closest to 5. Which number should he select?



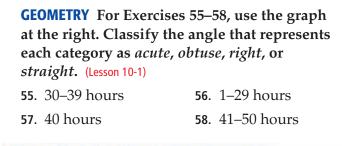
51. Which of the following is an irrational number?

	$\frac{\sqrt{25}}{\sqrt{7}}$	$\begin{array}{c} \mathbf{H} & -13 \\ \mathbf{J} & \frac{4}{5} \end{array}$	
2 . Fii	nd $\sqrt{169}$.		
Α	15		
В	13		
С	12		
D	11		

Spiral Review

 $D \sqrt{28}$

- **53. MEASUREMENT** Find the volume of a can of vegetables with a diameter of 3 inches and a height of 4 inches. (Lesson 11-10)
- **54. MEASUREMENT** A rectangular prism is 14 inches long, 4.5 inches wide, and 1 inch high. What is the volume of the prism? (Lesson 11-9)

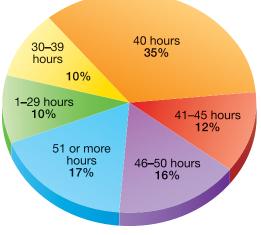


GET READY for the Next Lesson

PREREQUISITE SKILL Solve each equation. (Lesson 1-7) **59.** $7^2 + 5^2 = c$ **60.** $4^2 + b = 36$

59. $7^2 + 5^2 = c$	60. $4^2 + b = 36$
61. $3^2 + a = 25$	62. $9^2 + 2^2 = c$

Hours Worked in a Typical Week

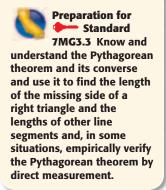


Source: Heldrich Work Trends Survey

The Pythagorean Theorem

Main IDEA

Find length using the Pythagorean Theorem.



NEW Vocabulary

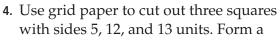
leg hypotenuse Pythagorean Theorem

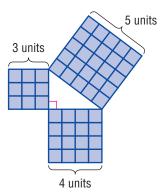
MINI Lab

Concepts in Motion BrainPOP® ca.gr6math.com

Three squares with sides 3, 4, and 5 units are used to form the right triangle shown.

- 1. Find the area of each square.
- **2**. How are the squares of the sides related to the areas of the squares?
- **3.** Find the sum of the areas of the two smaller squares. How does the sum compare to the area of the larger square?





right triangle with these squares. Compare the sum of the areas of the two smaller squares with the area of the larger square.

In a right triangle, the sides have special names.



The **Pythagorean Theorem** describes the relationship between the length of the hypotenuse and the lengths of the legs.

KEY C	ONCEPT		Pythagorean Theorem
Words	In a right triangle, the square of the length of the hypotenuse equals the sum of the squares of the lengths of the legs.	Model	c a b
Symbols	$c^2 = a^2 + b^2$		

READING Math

Square Roots Read $\pm \sqrt{5}$ as plus or minus the square root of 5.

When using the Pythagorean Theorem, you will encounter equations that involve square roots. Every positive number has both a positive and a negative square root. By the definition of square roots, if $n^2 = a$, then $n = \pm \sqrt{a}$. The notation $\pm \sqrt{}$ indicates both the positive and negative square root of a number. You can use this relationship to solve equations that involve squares.

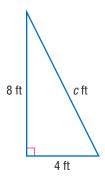
EXAMPLE Find the Length of the Hypotenuse



Check for Reasonableness You can eliminate -8.9 as a solution because the length of a side of a triangle cannot be a negative number.

Find the length of the hypotenuse of the triangle.

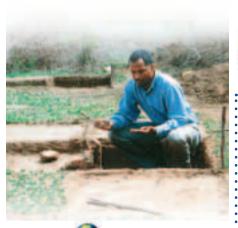
Pythagorean Theorem
Replace <i>a</i> with 8 and <i>b</i> with 4.
Evaluate 8 ² and 4 ² .
Add.
Definition of square root
Simplify.



The length of the hypotenuse is about 8.9 feet.

CHECK Your Progress

a. Find the length of the hypotenuse of a right triangle with legs 5 yards and 7 yards. Round to the nearest tenth.



Real-World Career ...

How Does an Archeologist Use Math? Before digging, archaeologists use the Pythagorean Theorem to calculate the diagonal of an excavation site to be sure that the area is a rectangle.



For more information, go to <u>ca.gr6math.com</u>.

Real-World EXAMPLE

ARCHAEOLOGY Archaeologists placed corner stakes to mark a rectangular excavation site as shown at the right. If their stakes are placed correctly, what is the measure of the diagonal of the excavation site?

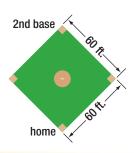
The diagonal of the rectangle is the hypotenuse of a right triangle. Write and solve an equation for *x*.

$c^2 = a^2 + b^2$	Pythagorean Theorem
$x^2 = 4^2 + 10^2$	Replace c with x , a with 4, and b with 10.
$x^2 = 16 + 100$	Evaluate 4 ² and 10 ² .
$x^2 = 116$	Add.
$x = \pm \sqrt{116}$	Definition of square root
$x \approx \pm 10.8$	Simplify.

The length of the diagonal of the excavation site is about 10.8 meters.

CHECK Your Progress

b. SOFTBALL A softball diamond is a square measuring 60 feet on each side. How far does a player on second base throw when she throws from second base to home? Round to the nearest tenth.

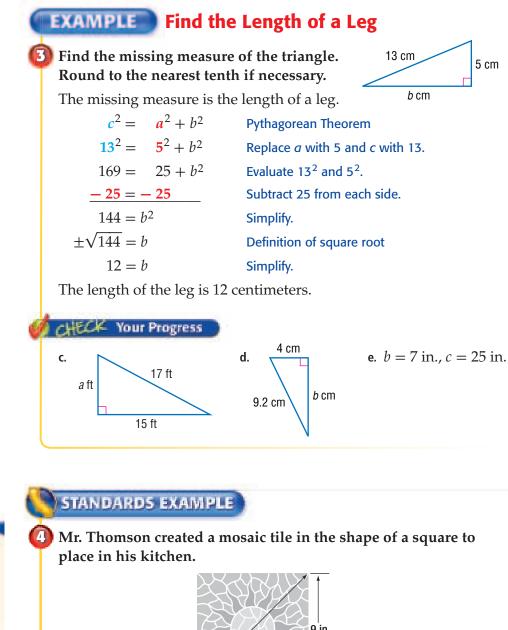


10 m

4 m

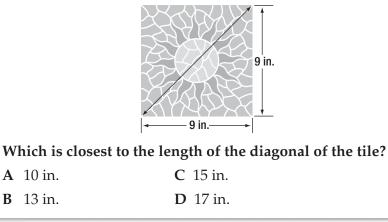


You can also use the Pythagorean Theorem to find the measure of a leg if the measure of the other leg and the hypotenuse are known.



Test-Taking Tip

Formulas Some formulas will be given to you during the test. It is a good idea to familiarize yourself with the formulas before the test.



Read the Item

You need to use the Pythagorean Theorem to find the length of the diagonal.

Solve the Item

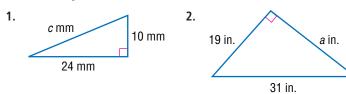
$c^2 = \mathbf{a}^2 + \mathbf{b}^2$	Pythagorean Theorem
$c^2 = 9^2 + 9^2$	Replace <i>a</i> with 9 and <i>b</i> with 9.
$c^2 = 81 + 81$	Evaluate 9 ² and 9 ² .
$c^2 = 162$	Add.
$c = \pm \sqrt{162}$	Definition of square root
$c \approx \pm 12.7$	Simplify.

The length is about 12.7 inches. The answer choice closest to 12.7 inches is 13 inches. So, the answer is B.

f. A painter leans a ladder against the side of a building. How far from the bottom of the building is the top of the ladder?
F 38.2 ft H 21.8 ft
G 28.0 ft J 20.0 ft
Personal Tutor at ca.gr6math.com

Your Understanding

Examples 1, 3 Find the missing measure of each triangle. Round to the nearest tenth if necessary.



3. b = 21 cm, c = 28
4. a = 11 yd, b = 12 yd

Example 2 (p. 641) **5. ARCHITECTURE** What is the width of the the fence gate shown at the right? Round to the nearest tenth.

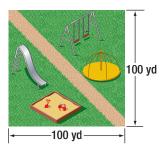


Example 4 (pp. 642–643)

6.

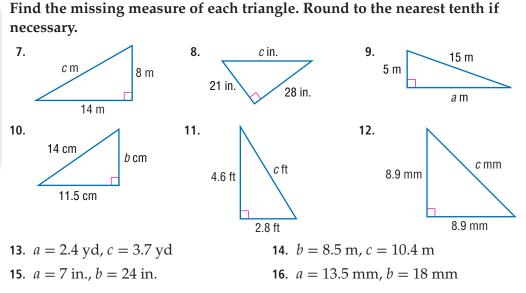
STANDARDS PRACTICE A company designed a public play area in the shape of a square. The play area will include a pathway, as shown. Which is closest to the length of the pathway? **A** 100 ft **C** 140 ft

B 125 ft **D** 175 ft

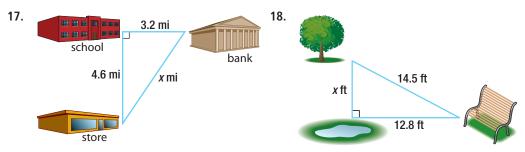


Exercises

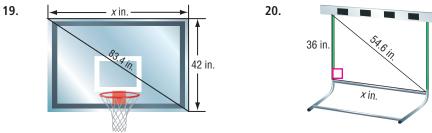
HOMEWORKHELP		
For Exercises	See Examples	
7–8, 11–12, 15–16	1	
17–20	2	
9–10, 13–14	3	
26–27	4	



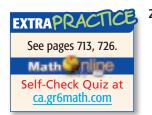
MEASUREMENT For Exercises 17 and 18, find each distance to the nearest tenth.



SPORTS For Exercises 19 and 20, find the length or width of each piece of sports equipment. Round to the nearest tenth.

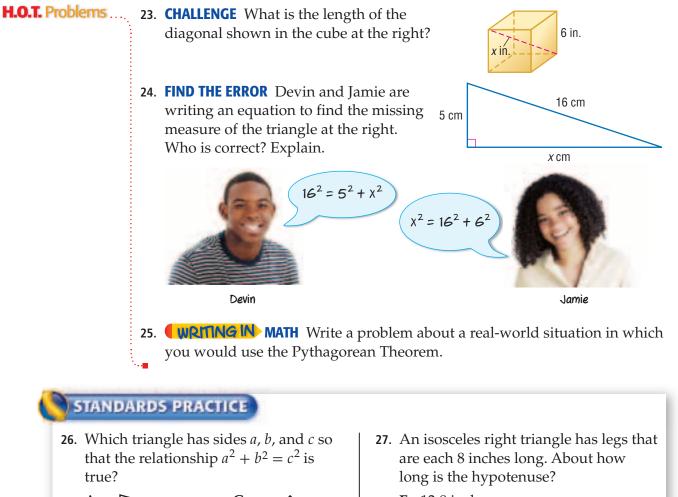


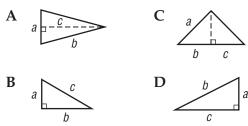
21. **MEASUREMENT** The doorway of a house is 3 feet wide and 6.5 feet tall. A square mirror 7 feet on each side must be delivered through the doorway. Can the mirror fit through the doorway? Justify your answer.



22. **MEASUREMENT** On a weekend trip around California, Sydney left her home in Modesto and drove 75 miles east to Yosemite National Park, then 70 miles south to Fresno, and finally 110 miles west to Monterey Bay. About how far is she from her starting point? Justify your answer with a drawing.







- F 12.8 inches
- G 11.3 inches
- H 8 inches
- I 4 inches



- **28. ESTIMATION** Which is closer to $\sqrt{55}$: 7 or 8? (Lesson 12-1)
- **29. MEASUREMENT** A cylinder-shaped popcorn tin has a height of 1.5 feet and a diameter of 10 inches. Find the volume to the nearest cubic inch. Use 3.14 for π . (Lesson 11-10)

Write each percent as a decimal. (Lesson 4-7)

30. 45% 31. 8% **32.** 124% **33**. 265%

GET READY for the Next Lesson

34. **PREREQUISITE SKILL** The average person takes about 15 breaths per minute. At this rate, how many breaths does the average person take in one week? Use the solve a simpler problem strategy. (Lesson 11-5)

12-3 Problem-Solving Investigation

MAIN IDEA: Solve problems by making a model.

Standard 6MR2.4 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning. Standard 6NS2.1 Solve problems involving addition, subtraction, multiplication, and division of positive fractions and explain why a particular operation was used for a given situation.

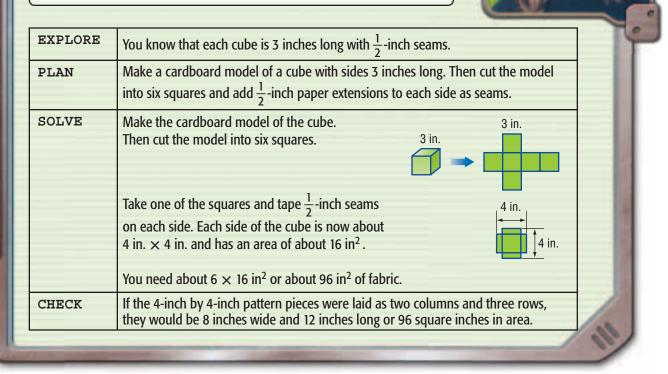
P.S.I. TERM +

e-Mail: MAKE A MODEL

YOUR MISSION: Make a model to solve the problem.

THE PROBLEM: How much fabric is needed to make one cube if there is a $\frac{1}{2}$ -inch seam on each side?

Libby: I'm going to help my mom make 3-inch soft alphabet blocks for the children at her daycare center. A model can be used to find out how much fabric is needed.



Analyze The Strategy

- 1. Explain why you think Libby started with the three-dimensional model to make her pattern.
- 2. **WRITING IN MATH** Write a problem that can be solved by making a model. Then solve the problem.

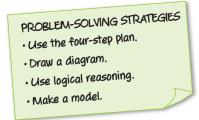
Mixed Problem Soluing



For Exercises 3–5, make a model to solve the problem.

- 3. ART Rodrigo is creating a layout of his bedroom for art class. The room measures 15 feet by 12 feet. If he uses a scale of $1 \text{ ft} = \frac{3}{4} \text{ inch}$, what are the dimensions of his bedroom on the model?
- 4. **BICYCLES** Eight customers stood outside The Bike Shop with either a bicycle or a tricycle that needed repair. If there was a total of 21 wheels, how many tricycles and bicycles were there?
- 5. **MEASUREMENT** Francis has a photo that measures 10 inches by $8\frac{1}{2}$ inches. If the frame he uses is $1\frac{1}{4}$ inches wide, what is the perimeter of the framed picture?

Use any strategy to solve Exercises 6–9. Some strategies are shown below.

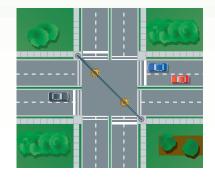


6. **COMMUNITY SERVICE** There are four drop-off centers for the community food drive. The table shows the total collections for each center. Suppose a newsletter reports that over 13,000 cans of food were collected. Is this estimate reasonable? Explain.

Center	Number of Cans
А	3,298
В	2,629
С	4,429
D	2,892

7. **SPORTS** Len can swim one 20-meter lap in $1\frac{1}{4}$ minutes. How long will it take her to swim 100 meters at the same rate?

8. **TRAFFIC** At the four-way intersection shown below, the traffic lights change every 90 seconds. About 8 cars in one lane travel through each light change. Determine the approximate number of cars in all lanes that travel through the intersection in 3 minutes.



9. **MEASUREMENT** How many square feet of wallpaper are needed to cover a wall that measures $9\frac{3}{4}$ feet by $16\frac{1}{2}$ feet?

Select the Operation

For Exercises 10–12, select the appropriate operation(s) to solve the problem. Justify your selection(s) and solve the problem.

- 10. MONEY Duante deposited \$450 in a new savings account in January, withdrew \$175 in February, and then began monthly deposits of \$75 from March through December. How much money does he have in his savings account?
- **11. BASEBALL** A regulation baseball diamond is a square with an area of 8,100 square feet. If it is laid out on a field that is 172 feet wide and 301 feet long, how much greater is the distance around the whole field than the distance around the diamond?
- 12. **DVDS** Marc currently has 68 DVDs in his collection. By the end of the next four months, he wants to have 92 DVDs in his collection. How many DVDs must he buy each month to obtain his goal?

Mid-Chapter Quiz

Lessons 12-1 through 12-3

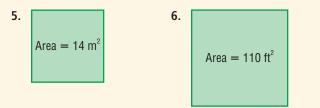
Estimate each square root to the nearest whole number. (Lesson 12-1)

 1. $\sqrt{32}$ 2. $\sqrt{80}$

 3. $\sqrt{105}$ 4. $\sqrt{230}$

CHAPTER

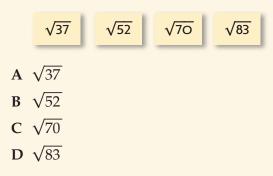
MEASUREMENT Estimate the side length of each square to the nearest whole number. (Lesson 12-1)



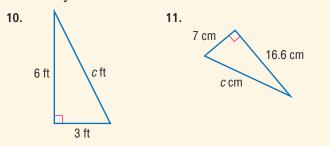
ALGEBRA Evaluate each expression to the nearest tenth if a = 20 and b = 7. (Lesson 12-1)

7.
$$\sqrt{a+b}$$
 8. $\sqrt{a-b}$

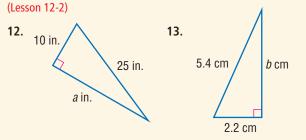
9. **STANDARDS PRACTICE** Imani is playing a review game in math class. She needs to pick the card that is labeled with a number closest to 8. Which should she pick? (Lesson 12-1)



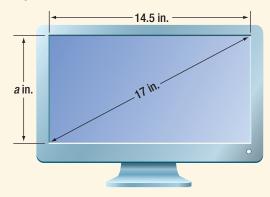
Find the length of the hypotenuse of each triangle. Round to the nearest tenth if necessary. (Lesson 12-2)



Find the missing measure of each triangle. Round to the nearest tenth if necessary.



14. **MEASUREMENT** On a computer monitor, the diagonal measure of the screen is 17 inches.



If the screen length is 14.5 inches, what is the height of the screen to the nearest tenth? (Lesson 12-2)

15. **STANDARDS PRACTICE** Eduardo jogs 5 kilometers north and 5 kilometers west. To the nearest kilometer, how far is he from his starting point? (Lesson 12-2)

F	25 km	Η	7 km
0	101	т	- 1

- **G** 10 km **J** 5 km
- **16. SCIENCE** A certain type of bacteria doubles every hour. If there are two bacteria initially in a sample, how many will be present after five hours? Use the *make a model* strategy. (Lesson 12-3)
- 17. SCALE MODELS A scale model is made of a building measuring 120 feet long, 75 feet wide, and 45 feet high. If the scale is 1 inch = 15 feet, what are the dimensions of the model? Use the *make a model* strategy. (Lesson 12-3)



Surface Area of Rectangular Prisms

Main IDEA

Find the surface areas of rectangular prisms.



Preparation for Standard 7MG2.1 Use formulas

routinely for finding the perimeter and area of basic two-dimensional figures and the surface area and volume of basic three-dimensional figures, including rectangles, parallelograms, trapezoids, squares, triangles, circles, prisms, and cylinders. Standard 6AF3.2 Express in symbolic form simple relationships arising from geometry.

NEW Vocabulary

surface area

MINI Lab

• Use the cubes to build a rectangular prism with a length of 8 centimeters.



- Count the number of squares on the outside of the prism. The sum is the *surface area*.
- 1. Record the dimensions, volume, and surface area in a table.
- **2**. Build two more prisms using all of the cubes. For each, record the dimensions, volume, and surface area.
- 3. Describe the prisms with the greatest and least surface areas.

The sum of the areas of all of the surfaces, or faces, of a threedimensional figure is the **surface area**.

KEY CONCEPT

Surface Area of a Rectangular Prism

Words The surface area *S* of a rectangular prism with length ℓ , width *w*, and height *h* is the sum of the areas of its faces. **Model** ℓ

Symbols $S = 2\ell w + 2\ell h + 2wh$

EXAMPLES Find Surface Area

Find the surface area of the rectangular prism. 3 cm There are three pairs of congruent faces. 4 cm • top and bottom 5 cm • front and back 5 cm two sides 3 cm back 3 cm Faces Area $2(5 \cdot 4) = 40$ top and bottom side bottom side 4 cm 4 cm front and back $2(5 \cdot 3) = 30$ front $2(3 \cdot 4) = 24$ 3 cm two sides 40 + 30 + 24 = 94sum of the areas 4 cm top The surface area is 94 square centimeters. 5 cm

Surface Area

TUDY

When you find the surface area of a three-dimensional figure, the units are square units, not cubic units.

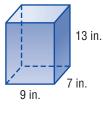
1.11

2) Find the surface area of the rectangular prism.

Replace ℓ , with 9, w with 7, and h with 13.

surface area = $2\ell w + 2\ell h + 2wh$

 $= 2 \cdot 9 \cdot 7 + 2 \cdot 9 \cdot 13 + 2 \cdot 7 \cdot 13$



= 126 + 234 + 182 Multiply first. Then add.

= 542

The surface area of the prism is 542 square inches.

CHECK Your Progress

Find the surface area of each rectangular prism.



Real-World EXAMPLE

3 GIFTS Rafael is wrapping a gift. He places it in a box 8 inches long, 2 inches wide, and 11 inches high. If Rafael bought a roll of wrapping paper that is 1 foot wide and 2 feet long, did he buy enough paper to wrap the gift? Justify your answer.

STEP 1 Find the surface area of the package. Replace ℓ with 8, *w* with 2, and *h* with 11.

> surface area = $2\ell w + 2\ell h + 2wh$ = $2 \cdot 8 \cdot 2 + 2 \cdot 8 \cdot 11 + 2 \cdot 2 \cdot 11$ = 252 in^2

STUDY TIP

Consistent Units Since the surface area of the package is expressed in inches, convert the dimensions of the wrapping paper to inches so that all measurements are expressed using the same units. **STEP 2** Find the area of the wrapping paper.



area = 12 in. • 24 in. or 288 in^2

Since 288 > 252, Rafael bought enough wrapping paper.

CHECK Your Progress

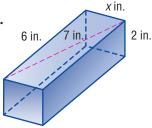
- c. **BOXES** The largest corrugated cardboard box ever constructed measured about 23 feet long, 9 feet high, and 8 feet wide. Would 950 square feet of paper be enough to cover the box? Justify your answer.
- d. **BOXES** If 1 foot was added to each dimension of the largest corrugated cardboard box, ever constructed, would 950 square feet of paper still be enough to cover the box? Justify your answer.

Personal Tutor at ca.gr6math.com

EXAMPLE Use the Pythagorean Theorem

4 Find the surface area of the rectangular prism.

The width and height of the prism are given. To find the surface area, you need to find the length of the prism. Notice that the diagonal, length, and width of the top face of the prism form a right triangle.





Square Roots The equation $13 = x^2$ has two solutions, 3.6 and -3.6. However, the length of the prism must be positive, so choose

the positive solution.

 $c^2 = a^2 + b^2$ Pythagorean Theorem $7^2 = 6^2 + x^2$ Replace c with 7, a with 6, and b with x. $49 = 36 + x^2$ Evaluate 7^2 and 6^2 . $49 - 36 = 36 + x^2 - 36$ Subtract 36 from each side. $13 = x^2$ Simplify. $\pm \sqrt{13} = x$ Definition of square root $\pm 3.6 \approx x$ Simplify.

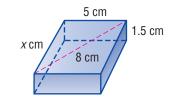
The length of the prism is about 3.6 inches. Find the surface area. surface area = $2\ell w + 2\ell h + 2wh$

= 2(3.6)(6) + 2(3.6)(2) + 2(6)(2) or 81.6

The surface area of the prism is about 81.6 square inches.

CHECK Your Progress

e. Find the surface area of the rectangular prism to the nearest tenth.



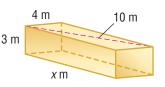
🛃 Your Understanding

Examples 1, 2 (pp. 649–650)

Find the surface area of each rectangular prism. Round to the nearest tenth
 if necessary.



- Example 3 (p. 650)3. PAINTING Lars built a toy box 5 feet long, 2 feet wide, and 2 feet high. If he has 1 quart of paint that covers about 87 square feet, does he have enough to paint the toy box twice? Justify your answer.
- Example 4 (p. 651)4. MEASUREMENT Find the surface area of the rectangular prism at the right. Round to the nearest tenth if necessary.

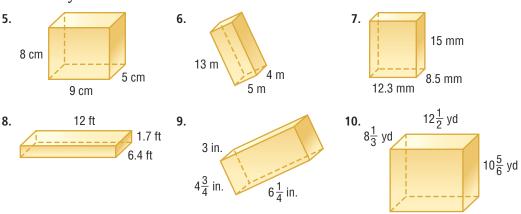


8.2 cm

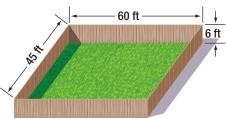
Exercises

HOMEWORKHELP		
For Exercises	See Examples	
5-10	1, 2	
11-12	3	
13–14	4	

Find the surface area of each rectangular prism. Round to the nearest tenth if necessary.



- 11. **BOOKS** When making a book cover, Anwar adds an additional 20 square inches to the surface area to allow for overlap. How many square inches of paper will Anwar use to make a book cover for a book 11 inches long, 8 inches wide, and 1 inch high?
- 12. FENCES If one gallon of paint covers 350 square feet, will 8 gallons of paint be enough to paint the inside and outside of the fence shown once? Explain.

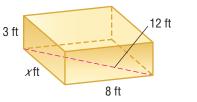


Find the surface area of each rectangular prism. Round to the nearest tenth if necessary.

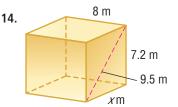


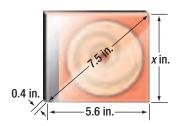


Real-World Link The recording industry in California employs over 27,000 people and adds billions of dollars annually to the California economy. **Source:** California Music Coalition



- **15. MUSIC** To the nearest tenth, find the approximate amount of plastic covering the outside of the CD case.
- **16. MEASUREMENT** What is the surface area of a rectangular prism that has a length of 6.5 centimeters, a width of 2.8 centimeters, and a height of 9.7 centimeters?





- **17. ALGEBRA** Write a formula for the surface area *s* of a cube in which each side measures *x* units.
- **18. PACKAGING** A company needs to make a trial size cereal box that holds 100 cubic centimeters of cereal. If cardboard costs \$0.05 per 100 square centimeters, how much would it cost to make 100 boxes?

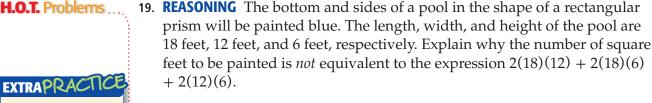
H.O.T. Problems

See pages 714, 726.

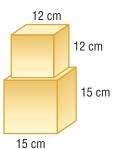
Math Mille

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- 20. CHALLENGE The figure at the right is made by placing a cube with 12-centimeter sides on top of another cube with 15-centimeter sides. Find the surface area.
- 21. **WRITING IN MATH** Explain why surface area of a three-dimensional figure is measured in square units rather than in cubic units.



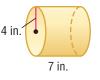
STANDARDS PRACTICE

- **22**. Which of the following expressions represents the surface area of a cube with side length *w*?
 - $\mathbf{A} w^3$
 - **B** $6w^2$
 - C $6w^3$
 - **D** $2w + 4w^2$

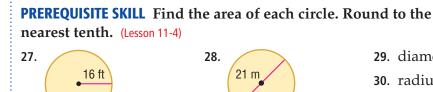
- 23. How much cardboard is needed to make a box with a length of 2.5 feet, a width of 1.6 feet, and a height of 2 feet?
 - **F** 37.5 square feet
 - **G** 24.4 square feet
 - H 8 square feet
 - J 6.1 square feet



- 24. **MEASUREMENT** A rectangular-shaped yard that measures 50 feet by 70 feet is bordered by a flowerbed that is 2 feet wide. What is the perimeter of the entire yard? Use the make a model strategy. (Lesson 12-3)
- **25. MEASUREMENT** What is the missing measure of a right triangle in which a = 13 feet and c = 18 feet? Round to the nearest tenth. (Lesson 12-2)
- **26. MEASUREMENT** What is the volume of the cylinder shown at the right? Round to the nearest tenth. (Lesson 11-10)



GET READY for the Next Lesson



- **29**. diameter = 13.6 yd
- **30**. radius = 23 km

Measurement Lab Changes in Volume and Surface Area

Main IDEA

Investigate changes in volume and surface area.

Extend

12-4



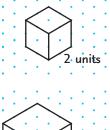
Preparation for Standard 7MG2.4 Relate the changes

in measurement with a change of scale to the units used (e.g., square inches, cubic feet) and to conversions between units (1 square foot = 144 square inches or [1 ft²] = [144 in²], 1 cubic inch is approximately 16.38 cubic centimeters or [1 in³] = [16.38 cm³]). Standard 6MR2.4 Use a

variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning. Suppose you have a model of a rectangular prism and you are asked to create a similar model whose dimensions are twice as large. In this lab, you will investigate how changing the dimensions of a threedimensional figure affects the surface area and volume.

ACTIVITY

- Draw a cube on dot paper that measures 1 unit on each side. Calculate the volume and the surface area of the cube. Then record the data in a table like the one shown below.
- Double the side lengths of the cube. Calculate the volume and the surface area of this cube. Record the data in your table.
- Triple the side lengths of the original cube. Now each side measures 3 units long. Calculate the volume and the surface area of the cube and record the data.



3 units

For each cube, write a ratio comparing the side length and the volume. Then write a ratio comparing the side length and the surface area. The first one is done for you.

Side Length (units)	Volume (units ³)	Surface Area (units²)	Ratio of Side Length to Volume	Ratio of Side Length to Surface Area
1	$1^3 = 1$	$6(1^2) = 6$	1:1	1:6
2				
3				
4				
5				
S				

a. Complete the table above.

CHECK Your Progress



- Draw a cube on dot paper that measures 8 units on each side. Calculate the volume and the surface area of the cube. Record the data in a table like the one shown below.
- Halve the side lengths of the cube in Step 1. Calculate the volume and the surface area of this cube and record the data.
- Halve the side lengths of the cube in Step 2. Calculate the volume and the surface area of the cube and record the data.
- For each cube, write a ratio comparing the side length and the volume and a ratio comparing the side length and the surface area. The first one is done for you.

Side Length (units)	Volume (units ³)	Surface Area (units²)	Ratio of Side Length to Volume	Ratio of Side Length to Surface Area
8	$8^3 = 512$	$6(8^2) = 384$	8:512 or 1:64	8:384 or 1:48
4				
2				
S				

CHECK Your Progress

b. Complete the table above.

ANALYZE THE RESULTS

- 1. Write a formula for the volume *V* of a cube with side length *s*.
- 2. Write a formula for the surface area *A* of a cube with side length *s*.

MAKE A CONJECTURE Complete each sentence.

- **3**. If the side length of a cube is doubled, the volume is **u** times greater.
- 4. If the side length of a cube is doubled, the surface area is times greater.
- 5. If the side length of a cube is tripled, the volume increases by times and the surface area increases by times.
- **6.** If the side length of a cube decreases by $\frac{1}{2}$, the surface area decreases by \blacksquare .

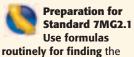


Ratios If you're looking for a pattern among ratios, it is sometimes helpful to reduce each ratio first.

Surface Area of Cylinders

Main IDEA

Find the surface area of a cylinder.



routinely for finding the perimeter and area of basic two-dimensional figures and the surface area and volume of basic three-dimensional figures, including rectangles, parallelograms, trapezoids, squares, triangles, circles, prisms, and cylinders.

MINI Lab

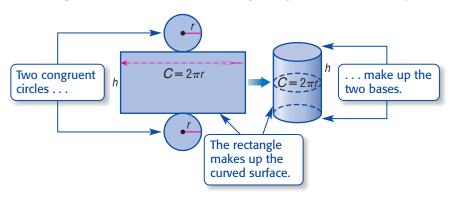
Trace the top and bottom of the can on grid paper. Then cut out the shapes.

Cut a long rectangle from the grid paper. The width of the rectangle should be the same as the height of the can. Wrap the rectangle around the side of the can. Cut off the excess paper so that the edges just meet.



- 1. Make a net of the cylinder.
- **2**. Name the shapes in the net.
- 3. How is the length of the rectangle related to the circles?
- 4. Explain how to find the surface area of the cylinder.

You can put two circles and a rectangle together to make a cylinder.



REVIEW Vocabulary

circumference the distance around a circle (Lesson 11-3)

In the diagram above, the length of the rectangle is the same as the circumference of the circle. Also, the width of the rectangle is the same as the height of the cylinder.

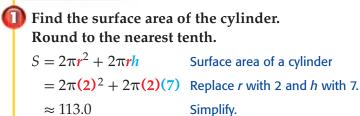
The surface area		the area of		the area of the
of a cylinder	equals	two bases	plus	curved surface.
Ś	=	$2(\pi r^2)$	+	$(2\pi r)h$

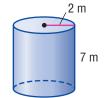
KEY C	ONCEPT	Surface Area of a Cylinder
Words Symbols	The surface area <i>S</i> of a cylinder with height <i>h</i> and radius <i>r</i> is the sum of the areas of the circular bases and the area of the curved surface. $S = 2\pi r^2 + 2\pi rh$	Model r h



Value of π Use 3.14 as the approximate value of π .

EXAMPLE Find the Surface Area of a Cylinder





The surface area is about 113.0 square meters.

CHECK Your Progress

a. Find the surface area of the cylinder. Round to the nearest tenth.

3 ft

9 ft

Real-World EXAMPLE

2 DESIGN A can of soup is 5 inches high, and its base has a diameter of 4 inches. How much paper is needed to make the label on the can?

Since the diameter is 4 inches, the radius is 2 inches. Only the curved side of the can has a label.

$S = 2\pi rh$	Curved surface of a cylinder
$=2\pi(2)(5)$	Replace <i>r</i> with 2 and <i>h</i> with 5.
≈ 62.8	Simplify.

So, about 62.8 square inches of paper is needed to make the label.

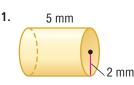
CHECK Your Progress

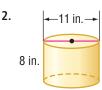
b. DESIGN Find the area of the label of a can of tuna with a radius of 5.1 centimeters and a height of 2.9 centimeters.

Personal Tutor at <u>ca.gr6math.com</u>

CHECK Your Understanding

Example 1 Find the surface area of each cylinder. Round to the nearest tenth.





Example 2 (p. 657)3. STORAGE The height of a water tank is 10 meters, and it has a diameter of 10 meters. What is the surface area of the tank?

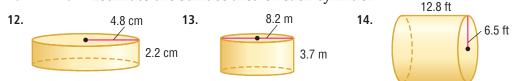
(p. 657)



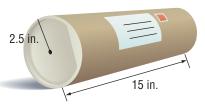
Exercises Find the surface area of each cylinder. Round to the nearest tenth. HOMEWORKHEL 4. 6 yd 5. 6. 3 ft 12.5 m For See Exercises Examples • 4–9 1 10 yd 2 10 - 119 m 18 ft 7. 8. 5 cm 9. 5.6 mm $11\frac{1}{2}$ in. 4 in. 6.2 cm

- **10. CANDLES** A cylindrical candle has a diameter of 4 inches and a height of 7 inches. What is the surface area of the candle?
- **11. PENCILS** Find the surface area of an unsharpened cylindrical pencil that has a radius of 0.5 centimeter and a height of 19 centimeters.

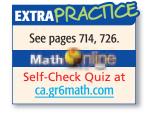
ESTIMATION Estimate the surface area of each cylinder



- **15. BAKING** Mrs. Jones baked a cake 5 inches high and 9 inches in diameter. If Mrs. Jones covers the top and sides of the cake with frosting, find the area that the frosting covers to the nearest tenth.
- **16. PACKAGING** The mail tube shown is made of cardboard and has plastic end caps. Approximately what percent of the surface area of the mail tube is cardboard?



- **17. CHALLENGE** If the height of a cylinder is doubled, will its surface area also double? Explain your reasoning.
- **18. WRITING IN MATH** Write a problem about a real-world situation in which you would find the surface area of a cylinder. Be sure to include the answer to your problem.
- **19. REASONING** Which has more surface area, a cylinder with radius 6 centimeters and height 3 centimeters or a cylinder with radius 3 centimeters and height 6 centimeters? Explain your reasoning.

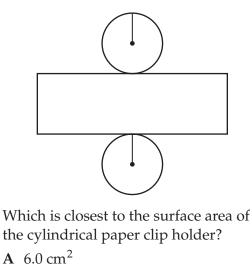


H.O.T. Problems ...

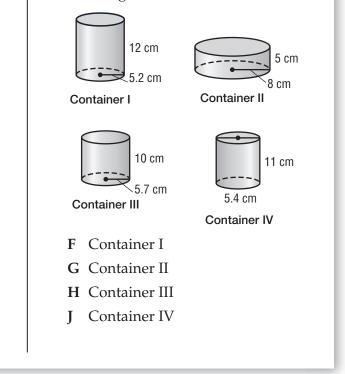
658 Chapter 12 Looking Ahead to Grade 7: Geometry and Measurement

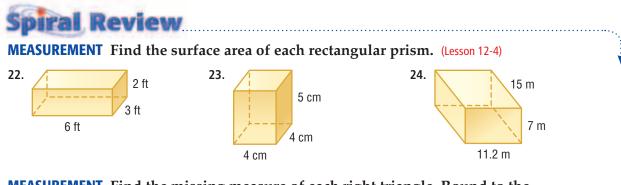
STANDARDS PRACTICE

20. Stacey has a cylindrical paper clip holder with the net shown. Use a centimeter ruler to measure the dimensions of the net in centimeters.



21. The three containers below each hold about 1 liter of liquid. Which container has the greatest surface area?





MEASUREMENT Find the missing measure of each right triangle. Round to the nearest tenth if necessary. (Lesson 12-2)

25. a = 8 in., b = 10 in. **26.** a = 12 ft, c = 20 ft **27.** b = 12 cm, c = 14 cm

Cross-Curricular Project

Math and History

B 6.5 cm^2

C 7.5 cm^2 **D** 15.5 cm^2

It's All Greek to Me It's time to complete your project. Use the information and data you have gathered about Pythagoras to prepare a Web page or poster. Be sure to include the three-dimensional solid you created with your project.

Math@nlipe Cross-Curricular Project at ca.gr6math.com

12 Study Guide and Review



Download Vocabulary Review from ca.gr6math.com

OLDA BLES

READY to Study

Be sure the following Key Concepts are noted in your Foldable.

Ch. 12	Rectangular Prisms	Cylinders
Deaw Examples		
Find Volume		
Find Sorface Area		

Key Concepts

Irrational Numbers (Lesson 12-1)

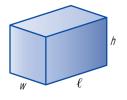
• An irrational number is a number that *cannot* be written as a fraction.

Pythagorean Theorem (Lesson 12-2)

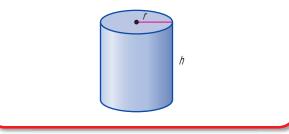
• In a right triangle, the square of the length of the hypotenuse equals the sum of the squares of the lengths of the legs.

Surface Area (Lessons 12-4, 12-5)

• The surface area *S* of a rectangular prism with length ℓ , width *w*, and height *h* is the sum of the areas of the faces. $S = 2\ell w + 2\ell h + 2wh$



• The surface area of *S* of a cylinder with height *h* and a radius *r* is the sum of the area of the circular bases and the area of the curved surface. $S = 2\pi r^2 + 2\pi rh$



Key Vocabulary

hypotenuse (p. 640) irrational number (p. 637) leg (p. 640) Pythagorean Theorem (p. 640) surface area (p. 648)

Vocabulary Check

State whether each sentence is *true* or *false*. If *false*, replace the underlined word or number to make a true sentence.

- 1. The side opposite the right angle in a <u>scalene triangle</u> is called a hypotenuse.
- 2. Either of the two sides that form the right angle of a right triangle is called a <u>hypotenuse</u>.
- **3.** An <u>irrational number</u> is a number that cannot be written as a fraction.
- 4. The Pythagorean Theorem states that in a right triangle, the square of the length of the hypotenuse equals the <u>difference</u> of the squares of the lengths of the legs.
- 5. The sum of the areas of all the surfaces of a three-dimensional figure is called the <u>surface area</u>.
- **6.** The formula for finding the surface area of a <u>cylinder</u> is $S = 2\ell w + 2\ell h + 2wh$.
- **7.** Rational numbers include <u>only positive</u> numbers.
- 8. The <u>Pythagorean Theorem</u> can be used to find length of the hypotenuse of a right triangle if the measures of both legs are known.
- **9.** To find the surface area of a <u>rectangular</u> <u>prism</u>, you must know the measurements of the height and the radius.
- **10**. The square root of a perfect square is a <u>rational number</u>.

Mixed Problem Solving For mixed problem-solving practice, see page 726.

Lesson-by-Lesson Review

12-1

Estimating Square Roots (pp. 636–639)

Estimate each square root to the nearest whole number.

11 . √6	12 . √99	13 . $\sqrt{48}$
14 . $\sqrt{76}$	15 . $\sqrt{19}$	16. $\sqrt{52}$

Estimate each square root to the nearest tenth.

17 . √61	18 . √132
19. $\sqrt{444}$	20. $\sqrt{12}$

21. SWIMMING POOL The bottom of Marcia's square swimming pool has an area of 118 square feet. What is the approximate length of one of the sides?

12-2

The Pythagorean Theorem (pp. 640–645)

Find the missing measure of each triangle. Round to the nearest tenth if necessary.



- **24.** a = 5 ft, b = 6 ft
- **25**. *b* = 10 yd, *c* = 12 yd
- **26**. a = 7 m, c = 15 m
- **27. COMMUNICATION** Find the length of the wire *x* that is attached to the telephone pole. Round to the nearest tenth.



28. LADDERS Bartolo has a 26-foot ladder. He places it 10-feet away from the base of a building. What is the height of the building where the top of ladder rests? **Example 1** Estimate $\sqrt{29}$ to the nearest whole number.

25 <	29 <	36	29 is between the perfect
			squares 25 and 36.
$\sqrt{25} < 1$	$\sqrt{29} < \gamma$	$\sqrt{36}$	Find the square root of
			each number.
5 < 7	$\sqrt{29} < $	6	$\sqrt{25} = 5$ and $\sqrt{36} = 6$

So, $\sqrt{29}$ is between 5 and 6. Since 29 is closer to 25 than to 36, the best whole number estimate is 5.

Example 2 Find the missing measure of the triangle shown at the right. Round to the nearest tenth if necessary.



Use the Pythagorean Theorem to solve for *c*.

c^2	=	$a^2 + b^2$	Pythagorean Theorem
c^2	=	$4^2 + 12^2$	a = 4 and $b = 12$
c^2	=	16 + 144	Evaluate.
c^2	=	160	Add.
С	=	$\pm\sqrt{160}$	Definition of square root
С	\approx	±12.6	Simplify.

Since length cannot be negative, the length of the hypotenuse is about 12.6 centimeters.





PSI: Make a Model (pp. 646–647)

Solve the problem by using the *make a model* strategy.

- 29. **FRAMING** A painting 15 inches by 25 inches is bordered by a mat that is 3 inches wide. The frame around the mat is 2 inches wide. Find the area of the picture with the frame and mat.
- **30. DVDS** A video store arranges its bestselling DVDs in their front window. In how many different ways can five bestseller DVDs be arranged in a row?

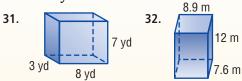
Example 3 The bottom layer of a display of soup cans has 6 cans in it. If there is one less can in each layer above it and there are 4 layers in the display, how many cans are there in the display?



So, based on the model there are 18 cans.

12-4 Surface Area of Rectangular Prisms (pp. 649–653)

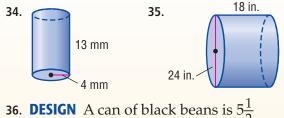
Find the surface area of each rectangular prism. Round to the nearest tenth if necessary.



33. MOVING A large wardrobe box is 2.25 feet long, 2 feet wide, and 4 feet tall. How much cardboard is needed to make the box?

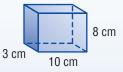
12-5 Surface Area of Cylinders (pp. 656–659)

Find the surface area of each cylinder. Round to the nearest tenth.



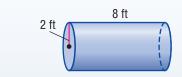
inches high, and its base has a radius of 2 inches. How much paper is needed to make the label on the can?

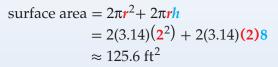
Example 4 Find the surface area of a rectangular prism.



surface area = $2\ell w + 2\ell h + 2wh$ = 2(10)(3) + 2(10)(8) + 2(3)(8)= 268 The surface area is 268 square centimeters.

Example 5 Find the surface area of the cylinder. Round to the nearest tenth.





The surface area is about 125.6 square feet.

Practice Test

Estimate each square root to the nearest whole number.

1. $\sqrt{500}$ **2.** $\sqrt{95}$ **3.** $\sqrt{265}$

Estimate each square root to the nearest tenth.

4. $\sqrt{570}$ **5.** $\sqrt{7}$ **6.** $\sqrt{84}$

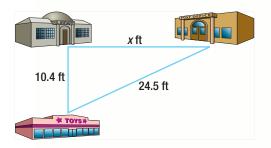
- 7. **STANDARDS PRACTICE** The length of one side of a square sandbox is 7 feet. Which number is closest to the length of the diagonal of the sandbox?
 - A $\sqrt{100}$

CHAPTER

- **B** $\sqrt{50}$
- $C \sqrt{14}$
- $D \sqrt{7}$

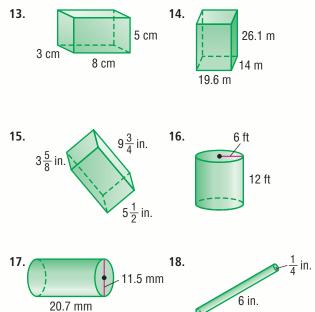
Find the missing measure of each right triangle. Round to the nearest tenth if necessary.

- 8. a = 5 m, b = 4 m
- 9. b = 12 in., c = 14 in.
- **10.** a = 7 in., c = 13 in.
- **11. MEASUREMENT** Use the diagram below to find the distance from the library to the post office. Round to the nearest tenth.

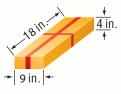


12. **CHAIRS** Chris is responsible for arranging the chairs at the meeting. There are 72 chairs, and he wants to have twice as many chairs in each row as he has in each column. How many chairs should he put in each row? How many rows does he need?

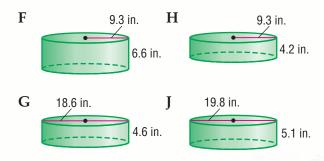
Find the surface area of each rectangular prism and cylinder. Round to the nearest tenth if necessary.



19. PACKAGING Mrs. Rodriguez is wrapping a gift. What is the least amount of wrapping paper she will need to wrap the box below?



20. **STANDARDS PRACTICE** The dimensions of four containers are given below. Which container has the greatest surface area?



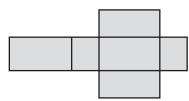
CHAPTER 12

California Standards Practice Cumulative, Chapters 1–12

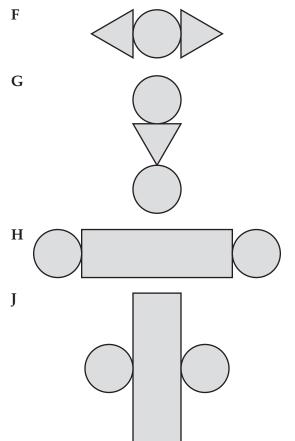


Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.

1 Which of the following three-dimensional figures could be formed from this net?



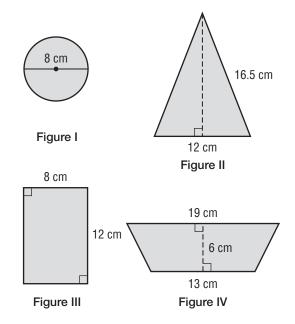
- A Cube
- **B** Rectangular pyramid
- C Triangular prism
- D Rectangular prism
- 2 Which of the following nets could be used to make a cylinder?



3 Carla has an above-ground swimming pool with a circumference of 20 feet. Which of the following equations could be used to find *r*, the radius of the pool?

A
$$r = \frac{10}{\pi}$$
 C $r = \frac{10}{2\pi}$
B $r = \frac{40}{\pi}$ **D** $r = \frac{\pi}{20}$

4 Of the following figures that Ryan drew, which 2 figures have the same area?



- **F** Figure I and II
- **G** Figure II and III
- H Figure II and IV
- J Figure III and IV
- **5** Cassandra drew a circle with a radius of 12 inches and another circle with a radius of 8 inches. What is the approximate difference between the areas of the 2 circles? Use $\pi = 3.14$.

A	452.16 in ²	C 50.24 in ²
B	251.2 in ²	D 25.12 in ²

More California Standards Practice For practice by standard, see pages CA1–CA39.

6 Which equation could be used to find the area of a circle with a radius of 10 centimeters?

$$\mathbf{F} \quad A = 5 \times \pi$$

G
$$A = \pi \times 5^2$$

$$\mathbf{H} \ A = 10 \times \pi$$

$$\mathbf{J} \quad A = \pi \times 10^2$$

- 7 Dave can run 30 yards in 8.2 seconds.During a race, he ran 120 yards. If Dave's rate of speed remained the same, how long did it take him to run the race?
 - A 43 seconds C 24.6 seconds
 - **B** 32.8 seconds **D** 18.4 seconds
- 8 Which of the following equations gives the surface area *S* of a cube with side length *m*?
 - $\mathbf{F} \quad S = m^3$
 - $\mathbf{G} \ S = 6m^2$
 - **H** S = 6m
 - J $S = 2m + 4m^2$

TEST-TAKING TIP

Question 9 Be sure to read each question carefully. In question 9, you are asked to find which statement is *not* true.

- **9** Which statement is *not* true about an equilateral triangle?
 - A The sum of the angles is 180° .
 - **B** It has three congruent angles.
 - C It has one right angle.
 - **D** It has exactly three congruent sides.

NEED EXTRA HELP?

10 Bill's Electronics bought 5 computers for a total of \$3,000. The business later bought another computer for \$600. What was the mean price of all the computers?

F	\$600.00	Η	\$3,600.00
G	\$3,200.00	J	\$6,100.00

11 A jar contains 9 yellow marbles and 1 red marble. Ten students will each randomly select one marble to determine who goes first in a game. Whoever picks the red marble goes first. Lily will pick first and keep the marble that she picks. Heath will pick second. What is the probability that Lily will pick a yellow marble and Heath will pick the red marble?

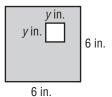
A
$$\frac{9}{10}$$
 C $\frac{1}{9}$

 B $\frac{4}{5}$
 D $\frac{1}{10}$

Pre-AP

Record your answers on a sheet of paper. Show your work.

12 A square with a side of *y* inches is inside a square with a side of 6 inches, as shown below.



- a. Write an expression that can be used to find the area of the shaded region in terms of *y*.
- b. If the dimensions of both squares are doubled, write an expression that could be used to find the area of the new shaded region.

If You Missed Question	1	2	3	4	5	6	7	8	9	10	11	12
Go to Lesson	11-8	11-8	11-3	11-2	11-4	11-4	6-5	12-4	10-3	8-2	9-8	11-1
For Help with Standard	MR2.4	MR2.4	AF3.1	AF3.1	MR1.2	MG1.2	NS1.3	AF3.2	SDAP3.1	SDAP1.1	SDAP3.5	AF3.1

Math California Standards Practice at ca.gr6math.com

Standards Review

Throughout the school year, you may be required to take several tests, and you may have many questions about them. Here are some answers to help you get ready.

How Should I Study?

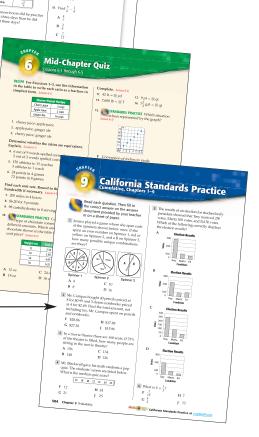
The good news is that you've been studying all along—a little bit every day. Here are some of the ways your textbook has been preparing you.

- Every Day Each lesson had practice questions that cover the California Standards.
- Every Week The Mid-Chapter Quiz and Practice Test had several practice questions.
- Every Month The California Standards Practice pages at the end of each chapter had even more questions similar to those on tests.

Are there Other Ways to Review?

Absolutely! The following pages contain even more practice for each California Standard.

Tips for Success	CA1
Multiple-Choice Questions	CA2
Practice by Standard CA4–C	CA39



Tips _{for} SUCCESS

Prepare

- Go to bed early the night before the test. You will think more clearly after a good night's rest.
- Become familiar with common formulas and when they should be used.
- Think positively.

During the Test

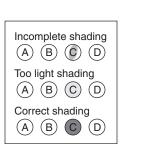
- Read each problem carefully. Underline key words and think about different ways to solve the problem.
- Watch for key words like *not*. Also look for order words like *least, greatest, first,* and *last*.
- Answer questions you are sure about first. If you do not know the answer to a question, skip it and go back to that question later.
- Check your answer to make sure it is reasonable.
- Make sure that the number of the question on the answer sheet matches the number of the question on which you are working in your test booklet.

Whatever you do...

- Don't try to do it all in your head. If no figure is provided, draw one.
- Don't rush. Try to work at a steady pace.
- Don't give up. Some problems may seem hard to you, but you may be able to figure out what to do if you read each question carefully or try another strategy.



RELAX! Just do your best.



Multiple-Choice Questions

In multiple-choice questions, you are asked to choose the best answer from four possible answers. To record a multiple-choice answer, you will be asked to shade in a bubble that is a circle. Always make sure that your shading is dark enough and completely covers the bubble.

STANDARDS EXAMPLE

Mrs. Hon's sixth grade students are purchasing stuffed animals to donate to a charity. They bought 3 boxes containing eight animals each and 5 boxes containing twelve animals each. Which expression *cannot* be used to find the total number of animals they bought to give to the charity?

Notice that the problem asks for the expression that *cannot* represent the situation. A 8 + 8 + 8 + 12 + 12 + 12 + 12 + 12B $3 \times 8 + 5 \times 12$ C 3(8) + 5(12)

D $8 \times (8 + 12)$

Read the problem carefully and locate the important information. There are 3 boxes that have eight animals, so that is 3×8 , or 24 animals. There are 5 boxes of twelve animals, so that is 5×12 , or 60 animals. The total number of animals is 24 + 60, or 84.

You know from reading the problem that you are looking for the expression that *does not* simplify to 84. Simplify each expression to find the answer.

A 8 + 8 + 8 + 12 + 12 + 12 + 12 + 12 = (8 + 8 + 8) + (12 + 12 + 12 + 12 + 12) = 24 + 60 = 84B $3 \times 8 + 5 \times 12 = 24 + 60$ = 84C 3(8) + 5(12) = 24 + 60 = 84D $8 \times (8 + 12) = 8 \times 20$ = 160The only expression that *does not* simplify to 84 is D.

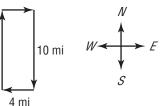
The correct choice is D.

STANDARDS EXAMPLE

On a hiking trip, Grace and Alicia traveled 10 miles south and 4 miles west as part of a rectangular hiking path. If they complete the path back to their starting point, how far will they have hiked?

F	14 mi	G 20 mi	H 28 mi	J 32 mi
---	-------	----------------	---------	---------

To solve this problem, you need to draw a diagram of the situation. Label the directions and the important information from the problem.



To find the total distance hiked, find the perimeter of the rectangle.

$P = 2\ell + 2w$	Perimeter of a rectangle
P = 2(10) + 2(4)	Replace ℓ with 10 and w with 4.
P = 20 + 8	Multiply.
P = 28	Add.

The total distance hiked will be 28 miles. The correct choice is H.

Some problems give more information than needed to solve the problem. Read the question carefully to determine the information you need.

STANDARDS EXAMPLE

One of the biggest pieces of cheese ever produced was made in 1866 in Ingersoll, Canada. It weighed 7,300 pounds. It was shaped as a cylinder with a diameter of 7 feet and a height of 3 feet. To the nearest cubic foot, what was the volume of the cheese? Use 3.14 for π.
 A 462 ft³
 B 143 ft³
 C 115 ft³
 D 63 ft³

You need to use the formula for the volume of a cylinder. The diameter is 7 feet, so the radius is $\frac{7}{2}$ or 3.5 feet. The height is 3 feet.

 $V = \pi r^2 h$ $V \approx (3.14)(3.5)^2(3)$ $V \approx 115.395$

Volume of a cylinder $5)^2(3)$ Replace π with 3.14, r with 3.5, and h with 3.Simplify.

The volume of the cheese is about 115 cubic feet. The correct choice is C.



Diagrams Draw a diagram for the situation. If you cannot write in the test booklet, draw a diagram on scratch paper.



Formulas Use the Mathematics Chart to find the correct formula.

Practice by Standard: Number Sense

Standard Set 1.0: Students compare and order positive and negative fractions, decimals, and mixed numbers. Students solve problems involving fractions, ratios, proportions and percentages.

DIRECTIONS

Choose the best answer.

QUICKPractice

- 1 Which list of numbers is ordered from *least* to *greatest*? (6NS1.1)
 - **A** 0.8, $\frac{1}{8}$, 1.8, $1\frac{1}{8}$
 - **B** $\frac{1}{8}$, 0.8, $1\frac{1}{8}$, 1.8
 - **C** 0.8, $\frac{1}{8}$, $1\frac{1}{8}$, 1.8
 - **D** $\frac{1}{8}$, 1.8, $1\frac{1}{8}$, 0.8
- 2 Korin and her family took a vacation over her summer break. The first day they drove 180 miles in 3 hours. What ratio represents their rate in miles per hour? (6NS1.2)
 - **F** 60:1
 - **H** 1:6
 - **G** 180:1
 - **J** 1:180

READING HINT A ratio is a comparison of two numbers by division.

For more help with ordering rational numbers,

You can answer this by first writing the ratio as a fraction. Then write the fraction in simplest form.

For more help with ratios, see page 282.

OlHCKReview

compare.

8

see page 215.

STRATEGY Think: Which answers can you eliminate because they are not reasonable?

Graph the numbers on a number line and

1.8

3 In 6 hours, Mr. Williams drove a total of 330 miles. If Mr. Williams drives at the same rate, which proportion could be solved to find *x*, the number of miles he could drive in 9 hours? (6NS1.3)

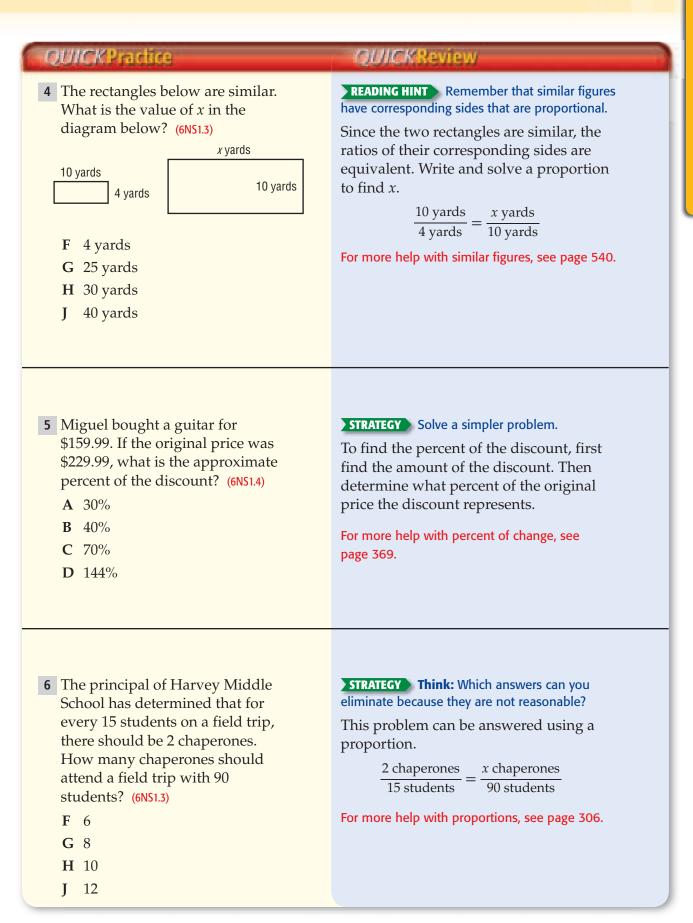
A
$$\frac{9}{330} = \frac{6}{x}$$

B $\frac{6}{9} = \frac{x}{330}$
C $\frac{6}{330} = \frac{x}{9}$
D $\frac{6}{330} = \frac{9}{x}$

STRATEGY Solve the proportion to see whether the answer makes sense.

First, write a ratio comparing the number of hours to miles when Mr. Williams drove 6 hours. Then write an equivalent ratio that compares the number of hours to miles for 9 hours.

For more help with proportions, see page 306.

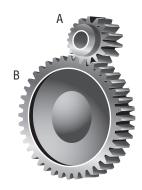


Practice on Your Own

7 During softball practice on Tuesday, Maya had 9 hits out of 24 at-bats. Which of the following ratios represents Maya's batting average? (6NS1.2)

 $\frac{3}{8}$ Α $\frac{1}{4}$ B

- $\frac{1}{2}$ С
- $\frac{2}{3}$ D
- 8 When gear B turns 3 revolutions, gear A turns 8 revolutions. When gear B turns 104 revolutions, how many revolutions does gear A turn? (6NS1.3)



- F 99
- **G** 62
- **H** 48
- I 39
- 9 Elyse and her grandmother went to a restaurant for dinner. Their bill came to \$48. They added a 20% tip. How much total did they spend on dinner? (6NS1.4)
 - A \$9.60
 - **B** \$38.40
 - C \$57.60
 - **D** \$68

Standard Set 1.0

- **10** Noah typed a 1,500 word essay in 24 minutes. At this rate, how long would it take him to type a 2,500 word essay? (6NS1.3)
 - F 35 minutes
 - **G** 40 minutes
 - H 48 minutes
 - 56 minutes I
- **11** Which point shows the location of $-2\frac{3}{4}$ on the number line? (6NS1.1)

$$-3$$
 A B_{-2} C D_{-1}

- A point A
- **B** point B
- C point C
- D point D
- 12 Selia wants to buy a sweater that costs \$58. The sales tax is 7.5%. About how much will she pay in sales tax? (6NS1.4)
 - \$62.35 F
 - **G** \$43.50
 - **H** \$4.35
 - \$6.35 L
- 13 Leticia ran 3 miles in 25 minutes. At this rate, which of the following proportions can be used to find *x*, the number of minutes it would take her to run 5 miles? (6NS1.3)

$$\mathbf{A} \quad \frac{3}{25} = \frac{x}{5}$$
$$\mathbf{B} \quad \frac{3}{5} = \frac{5}{5}$$

$$-\frac{25}{5}$$

$$25 - \overline{x}$$

D $\frac{25}{5} = \frac{3}{x}$

Practice by Standard: Number Sense

Standard Set 2.0: Students calculate and solve problems involving addition, subtraction, multiplication, and division.

DIRECTIONS

Choose the best answer.

QUICKPractice	OUICKReview
 1 What is the least common multiple of 3, 5, and 6? (6N52.4) A 15 B 18 C 30 D 35 	 READING HINT Recall that the least common multiple is the least of their common multiples, excluding zero. Make a list of the common multiples of 3, 5, and 6. Then choose the least multiple, excluding zero. For more help with the least common multiple, see page 211.

2 The Student Council is wrapping gifts for a fund-raiser. Each gift uses $1\frac{1}{4}$ feet of ribbon. How many gifts can be wrapped using the spool of ribbon below? (6N52.1)



 F
 2
 G
 8

 H
 6
 J
 12

STRATEGY Think: Which operation can be used to solve the problem?

If each gift uses $1\frac{1}{4}$ feet of ribbon, then the number of gifts that can be wrapped using a 10 foot length of ribbon can be found by dividing 10 by $1\frac{1}{4}$.

For more help with division of fractions, see page 265.

- **3** What is -13 + (-27)? (6NS2.3)
 - **A** 14
 - **B** 40
 - **C** −14
 - **D** -40

STRATEGY Use a number line to visualize the situation.

To add integers with the same sign, add their absolute values. The sum is negative if both integers are negative.

For more help with adding integers, see page 95.

OUICKPractice

- 4 At 7 A.M., the temperature was -5° F. By noon, the temperature had risen 18°F. What was the temperature at noon? (6N52.3)
 - **F** −23°F
 - **G** −13°F
 - **H** 13°F
 - J 23°F

OUICKReview

STRATEGY Use the information presented in the problem to write an addition expression.

To find the temperature at noon, add 18° F and -5° F. To add two integers with different signs, subtract their absolute values. The sum has the same sign as the integer with the larger absolute value.

For more help with adding integers, see page 95.

5	Wl	hat is	$\frac{15}{16} \times$	$\frac{16}{27}$?	(6NS2.1)
	A	$\frac{1}{11}$			
	B	$\frac{5}{9}$			
	C				
	D	$\frac{31}{43}$			

STRATEGY First, estimate. Then, eliminate unreasonable answers.

To multiply fractions, multiply the numerators and multiply the denominators. Be sure to simplify your answer. It may be helpful to simplify before multiplying, if possible.

For more help with multiplying fractions, see page 252.

6 The table shows Laura's golf scores, in number of strokes above or below par, for the first five holes of a game. What was her total golf score for the first five holes? (6NS2.3)

	Holes	Score
	1	0
	2	1
	3	-1
	4	-2
	5	3
-	-1	H 1
()	J 2

STRATEGY Use properties of addition to check your answer.

To find her total score for the first five holes, you need to find 0 + 1 + (-1) + (-2) + 3, or 1.

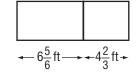
For more help with adding integers, see page 95.

F G

Standard Set 2.0

Practice on Your Own

- 7 Which answer choice best describes the meaning of $4 \div \frac{1}{2}$? (6N52.2)
 - A The number of fourths that are in 2 wholes.
 - **B** The number of halves that are in 4 wholes.
 - **C** The number of times 4 divides into 2.
 - **D** The number of times 4 divides into $\frac{1}{2}$.
- 8 What is -4 (-18)? (6NS2.3) F -14
 - **G** 14
 - H 22
 - J -22
- **9** What length of tablecloth will be needed to cover the two tables pictured below if they are put together as shown? (6NS2.4)



- A $2\frac{7}{9}$ feet
- **B** $10\frac{1}{2}$ feet
- C $10\frac{7}{9}$ feet
- **D** $11\frac{1}{2}$ feet
- The elevation of Hikers Peak is 708 feet and the elevation of Greene Lake is -22 feet. What is the difference between these elevations? (6NS2.3)
 - **F** 730 feet
 - **G** 686 feet
 - **H** −686 feet
 - J -730 feet

- **11** What is the greatest common divisor of 18, 45, and 54? (6N52.4)
 - **A** 3
 - **B** 6
 - **C** 9
 - **D** 18
- 12 The table shows the average daily temperatures in degrees Fahrenheit for the past five days for Snow Valley.

Day	Temperature (°F)
1	-7
2	4
3	10
4	-13
5	-9

What was the average temperature of Snow Valley for the past five days? (6N52.3)

$$F -15^{\circ}F$$
 $H 3^{\circ}F$
 $G -3^{\circ}F$
 $J 5^{\circ}F$

- **13** What is $\frac{1}{15} + \frac{4}{9}$? (6N52.4) **A** $\frac{1}{9}$ **C** $\frac{23}{45}$ **B** $\frac{5}{24}$ **D** $\frac{2}{3}$
- 14 The Traverse Valley Junior High football team lost 18 yards on the first play, gained 6 yards on the second play, and lost 9 yards on the third play. If they gained 14 yards on the fourth play, which of the following expressions can be used to represent the total amount of yards gained? (6NS2.3)

$$\mathbf{F} \quad (-18) + 6 + (-9) + 14$$

- **G** 18 + 6 + 9 + 14
- **H** (-18) 6 + (-9) 14
- J (-18) + 6 + 9 + (-14)

Practice by Standard: Algebra and Functions

Standard Set 1.0: Students write verbal expressions and sentences as algebraic expressions and equations; they evaluate algebraic expressions, solve simple linear equations, and graph and interpret their results.

DIRECTIONS

Choose the best answer.

OUIICKPractic

- 1 The total cost of a movie ticket t, soda s, and popcorn f is \$12.50. If the soda and popcorn together cost \$4.50, which algebraic equation can be used to find t, the cost of the movie ticket? (6AF1.1)
 - A \$12.50 t = \$4.50
 - **B** 2t + \$4.50 = \$12.50
 - C t + \$12.50 = \$4.50
 - **D** t \$4.50 = \$12.50

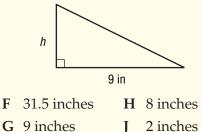
WIICKReview

READING HINT An equation is a sentence in mathematics that contains an equals sign.

The cost of the movie ticket plus the cost of the soda plus the cost of the popcorn is \$12.50. Thus, t + s + p = 12.50. The soda and the popcorn together cost \$4.50. Substitute this amount for s + p in the equation.

For more help with writing equations, see page 128.

2 The area of a triangle can be found using the equation $A = \frac{1}{2}bh$. What is the height *h* of the triangle pictured below if the area is 36 square inches? (6AF1.1)



READING HINT In the formula $A = \frac{1}{2}bh$, A is the area of the triangle, b is the base of the triangle, and h is the height of the triangle.

Replace *A* with 36 and *b* with 9 in the equation $A = \frac{1}{2}bh$. Then solve the equation for *h*.

For more help with solving multiplication equations, see page 142.

3 Which value of *n* makes the following equation true? (6AF1.1)

		n + 5.4 = 1	18.7
Α	24.1	C	13.3
B	-13.3	D	6.6

STRATEGY Think: Which answers can you eliminate because they are not reasonable?

To solve this addition equation, subtract 5.4 from each side of the equation.

For more help with solving addition equations, see page 136.

QUICKPractice

- 4 Which expression can be used to find the cost of buying *s* sweaters at \$35 each, *j* pairs of jeans at \$30 each, and *h* hats at \$12 each? (6AF1.2)
 - **F** 35 + 30 + 12 + s + j + h

G
$$35j + 30s + 12h$$

H 77
$$(j + s + h)$$

J
$$35s + 30j + 12h$$

QUICKReview

READING HINT An expression contains variables, numbers, and at least one operation.

To find the total cost of *s* sweaters, multiply *s* by the cost of each sweater, \$35. To find the total cost of *j* pairs of jeans, multiply *j* by the cost of each pair of jeans, \$30. To find the total cost of *h* hats, multiply *h* by the cost of each hat, \$12. Add these quantities.

For more help with writing expressions, see page 128.

5 The steps Gina took to evaluate the expression $5y + 5 \cdot 5$ when y = 2 are shown below.

 $5y + 5 \cdot 5$ when y = 2 $5 \cdot 2 = 10$ 10 + 5 = 15 $15 \cdot 5 = 75$

What should Gina have done differently in order to evaluate the expression? (6AF1.3)

- A multiplied (10 + 5) by $(10 \cdot 5)$
- **B** multiplied (10 + 5) by 2
- **C** added $(5 \cdot 5)$ to 10
- **D** added (5 5) to 15

6 Evaluate the expression below. (6AF1.4) $9 + 9 \div 3 + 3$

F 3 H 12	F	3	Н	12
------------------------	---	---	---	----

G 9 **J** 15

READING HINT To evaluate expressions, use the correct order of operations.

Recall that multiplication comes before addition in the order of operations. Gina should evaluate 5*y* when y = 2, which is 10, and multiply 5 • 5, which is 25. She then should find the sum of 10 and 25.

For more help with evaluating expressions, see page 38.

READING HINT To evaluate expressions, use the correct order of operations.

Recall that division comes before addition. Find $9 \div 3$ before adding in order from left to right.

For more help with evaluating expressions, see page 38.

Practice on Your Own

- 7 Félix has a cell phone plan that allows him to talk for 500 minutes each month. If he uses 75 minutes each day of his monthly cell phone minutes, which expression represents how many minutes he has left after *x* days? (6AF1.2)
 - **A** 500*x* − 75
 - **B** 500 75x
 - **C** 500*x*
 - **D** 500 + 75x
- 8 Which of the following algebraic equations best describes the total distance *D* traveled by a commercial jet airliner after *h* hours if the airliner travels 480 miles per hour? (6AF1.1)
 - **F** D = 480h
 - **G** D = 480 + h

H
$$D = \frac{480}{h}$$

- J D = 480 h
- **9** The table shows the price per pound of several kinds of produce.

Produce	Price (\$ per lb)
Peaches	2.79
Apples	1.89
Bananas	1.19
Apricots	3.19

Which of the following equations can Miranda use to find the number of pounds of bananas b she can buy with \$10 if she also buys 2 pounds of peaches? (6AF1.1)

- **A** \$10 \$1.19(2) = b
- **B** \$10 + b = \$2.79(2)

C
$$\$10 + 2b = \$2.79$$

$$\mathbf{D} \ \frac{\$10 - \$2.79(2)}{\$1.19} = k$$

Standard Set 1.0

- 10 Lauren earns \$8 per hour selling jewelry. How many hours does she need to work to earn \$68? (6AF1.1)
 - **F** 8 hours
 - G 8.5 hours
 - H 60 hours
 - J 544 hours
- **11** What value of *g* makes the following equation true? (6AF1.1)

$$g \div 6 = -2$$

- **D** 12
- 12 A movie ticket at Maximum Cinemas costs \$9 and a small drink costs \$1.50. Kayla reasoned that the cost of 4 movie tickets and four small drinks can be found using the expression 4(\$9 + \$1.50). Which property shows that this cost is also equivalent to 4 × \$9 + 4 × \$1.50, or \$42? (6AF1.3)
 - F Commutative Property of Addition
 - **G** Commutative Property of Multiplication
 - H Associative Property of Addition
 - J Distributive Property
- **13** What is the value of the expression $\frac{mn}{p}$ if m = 6, n = -7, and p = 2? (6AF1.2)
 - **A** −21
 - **B** $-\frac{1}{2}$
 - **C** 21
 - **D** 43

Practice by Standard: Algebra and Functions

Standard Set 2.0: Students analyze and use tables, graphs, and rules to solve problems involving rates and proportions.

DIRECTIONS

Choose the best answer.

QUICKPractice	QUICKReview
 1 A piece of string is 125 incher long. About how long is the in centimeters? (6AF2.1) A 3 centimeters B 49 centimeters C 321 centimeters D 4,875 centimeters 	
2 The cost of oranges at sever grocery stores is listed in the below. Which store has the unit cost for oranges? (6AF2.2 Store Cost Casey's Corner 5 oranges fr	e tableone unit, or in this case, the cost of one orange.leastFirst, find each unit cost for each grocery2)store. To do this, simplify each ratio ofnumber of oranges to dollar amount ofcost. Then compare the unit costs to

Store	Cost	
Casey's Corner	5 oranges for \$3	
Mark's Market	4 oranges for \$2	
Geraldine's Grocery	8 oranges for \$5	

- F Casey's Corner
- G Mark's Market
- H Geraldine's Grocery
- J All three stores have the same unit cost for oranges.

3 Jordan drives at a rate of 70 miles per hour on the interstate. At this speed, how long will it take him to drive 280 miles? (6AF2.3)

D 5 hours

- A 3 hours C 4.5 hours
- **B** 4 hours

STRATEGY Use the equation d = rt, where d represents the distance, r represents the rate of travel, and t represents the time.

determine which grocery store has the

For more help with unit rates, see page 287.

least unit cost.

Solve the equation 280 = 70t to find the time *t* it will take Jordan to drive 280 miles.

For more help with problems involving average speed, distance, and time, see page 287.

OUICKPractice

4 The table below shows the average resting heart rate, in beats per minute, of selected mammals.

Mammal	Average Resting Heart Rate (beats per minute)
Gray Whale	9
Cow	50
Mouse	376

At this rate, how many times would the average cow's heart beat in the course of 12 minutes? (6AF2.2)

F	42 times	Η	600 times
G	450 times	J	800 times

OUICKReview

STRATEGY Think: Which answers can you eliminate because they are not reasonable?

You can multiply the unit rate $\frac{50 \text{ beats}}{1 \text{ minute}}$ by 12 minutes to find the number of times the average cow's heart will beat in the course of 12 minutes.

For more help with unit rates, see page 287.

- 5 Which ratio below shows a unit rate? (6AF2.2)
 - A $\frac{65 \text{ words}}{1 \text{ minute}}$

 - \$450 C <u>900</u> miles
 - 2 days 9 songs
 - $-\frac{1}{47 \text{ minutes}}$

READING HINT Recall that a unit rate is a measure of one quantity per unit value of another quantity.

The only ratio that compares a measure of one quantity per unit value of another quantity is the ratio in answer choice A.

For more help with unit rates, see page 287.

- 6 Yolanda drove 310 miles in 5 hours. At this rate, how many miles could she drive in 9 hours? (6AF2.2)
 - F 62 miles
 - G 172 miles
 - H 525 miles
 - J 558 miles

STRATEGY You can use unit rates, proportions, or equations to solve this problem.

You can simplify the ratio $\frac{310 \text{ miles}}{5 \text{ hours}}$ to find the number of miles Yolanda drove, on average, per hour. Then multiply this unit rate by 9 hours to find the number of miles she could drive in 9 hours.

For more help with unit rates, see page 287.

Standard Set 2.0

Practice on Your Own

7 Seki, Odell, and Brady took their bicycles on a week-long vacation. The table shows the total distances and length of time each person biked during the week.

Person	Disance	Time	
Seki	100 miles	5 hours	
Odell	143 miles	6.5 hours	
Brady	133 miles	7 hours	

Which person had the fastest average unit rate of travel? (6AF2.2)

- A Seki
- **B** Odell
- C Brady
- **D** Each biker had the same unit rate of travel.
- 8 In training for a half-marathon, Isabel ran 5.5 miles on Friday. About how many kilometers did she run on Friday? (1 mile ≈ 1.61 kilometers) (6AF2.1)
 - **F** 3.4 kilometers
 - G 3.9 kilometers
 - H 7.1 kilometers
 - J 8.9 kilometers
- **9** A certain river flows at a rate of 10,000 gallons of water every 20 minutes. Which of the following is true concerning the unit rate of flow of the river (in gallons per minute)? (6AF2.2)
 - A The unit rate of flow of the river is 500 gallons per minute.
 - **B** The unit rate of flow of the river is 500 minutes per gallon.
 - **C** The unit rate of flow of the river is 50 gallons per minute.
 - **D** The unit rate of flow of the river is 200,000 gallons per minute.

10 The table shows the prices of several beverages. Which beverage has the lowest unit price? (6AF2.2)

Beverage	Amount	Price
Soda	12 oz.	\$1.20
Juice	16 oz.	\$2.40
Bottled Water	20 oz.	\$1.60
Iced Tea	8 oz.	\$1.20

- F Soda
- **G** Juice
- H Bottled Water
- J Iced Tea
- Nick's Laundromat charges \$1.75 to wash and dry one load of laundry. If a customer spent \$7.00 doing laundry at Nick's Laundromat, how many loads of laundry did the customer wash and dry? (6AF2.2)

Α	3		C	5
B	4		D	6

- 12 Which rate listed below is the slowest? (6AF2.2)
 - F 132 miles in 2 hours
 - G 28 miles in 5 hours
 - H 180 miles in 10 hours
 - J 30 miles in 15 hours
- 13 Marla's car averages 22 miles per gallon of gasoline. At this rate, how many gallons of gasoline are needed for a 330 mile trip? (6AF2.3)
 - A 11 gallons
 - **B** 12 gallons
 - C 15 gallons
 - D 18 gallons

Practice by Standard: Algebra and Functions

Standard Set 3.0: Students investigate geometric patterns and describe them algebraically.

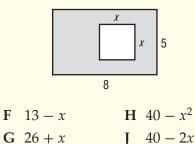
DIRECTIONS

Choose the best answer.

QUICKPractice	QUICKReview
1The rectangle shown below has length 27 centimeters and perimeter P centimeters.27 centimeters27 centimetersWhich equation could be used to find the width of the rectangle? (6AF3.1)A $P = 27 + \frac{w}{2}$ C $P = 54 + 2w$ B $P = 27 - w$ D $P = 54 + w$	READING HINT The perimeter of a rectangle is found by using the formula $P = 2\ell + 2w$. Replace ℓ with 27 in the equation $P = 2\ell + 2w$, since the length of the rectangle is 27 centimeters. For more help with the perimeter of a rectangle, see page 156.
 2 Which equation could be used to find the area in square yards of a circle with a diameter of 14 yards? (6AF3.2) F A = 14 × π H A = π × 11² G A = 28 × π J A = π × 7² 	READING HINT Use the correct units. The area of a circle is found by using the formula $A = \pi r^2$, but the problem gives you the diameter. Recall that the radius is half of the diameter. For more help with the area of a circle, see page 589
3 Which expression is equivalent to the area, in square units, of the triangle below? (6AF3.1) A $18y$ C $18 + y$ B $9y$ D $\frac{18}{y}$	STRATEGY The area of a triangle is found by using the formula $A = \frac{1}{2}bh$. Replace <i>b</i> with 18 in the expression $\frac{1}{2}bh$. Remember to simplify the expression. For more help with the area of a triangle, see page 578.

QUICKPractice

4 A square with side length *x* is inside a rectangle that measures 8 by 5, as pictured below. Which expression represents the area of the shaded region in terms of *x*? (6AF3.2)



QUICKReview

READING HINT Recall that the area of the rectangle is found by multiplying the length by the width.

Find the area of the rectangle. Write an expression for the area of the square. Then, write an expression that represents the area of the square subtracted from the area of the rectangle.

For more help with the area of a rectangle, see page 156.

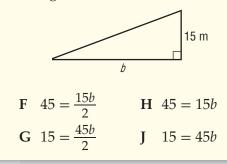
5 A circle has a circumference of 20 inches and a diameter of *d* inches. Which equation below could be used to find the diameter, in inches, of the circle? (6AF3.1)

A $d = 20 - \pi$ **C** $d = 20 \times \pi$ **B** $d = \frac{20}{\pi}$ **D** $d = \frac{\pi}{20}$ **READING HINT** The circumference of a circle is found by using the formula $C = \pi d$.

In the equation $C = \pi d$, replace *C* with 20. Then solve the equation for *d*.

For more help with the circumference of a circle, see page 584.

6 The triangle below has a height of 15 meters and an area of 45 square meters. Which equation below could be used to find the length of the base *b* of the triangle? (6AF3.2)



STRATEGY Notice that you do not need to solve the equation for *b*.

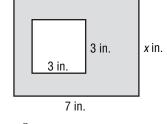
Replace *A* with 45 and *h* with 15 in the equation, $A = \frac{1}{2}bh$.

For more help with the area of a triangle, see page 578.

7 A clock has a radius of 5 inches. Which expression could be used to find the circumference of the clock? (6AF3.1)



- A 5π
- **B** 10π
- C 25π
- $D \frac{5}{\pi}$
- 8 Which equation could be used to find the area of a circle with a diameter of 6 centimeters? (6AF3.1)
 - **F** $A = 6^2 \times \pi$
 - **G** $A = 6 \times \pi$
 - **H** $A = 3^2 \times \pi$
 - $\mathbf{J} \quad A = 12 \times \pi$
- **9** The rectangle below has a length of 7 inches and a width of *x* inches. The square has side lengths of 3 inches. Which is an expression for the area of shaded region? (6AF3.2)



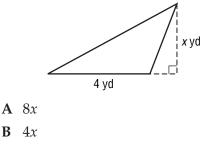
- **A** 7 + x + 9
- **B** 23 + 2x
- **C** 7x 9
- **D** 7x + 9

Standard Set 3.0

10 Bryn has a water wheel in her backyard. It has a diameter of *d* feet. Which expression can be used to find its circumference, *C*, in feet? (6AF3.1)



- **F** πd
- $G \frac{\pi d}{2}$
- H $2\pi d$
- J πd^2
- **11** Which of the following expressions represents the area in square yards of the triangle shown below? (6AF3.2)



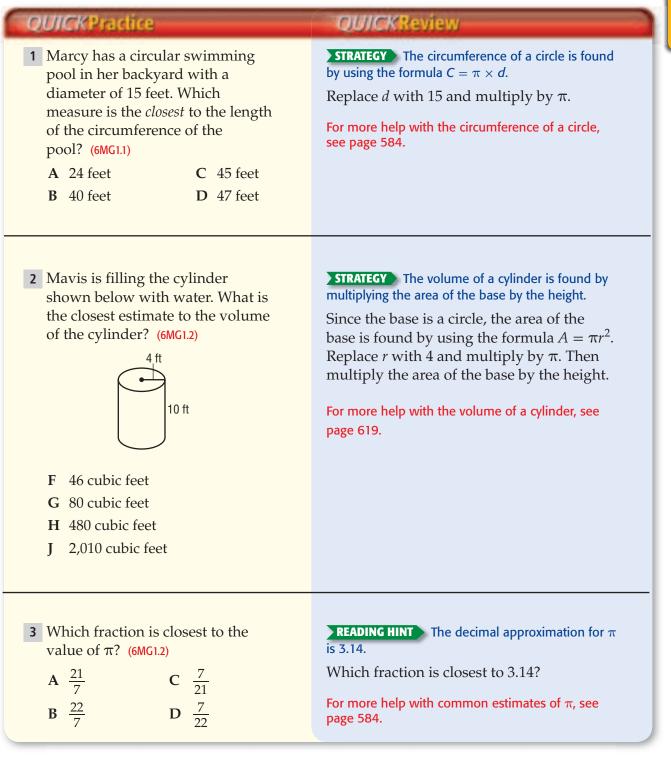
- C 2x
- **D** $4x^2$
- **12** Which of the following expressions gives the perimeter of a rectangle whose length is three times its width, *w*? (6AF3.2)
 - **F** 5w **H** 3+w
 - **G** 8w **J** $3w^2$

Practice by Standard: Measurement and Geometry

Standard Set 1.0: Students deepen their understanding of measurement of plane and solid shapes and use this understanding to solve problems.

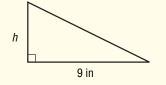
DIRECTIONS

Choose the best answer.

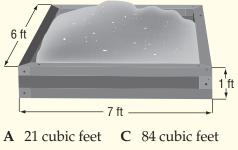


OUTOK Practice

4 Which of the following formulas would give the area of the circular tabletop shown? (6MG1.1)



- $\mathbf{F} \quad A = \pi \times d \\ \mathbf{G} \quad A = \pi \times r^2$
- **H** $A = \pi \times d^2$
- $\mathbf{I} \quad A = 2 \times \pi \times r$
- 5 Ariel is filling the sand box shown below with sand. What is the volume of the sand box? (6MG1.3)



B 42 cubic feet **D** 168 cubic feet

6 In the formula for the circumference of a circle, $C = \pi \times d$, which of the following represents a constant? (6MG1.1)

- F C only
- $G \pi$
- **H** d only
- J Both *C* and *d* are constants.

OUICKReview

STRATEGY It is helpful to memorize common formulas.

The area of a circle is found by using the formula $A = \pi r^2$.

For more help with the area of a circle, see page 589.

STRATEGY The sandbox is in the shape of a rectangular prism.

The volume of a rectangular prism is found by multiplying the area of the base by the height of the prism. Since the base is a rectangle, this is the same as multiplying the length by the width of the prism and then multiplying this product by the height of the prism.

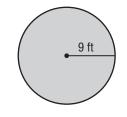
For more help with finding the volume of a rectangular prism, see page 613.

READING HINT A constant is a value that remains unchanged.

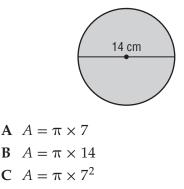
Both *C* and *d* are variables; they can represent the values for circumference and diameter, respectively. These values can change depending on the dimensions of the circle. The only value that remains unchanged is π .

For more help with the circumference of a circle, see page 584.

7 Which value below is the best estimate for the area of the circle shown below? (6MG1.2)



- A 28 square feet
- **B** 57 square feet
- C 254 square feet
- D 486 square feet
- 8 Which of the following statements is true concerning the formulas for the area and circumference of a circle? (6MG1.)
 - **F** The area of a circle is found by multiplying the radius by π .
 - **G** In both formulas, π is a constant.
 - **H** The circumference of a circle is found by multiplying the diameter by its radius.
 - J The circumference of a circle is found by multiplying the radius by π .
- 9 Which of the following formulas would give the area in square centimeters of the circle shown below? (6MG1.1)



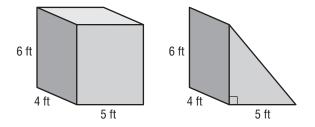
 $\mathbf{D} \ A = \pi \times 14^2$

Standard Set 1.0

- **10** Which of the following equations gives the circumference in meters of a circle with a diameter of 10 meters? (6MG1.)
 - $F \quad C = \pi \times 5$ $G \quad C = \pi \times 10$
 - **H** $C = \pi \times 5^2$

J
$$C = \pi \times 10^2$$

- 11 Which of the following expressions gives the area in square centimeters of a circle with a radius of 2 centimeters? (6MG1.2)
 - A 4π
 - **B** 2π
 - C 8π
 - **D** 12π
- **12** How do the volumes of the two prisms below compare? (6MG1.3)



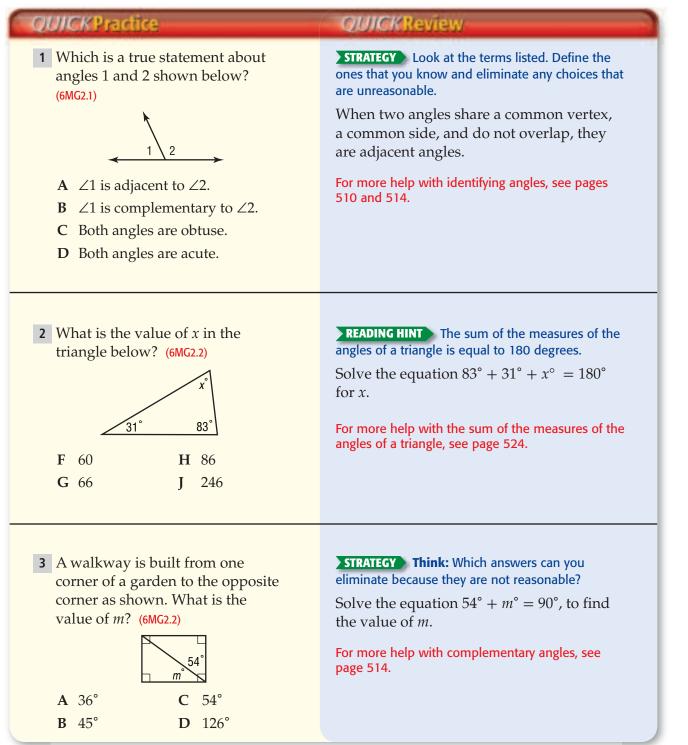
- **F** The rectangular prism has a volume that is 4 times the volume of the triangular prism.
- **G** The rectangular prism has a volume that is 2 times the volume of the triangular prism.
- **H** The rectangular prism has a volume that is $\frac{1}{2}$ times the volume of the triangular prism.
- J The rectangular prism has a volume that is $\frac{1}{4}$ times the volume of the triangular prism.

Practice by Standard: Measurement and Geometry

Standard Set 2.0: Students identify and describe the properties of two-dimensional figures.

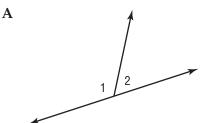
DIRECTIONS

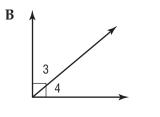
Choose the best answer.

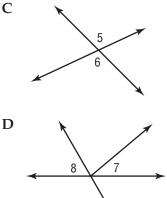


QUICKPractice	QUICKReview
 4 Which drawing below is a right isosceles triangle? (6MG2.3) F G G H J 	READING HINT An isosceles triangle has at least two congruent sides, and a right triangle has one right angle. The only triangle shown that has at least two congruent sides and one right angle is the triangle shown in answer choice G. For more help with classifying triangles, see page 524.
5 Angles <i>R</i> and <i>S</i> are supplementary. If $m \angle R = 68^\circ$, what is $m \angle S$? (6MG2.2) A 22° C 112° B 32° D 292°	READING HINT Two angles are supplementary if the sum of their measures is equal to 180 degrees. Solve the equation $68^\circ + m\angle S = 180^\circ$ for $m\angle S$. For more help with the supplementary angles, see page 514.
6 In the figure below \overrightarrow{AD} intersects \overrightarrow{BE} at $F, m \angle AFB = 70^\circ$, and $\angle CFD$ $\cong \angle EFD$. What is $m \angle BFC$? (6MG2.2) $\overrightarrow{A} \qquad \overrightarrow{F} \qquad \overrightarrow{D}$ F 170° H 110° G 140° J 40°	READING HINT congruent to.The symbol \cong means is congruent to.You know $m \angle AFB = 70^{\circ}$. Use the fact that vertical angles are congruent to find $m \angle EFD$.Since $\angle CFD \cong \angle EFD$, they have the same measure, 70° . Use the fact that $m \angle AFB +$ $m \angle BFC + m \angle CFD = 180^{\circ}$ to find $m \angle BFC$ given that you know $m \angle AFB = m \angle CFD$ $= 70^{\circ}$.For more help with finding an unknown angle, see page 514.

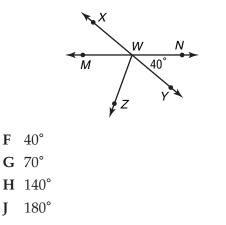
7 Which pair of angles below are supplementary? (6MG2.1)





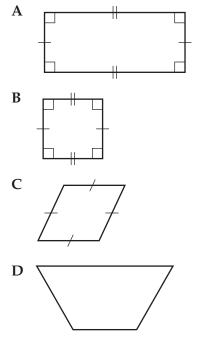


8 In the figure below \overrightarrow{MN} intersects \overrightarrow{XY} at W, $m \angle YWN = 40^\circ$, and $\angle ZWY \cong \angle MWZ$. What is $m \angle ZWY$? (6MG2.2)



Standard Set 2.0

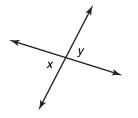
9 Which drawing below is a parallelogram with 4 congruent sides and no right angles? (6MG2.3)



10 Angles *XYZ* and *RST* are complementary. If $m \angle XYZ = 34^\circ$, what is the measure of angle RST? (6MG2.2)

F	146°	Η	32°
G	56°	J	23°

11 Corey drew two angles, *x* and *y*, as shown below. What must be the relationship between these two angles? (6MG2.1)



- **A** $\angle x$ and $\angle y$ are complementary.
- **B** $\angle x$ and $\angle y$ are supplementary.
- **C** $\angle x$ and $\angle y$ are are vertical angles.
- **D** $\angle x$ and $\angle y$ are are adjacent angles.

I

Practice by Standard: Statistics, Data Analysis, and Probability

Standard Set 1.0: Students compute and analyze statistical measurements for data sets.

DIRECTIONS

Choose the best answer.

OUICKPractice

1 The table shows the number of pages that Theo read each day for a week. What is the mean number of pages that he read? (6SDAP1.1)

	Day	Pages Read		
	Monday	7		
	Tuesday	12		
	Wednesday	12		
	Thursday	6		
	Friday	5		
	Saturday	10		
	Sunday	4		
A	6	C 8		
B	7	D 12		
B	7	D 12		

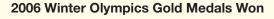
OU/CKReview

READING HINT The mean of a set of data is the sum of the data divided by the number of items in the data set.

To find the mean, first find the sum of the data. Then divide the sum by 7, the number of items in the data set.

For more help with finding the mean, see page 402.

2 The line plot shows the number of gold medals won by each country participating in the 2006 Winter Olympic games. What is the mode of this data? (6SDAP1.1)



 READING HINT The mode of a set of data is the number or numbers that occur most often.

Look for the number that occurs most often. On the line plot, the value 0 occurs most often.

For more help with finding the mode, see page 402.

OUICKPractice

3 The following table shows the scores that students received on Mr. Hill's science quiz.

Quiz Scores										
	10	6	9	5	10	9	7	8	3	8

How would the range of the above data set change if a score of 2 was added? (6SDAP1.2)

- **A** The range would increase.
- **B** The range would decrease.
- **C** The range would stay the same.
- **D** There is not enough information.

OUICKReview

READING HINT The range of a data set is the difference between the greatest and least values in the data set.

Since 2 is lower than the lowest value of the original data set, the range would increase.

range of original data set : 10 - 3, or 7

range when a score of 2 is added: 10 - 2, or 8

Since 8 > 7, the range would increase.

For more help with understanding how additional data values affect the range, see page 396.

4 In the data set below, how would the median be affected if the outlier was excluded? (6SDAP1.3)

1, 14, 16, 18, 13, 11, 15, 16

- **F** The median would increase.
- **G** The median would decrease.
- H The median would stay the same.
- J There is not enough information.

READING HINT Outliers are data points that are quite separated from the rest of the data points.

First, find the median of the original data set by writing the numbers in order from least to greatest and finding the middle number. Then repeat this process with the outlier, 1, excluded from the data set. Compare the two medians.

For more help with understanding how the exclusion of outliers affect the median, see page 410.

- Luisa has scores of 85, 78, 95, and 100 on four of her math tests. How would a score of 65 on her fifth test affect the mean of her previous test average? (6SDAP1.2)
 - A The mean would increase.
 - **B** The mean would decrease.
 - **C** The mean would stay the same.
 - **D** There is not enough information.

READING HINT You are not asked to find the mean. It is not necessary to perform any calculations to solve this problem.

Since a score of 65 is lower than any of her first four test scores, the mean would decrease.

For more help with understanding how additional data values affect the mean, see page 402.

Standard Set 1.0

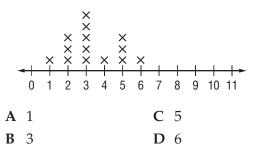
Practice on Your Own

- 6 Lizzie recorded the number of T-shirts that her boutique sold each day for 10 days. What is the median of the data set? (6SDAP1.1)
 - 6, 7, 20, 16, 10, 25, 14, 18, 2, 24

F	14.2	Η	16
G	15	J	There is no median.

7 What is the mode of the data set below? (6SDAP1.1)

Number Of TVs per Household



8 Chet's batting averages are 0.287, 0.216, 0.167, 0.287, and 0.325.

If an average of 0.344 is added to this list, then which of the following is true? (6SDAP1.2)

- **F** The mean would increase.
- G The mean would decrease.
- H The median would decrease.
- J The mode would increase.
- 9 How would the mode of the data set below be affected if the outlier was removed? (6SDAP1.3)

High Temperatures (°F)						
85	84	85	78	74	85	
74	82	84	85	101	80	

- A The mode would increase.
- **B** The mode would decrease.
- **C** The mode would remain unchanged.
- **D** There is not enough information.

10 Hector priced the cost of a movie ticket at five theaters in his hometown. How does the outlier affect the mean of the data set? (6SDAP1.3)

Movie Ticket Prices				
\$8.50	\$7.50	\$1.00	\$8.25	\$8.00

- **F** The mean would be less if the outlier was excluded.
- **G** The mean would be greater if the outlier was excluded.
- H The mean would remain unchanged if the outlier was excluded.
- J There is not enough information.
- 11 The hourly wages of several employees at a department store are listed below.
 Suppose the wages \$7.50, \$8.75, and \$12.00 are added to this set. How does the additional data affect the median of the new data set? (6SDAP1.2)

Department Store Wages				
\$8.25 \$10.00 \$15.25 \$18.75 \$9.25				
\$9.00	\$9.50	\$9.50	\$10.25	\$11.25

- A The median would increase.
- **B** The median would decrease.
- **C** The median would stay the same.
- **D** There is not enough information.
- **12** Julian priced eight DVDs. The prices are shown below.

DVD Prices							
\$20 \$20 \$23 \$24 \$21 \$26 \$22 \$23							\$23

What is the range of these prices? (6SDAP1.1)

F	26
G	20
Η	6
I	4

Practice by Standard: Statistics, Data Analysis, and Probability

Standard Set 2.0: Students use data samples of a population and describe the characteristics and limitations of samples.

DIRECTIONS

Choose the best answer.

QUICKPractice	QUICKReview
 The student council wants to determine the student body's favorite sport. They decide to survey the basketball team. What type of sampling is this? (6SDAP2.2) A random sampling B convenience sampling C voluntary response sampling D none of the above 	 READING HINT Convenience sampling can occur when sampling is not taken randomly. The survey is a convenience sample since it includes members of a population that are easily accessed; i.e., the members of the basketball team. For more help with types of sampling, see page 438.

2 The table shows the income made by Rollie's Music in one week.

Day of The Week	Income
Monday	\$525
Tuesday	\$850
Wednesday	\$325
Thursday	\$380
Friday	\$975

Which statement is valid about the income of the store? (6SDAP2.5)

- **F** There were no days with an income less than \$400.
- **G** Friday's income was more than \$600 greater than Thursday's.
- H There was no day that had over \$1,000 in income.
- J The combined income of Wednesday and Thursday was greater than \$900.

READING HINT You are looking for only one valid conclusion.

Check each answer to choice to see if it is valid.

For more help with identifying valid claims, see page 438.

OUICKPractice

- **3** Which sample below is *not* random? (6SDAP2.2)
 - A To determine the favorite dessert of a community, 250 people at the local ice cream parlor are surveyed.
 - **B** To determine the favorite sport of the sixth grade class, every 10th student in an alphabetical list is surveyed.
 - C To determine whether the community should build a swimming pool, every 25th person in the phone book is surveyed.
 - **D** To determine whether the high school should get a water polo team, two students from every homeroom are surveyed.

OUICKReview

READING HINT You are looking for a sample that is *not* random. Recall that in a random sample, each member of the population has an equal chance of being selected.

Check each answer choice to determine if it is a random sample. Select the answer choice that is *not* random.

For more help with random sampling, see page 438.

- 4 Carlos is trying to decide which sandwich to add to his sandwich shop menu. Which of the following methods is the *best* way for him to choose a random sample of his customers to survey? (6SDAP2.2)
 - F Survey every customer who orders a combo meal at lunch time.
 - **G** Survey every 10th customer who enters the sandwich shop for one week.
 - H Survey every customer who orders a turkey sandwich.
 - J Give his customers a telephone survey response card.

STRATEGY You are looking for the *best* way to choose a random sample.

Eliminate answer choice F because people's preferences at lunch time may be different than at other times of the day.

Eliminate answer choice H because people that order turkey sandwiches probably already prefer turkey.

Eliminate answer choice J because everyone may not respond to a phone survey.

For more help with random sampling, see page 438.

- 5 Marcus wants to find what type of pizza is preferred by most students at his school. Which of the following is the best method of choosing a random sample of the students in his school? (6SDAP2.2)
 - A selecting all the students on his bus
 - **B** selecting all the students in his math class
 - C selecting 8 students from each third period class
 - **D** selecting students that like the same kind of pizza as Marcus
- **6** Lily wants to predict who will win the local Mayoral election. Which of the following is the best method of choosing a random sample that could predict which candidate might be elected? (6SDAP2.2)
 - **F** selecting every 20th person in the phone book
 - **G** selecting the first 50 customers at Lily's favorite restaurant
 - H selecting the teachers at her school
 - J selecting her parents' friends

7 Eliot surveyed his sixth grade class to determine their favorite subject.

Subject	Percent of Sixth Grade Students
Math	35%
English	25%
Science	20%
Spanish	20%

Which statement is a valid conclusion based on the survey results? (6SDAP2.5)

- A English is the favorite subject.
- **B** Math is the least favorite subject.
- C Math is the favorite subject.
- **D** Science is the least favorite subject.

Standard Set 2.0

8 Mr. Carter surveyed the students in his third period science class to determine their favorite food. The following table shows the results of the survey.

Favorite Food	Number of Students
Pizza	12
Hamburgers	6
Tacos	8
Spaghetti	5
Chinese	2

Which of the following claims is valid based upon this survey? (6SDAP2.5)

- **F** More students chose pizza as their favorite food than tacos and spaghetti combined.
- **G** The number of students that chose spaghetti was the same as the number of students that chose tacos.
- H Ten times as many students chose pizza as their favorite food than Chinese.
- J Twice as many students selected pizza as their favorite food than hamburgers.
- **9** Carson wants to survey the students at his middle school to determine how many hours they spend on homework each weeknight. Which of the following methods would be the best way to generate a random sample? (6SDAP2.2)
 - **A** Every student is asked to visit a website to complete a survey.
 - **B** A questionnaire is handed out to all students taking Spanish.
 - **C** Two people from each homeroom are surveyed.
 - **D** Randomly selected parents at a parent meeting are surveyed.

Practice by Standard: Statistics, Data Analysis, and Probability

Standard Set 3.0: Students determine theoretical and experimental probabilities and use these to make predictions about events.

DIRECTIONS

Choose the best answer.

QUICKPractice	QUICKReview
1What is the probability that a number cube will turn up a 5 or a 6 when it is rolled? (6SDAP3.3)A $\frac{5}{6}$ CB $\frac{2}{3}$ DD $\frac{1}{3}$	READING HINT A number cube has 6 faces. The probability that any one face will turn up is $\frac{1}{6}$. The probability that either a 5 or a 6 will turn up is $\frac{2}{6}$, or $\frac{1}{3}$. For more help with theoretical probability, see page 486.
 2 Claudio has 2 different shirts, green and yellow, and 2 different pairs of pants, blue and black, to wear to work. What is the probability that he will wear the green shirt and the black pants if he is equally likely to select any shirt-pant combination? (6SDAP3.1) F 15% H 50% G 25% J 75% 	STRATEGY Make an organized list of all possible outcomes. You can draw a tree diagram or make a table to find the probability. There are 2 choices for the shirt then 2 choices for each pair of pants for a total of 2×2 , or 4 combinations. One outcome is favorable, so the probability is $\frac{1}{4}$, or 25%. For more help with finding probabilities, see page 471.
 3 To win at a carnival booth, the spinner below is spun. What is the probability that the spinner does <i>not</i> land on red? (6SDAP3.3) A 20% C 60% B 40% D 80% 	STRATEGY Think: Which answers can you eliminate because they are not reasonable? The question asks for the probability that the spinner does <i>not</i> land on red. The probability that the spinner lands on green or yellow is $\frac{3}{5}$. For more help with finding the probability of an event <i>not</i> occurring, see page 460.

QUICKPractice

4 Xavier will choose one item from each of the following lists. (6SDAP3.1)



Which set shows *all* the possible choices of frozen yogurt and cone?

- **F** {(chocolate, strawberry, vanilla)}
- G {(chocolate, sugar), (chocolate, waffle)}
- H {(chocolate, sugar), (strawberry, waffle), (vanilla, sugar)}
- J {(chocolate, sugar), (chocolate, waffle), (strawberry, sugar), (strawberry, waffle), (vanilla, sugar), (vanilla, waffle)}

OUICKReview

READING HINT Items in a set can be listed as ordered pairs inside brackets, { }.

Read through the answer choices. You are looking for an answer choice where each element in the frozen yogurt list is paired with each element in the cone list.

For more help with listing the sample space, see page 465.

- 5 Which of the following are two dependent events? (6SDAP3.5)
 - A choosing a book from a bookshelf, not replacing it, and then choosing a second book from the same shelf
 - **B** rolling 2 number cubes
 - **C** spinning a spinner twice
 - **D** tossing a coin three times

READING HINT Dependent events are events in which the outcome of one affects the outcome of the other.

Read through the answer choices. You are looking for an answer choice where the first event affects the second event.

For more help with dependent events, see page 492.

6 A number cube is rolled and a coin is tossed. What is the probability that a multiple of 3 will turn up and tails? (6SDAP3.4)



READING HINT The probability of one event following another, in independent trials, is the product of the two individual probabilities.

The probability that a multiple of 3 will turn up is $\frac{2}{6}$, or $\frac{1}{3}$. Multiply this by $\frac{1}{2}$, the probability that tails will turn up on the coin.

For more help with disjoint events, see page 492.

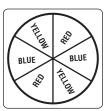
7 Andrés is choosing colors for his new car. He has three choices for the exterior, red, blue, or white and two choices for the interior, black or brown. Which tree diagram represents all of his choices? (6SDAP3.1)

Α	red	 white black brown
	blue	 white black brown
В	red <	- black > brown
	blue <	 black brown
	white <	 black brown
C	red	/ blue / white / black / brown
D	red —	- brown

- blue brown white — brown black — brown
- 8 Sam's Sandwich Shop offers a variety of sandwiches. You can choose one type of meat from turkey, ham, or roast beef, one kind of cheese from American or Provolone, and then either sourdough or wheat bread. How many choices does each customer have if they must select a meat, a cheese, and a type of bread? (6SDAP3.1)
 - **F** 6
 - **G** 7
 - H 12
 - **J** 24

Standard Set 3.0

- **9** Which of the following are independent events? (6SDAP3.5)
 - A choosing two coins from a purse without replacing the first coin
 - **B** choosing a pizza topping and then choosing a second pizza topping that is different from the first topping
 - **C** choosing a shirt to wear on Sunday and then choosing a different shirt to wear on Monday
 - D choosing a CD from a collection of 5 CDs and then choosing a DVD from a collection of 15 DVDs
- **10** What is the approximate probability of the spinner below landing on either red or blue? (6SDAP3.3)



- **F** 25%
- **G** 40%
- H 67%
- J 75%
- **12** There are 125 sixth grade students at Belgrade Intermediate School. 62 of these are girls. If a student is chosen at random, what is the probability that the student is *not* a girl? (6SDAP3.3)
 - A $\frac{62}{125}$
 - **B** $\frac{63}{125}$
 - C $\frac{62}{63}$
 - 63 63

D

Practice by Standard: Mathematical Reasoning

Standard Set 1.0: Students make decisions about how to approach problems.

DIRECTIONS

Choose the best answer.

1 Which is a correct first step to

- 1 Which is a correct first step to solve the equation -4 + 9x = -49for *x*? (6MR1.3, 6AF1.1)
 - **A** Divide each side by 9.
 - **B** Add -4 to each side.
 - C Add 4 to each side.
 - **D** Multiply each side by 9.

OUICKReview

STRATEGY Recall that to solve a two-step equation, you must undo the operations in reverse order of the order of operations.

To work backward, first subtract -4 from each side of the equation. To subtract -4, add positive 4.

For more help with solving two-step equations, see page 151.

- 2 On Tuesday, a gas station charged \$24.56 for 8 gallons of gasoline. At this rate, which conjecture below is valid concerning the cost of *g* gallons of gasoline? (6MR1.2, 6AF2.3)
 - **F** The cost of g gallons is \$24.56g.
 - **G** The cost of *g* gallons is \$8.00*g*.
 - **H** The cost of g gallons is \$3.70g.
 - J The cost of *g* gallons is \$3.07*g*.

STRATEGY Think: Which answers can you eliminate because they are not reasonable?

You can find the cost per gallon by dividing the cost of 8 gallons, \$24.56, by the number of gallons, 8.

For more help with unit rates, see page 287.

3 Two quantities *x* and *y* are related in the following way.

x	у
4	12
7	21
11	33
14	42

Identify the relationship between x and y. (6MR1.1, 6AF1.2)

A
$$y = 3x$$

B $y = x + 8$
C $x = 3y$
D $y = 3 + x$

STRATEGY Check each row in the table to make sure that the pattern continues. By considering only the first row, either answer choice A or B would be appropriate.

Observe the pattern in the table. Notice that each *y*-coordinate is found by multiplying its corresponding *x*-coordinate by 3. This relationship can be represented by the equation y = 3x.

For more help with identifying relationships from a table, see page 63.

Standard Set 1.0

Practice on Your Own

4 If the pattern below continues, what will be the next number? (6MR1.1, 6NS2.0)

5, 10, 15, ?

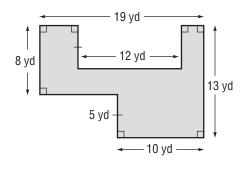
F	10	Н	20
G	15	J	30

5 Consider the following problem.

A plane flew from New York to Los Angeles at 450 miles per hour. On the return flight, it flew at 410 miles per hour. If the return trip took 5 hours and 58 minutes, what was the distance traveled?

Identify the irrelevant information in the problem. (6MR1.1, 6AF2.3)

- A the rate at which the plane flew from New York to Los Angeles
- **B** the rate at which the plane flew from Los Angeles to New York
- C the length of time of the return flight
- D the distance between New York and Los Angeles
- **6** Which expression can be used to find the area in square yards of the complex figure below? (6MR1.3, 6AF1.4)



- **F** $(19 \times 13) (9 \times 5) (12 \times 5)$
- **G** $(10 \times 5) + (8 \times 5) + (12 \times 13)$
- **H** $(13 \times 10) + (19 \times 8) (12 \times 5)$
- J $(19 \times 13) (8 \times 5) (12 \times 8)$

- 7 Carla is twice as old as her younger sister, Emilia. Emilia's age is $\frac{1}{3}$ that of her older brother, Lucas. Lucas is half the age of their father, Pedro. To find all of their ages, which of the following could you find first, given that you know Pedro's age? (6MR1.3, 6NS2.0)
 - A Emilia's age
 - **B** Lucas' age
 - **C** Carla's age
 - **D** the sum of Carla's and Emilia's ages
 - 8 A coin was tossed 6 times and each time, it turned up heads. Which of the following statements below is valid concerning the probability that the coin will turn up heads on the 7th time it is tossed? (6MR1.2, 6SDAP3.3)
 - **F** The probability is 0.
 - **G** The probability is $\frac{1}{2}$.
 - **H** The probability is $\frac{20}{21}$.
 - J The probability is 1.
 - **9** A light bulb manufacturer determines that 0.025 of the bulbs produced are defective. Which conjecture below is valid concerning the number of defective light bulbs in a batch of 280 light bulbs produced? (6MR1.2, 6SDAP3.2)
 - A About 7 light bulbs are expected to be defective.
 - **B** About 5 light bulbs are expected to be defective.
 - **C** About 3 light bulbs are expected to be defective.
 - **D** About 2 light bulbs are expected to be defective.

Practice by Standard: Mathematical Reasoning

Standard Set 2.0: Students use strategies, skills, and concepts in finding solutions.

DIRECTIONS

Choose the best answer.

QUICKPractice

1 The table below shows the scores of the students in Mrs. Meyer's Spanish class on their final exam.

				80						
74	86	72	81	92	93	70	80	68	72	84

Mrs. Meyer calculated that the mean of the scores was 70. Which of the following shows that her calculation is invalid? (6MR2.7, 6SDAP1.1)

- A No one scored below 70.
- **B** The mode is 72, not 70.
- **C** Most of the students have scores higher than the mean.
- **D** Most of the students have scores lower than the mean.

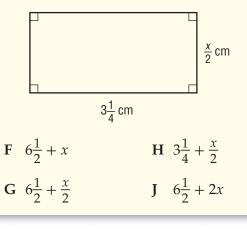
OUICKReview

STRATEGY You do not have to calculate the mean in order to answer this problem.

You are looking for a true statement that shows that 70 cannot be the mean. Read through each answer choice, checking for its validity and how it shows that the Mrs. Meyer's calculation of the mean cannot be true.

For more help with calculating the mean of a data set, see page 402.

2 Which expression represents the perimeter in centimeters of the rectangle below? (6MR2.4, 6AF3.2)



READING HINT The perimeter of a rectangle is found by using the formula $P = 2\ell + 2w$. Replace ℓ with $3\frac{1}{4}$ and w with $\frac{x}{2}$ in the formula for the perimeter of a rectangle. Then simplify the expression.

For more help with the perimeter of a rectangle, see page 156.

3 Which of the following is true concerning the circumference in feet of the circle shown? (6MR2.6, 6AF3.1)

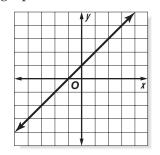


- **A** The exact circumference can be found by multiplying 3.14 by 5.
- **B** The approximate circumference can be found by multiplying 3.14 by 5.
- **C** The exact circumference can be found by multiplying $\frac{22}{7}$ by 5.
- **D** The approximate circumference can be found by multiplying 3.14 by 10.
- 4 A caterer made 12 batches of muffins with 21 cups of flour. Which of the following proportions can be used to find *x*, the number of cups of flour needed to make 28 batches of muffins? (6MR2.5, 6NS1.3)

F
$$\frac{12}{21} = \frac{x}{28}$$

G $\frac{12}{21} = \frac{28}{x}$
H $\frac{12}{28} = \frac{x}{21}$
J $\frac{12}{x} = \frac{28}{21}$

5 Describe the relationship between *x* and *y* on the graph below. (6MR2.4, 6AF1.1)



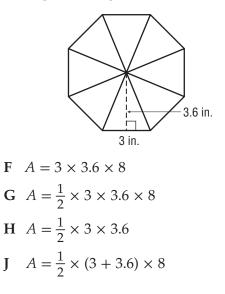
A Each *y*-coordinate is one unit greater than each *x*-coordinate.

$$\mathbf{B} \quad y = x - 1$$

$$\mathbf{C} \quad \boldsymbol{v} = \boldsymbol{x}$$

D y = -x

- 6 Parker can mow one lawn in 3.9 hours. He determined that it would take him 15.6 hours to mow 4 lawns. Which of the following verifies that his solution is reasonable? (6MR2.1, 6NS1.3)
 - **F** $3.9 \times 4 \approx 4 \times 4$, or 16, and $15.6 \approx 16$
 - **G** 3.9 × 4 \approx 3 × 4, or 12, and 12 ÷ 4 = 3
 - H $15.6 3.9 \approx 16 4$, or 12, and 12 + 4 = 16
 - J $3.9 + 4 \approx 4 + 4$, or 8, and 8 + 4 = 12
- 7 Myra determines that there are 16 possible outcomes when a coin is tossed four times. Which of the following shows that her calculation is valid? (6MR2.7, 6SDAP3.1)
 - **A** There are two possible outcomes for each toss and $2 \times 4 = 8$.
 - **B** There are two possible outcomes for each toss and 2 + 14 = 16.
 - **C** There are two possible outcomes for each toss and $2 \times 16 = 32$.
 - **D** There are two possible outcomes for each toss and $2 \times 2 \times 2 \times 2 = 16$.
- 8 Which of the following equations can be used to find the area *A* in square inches of the regular octagon below? (6MR2.2, 6AF3.2)



Standard Set 2.0

Practice by Standard: Mathematical Reasoning

Standard Set 3.0: Students move beyond a particular problem by generalizing to other situations.

DIRECTIONS

Choose the best answer.

D $A = \frac{1}{2}\ell w$

QUICKPractice	QUICKReview
1 A diagonal drawn on a rectangle splits a rectangle into two congruent triangles. Using the formula for the area of a rectangle, which of the following would give the area of each triangle? (6MR3.2, 6AF3.2) A $A = \ell w + 2\ell w$ B $A = \ell w^2$ C $A = 2\ell w$	READING HINT Recall that the area of a rectangle can be found by using the formula $A = \ell w$. Since the rectangle is split into two triangles, the area of each triangle can be found by halving the area of the rectangle. For more help with the area of a triangle, see page 578

2 The measures of several complementary angle pairs are shown in the table.

m∠x	m∠y
31°	59°
72°	18°
47°	43°

Use the table to make a generalization about the measures of any two complementary angles x and y. (6MR3.3, 6MG2.1)

F $m \angle x + m \angle y = 180^{\circ}$

G
$$m \angle x - m \angle y = 90^{\circ}$$

H
$$m \angle x + m \angle y = 90^{\circ}$$

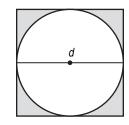
$$\mathbf{J} \quad m \angle x + 90^\circ = m \angle y$$

STRATEGY Recall that the sum of the measures of complementary angles is 90°.

Use the definition of complementary angles to verify that the sum of each angle pair in the table is 90° . Then write an equation representing the sum of any two complementary angles *x* and *y*.

For more help with complementary angles, see page 514.

- 3 Liseli read a 250-page book in 10 hours. Which of the following is a reasonable calculation for the number of hours it would take her to read a 325-page book at this rate? (6MR3.1, 6NS1.3)
 - **A** 25
 - **B** 15
 - **C** 13
 - **D** 8
- 4 A circle with diameter *d* is inside a square with side length *d*, as shown. Which expression represents the area of the shaded region in terms of *d*? (6MR3.2, 6AF3.1)

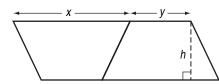


$$\mathbf{F} \quad d^2 - (\pi \times d^2)$$

$$\mathbf{G} \ d^2 - (\pi \times 2d^2)$$

$$\mathbf{H} \quad d^2 - \left[\pi \times \left(\frac{d}{2}\right)^2\right]$$
$$\mathbf{J} \quad d^2 + \left(\pi \times \frac{1}{2}d^2\right)$$

5 The parallelogram below is split into two congruent trapezoids.



Which of the following represents the area of each trapezoid? (6MR3.2, 6AF3.2)

A $A = \frac{1}{2}xyh$ B $A = \frac{1}{2}(x + y)h$ C $A = \frac{1}{2}(x + y + h)$ D A = (x + y)h

Standard Set 3.0

- **6** Alfonso decides to leave a 20% tip on a restaurant bill of \$14.75. He determines that the tip should be about \$5.00. Which of the following shows that his solution is *not* reasonable? (6MR3.1, 6NS1.4)
 - **F** 20% of \$14.75 $\approx \frac{1}{3}$ of \$15.00, or \$5.00

G 20% of \$14.75
$$\approx \frac{1}{5}$$
 of \$15.00, or \$3.00

H 20% of \$14.75
$$\approx \frac{1}{2}$$
 of \$15.00, or \$7.50

- J 20% of \$14.75 $\approx \frac{1}{4}$ of \$15.00, or \$3.75
- 7 The table shows the number of possible outcomes when a coin is tossed a certain number of times.

Number of Tosses	Number of Outcomes
1	2
2	4
3	8

Use the table to make a generalization about the number of possible outcomes p when a coin is tossed m times. (6MR3.3, 6SDAP3.1)

- **A** $p = m \times 2$ **B** $p = m^2$ **C** $p = 2^m$ **D** p = m + m
- 8 The sum of $\frac{3}{5}$ and $\frac{1}{5}$ is $\frac{4}{5}$, the sum of $\frac{2}{7}$ and $\frac{4}{7}$ is $\frac{6}{7}$, and the sum of $\frac{1}{11}$ and $\frac{5}{11}$ is $\frac{6}{11}$. Use this pattern to make a generalization about the sum of the fractions $\frac{a}{b}$ and $\frac{c}{b}$. (6MR3.2, 6NS2.1) F $\frac{a}{b} + \frac{c}{b} = \frac{a+c}{b}$ G $\frac{a}{b} + \frac{c}{b} = \frac{ac}{b}$ H $\frac{a}{b} + \frac{c}{b} = \frac{a+c}{b+b}$ J $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$

Student Handbook

Built-In Workbooks

Prerequisite Skills	668
Extra Practice	679
Mixed Problem Solving	715

Reference

English-Spanish Glossary
Selected Answers
Photo Credits
Index
Mathematics Chart Inside Back Cover



How to Use the Student Handbook

A Student Handbook is the additional skill and reference material found at the end of books. The Student Handbook can help answer these questions.

What If I Forget What I Learned Last Year?

Use the Prerequisite Skills section to refresh your memory about things you have learned in other math classes. Here's a list of the topics covered in your book.

- 1. Divisibility Patterns
- 2. Place Value and Decimals
- 3. Comparing and Ordering Decimals
- 4. Rounding Decimals
- 5. Estimating with Decimals
- 6. Adding and Subtracting Decimals
- 7. Multiplying Decimals
- 8. Powers of Ten
- 9. Dividing Decimals
- 10. Mixed Numbers and Improper Fractions
- 11. Measuring and Drawing Angles

What If I Need More Practice?

You, or your teacher, may decide that working through some additional problems would be helpful. The **Extra Practice** section provides these problems for each lesson so you have ample opportunity to practice new skills.

What If I Have Trouble with Word Problems?

The **Mixed Problem Solving** portion of the book provides additional word problems that use the skills presented in each chapter. These problems give you real-world situations where the math can be applied.

What If I Forget a Vocabulary Word?

The **English-Spanish Glossary** provides a list of important, or difficult, words used throughout the textbook. It provides a definition in English and Spanish as well as the page number(s) where the word can be found.

What If I Need to Check a Homework Answer?

The answers to the odd-numbered problems are included in **Selected Answers**. Check your answers to make sure you understand how to solve all of the assigned problems.

What If I Need to Find Something Quickly?

The **Index** alphabetically lists the subjects covered throughout the entire textbook and the pages on which each subject can be found.

What If I Forget a Formula?

Inside the back cover of your math book is a **Mathematics Chart** that lists formulas and symbols that are used in the book.

Prerequisite Skills

Divisibility Patterns

In $54 \div 6 = 9$, the quotient, 9, is a whole number. So, we say that 54 is **divisible** by 6. You can use the following rules to determine whether a number is by 2, 3, 4, 5, 6, 9, and 10.

A number is divisible by:

- 2 if the ones digit is divisible by 2.
- 3 if the sum of the digits is divisible by 3.
- 4 if the number formed by the last two digits is divisible by 4.
- 5 if the ones digit is 0 or 5.
- 6 if the number is divisible by both 2 and 3.
- 9 if the sum of the digits is divisible by 9.
- 10 if the ones digit is 0.

EXAMPLE Use Divisibility Rules

Determine whether 972 is divisible by 2, 3, 4, 5, 6, 9, or 10.

- 2: Yes; the ones digit, 2, is divisible by 2.
- 3: Yes; the sum of the digits, 9 + 7 + 2 = 18, is divisible by 3.
- 4: Yes; the number formed by the last two digits, 72, is divisible by 4.
- 5: No; the ones digit is not 0 or 5.
- 6: Yes; the number is divisible by 2 and 3.
- 9: Yes; the sum of the digits, 18, is divisible by 9.
- 10: No; the ones digit is not 0.

Exercises

Use divisibility rules to determine whether the first number is divisible by the second number.

1 . 447; 3	2 . 135; 6	3 . 240; 4
4. 419; 3	5. 831; 3	6 . 4,408; 4
7 . <i>7</i> ,110; 5	8. 1,287; 9	9 . 2,984; 9
10 . <i>7,</i> 026; 6	11 . 1,260; 10	12 . 8,903; 6

Determine whether each number is divisible by 2, 3, 4, 5, 6, 9, or 10.

13. 712	14. 1,035	15 . 8,901
16. 462	17. 270	18 . 1,005
19. 32,221	20. 8,340	21 . 920
22 . 50,319	23 . 64,042	24. 3,498

25. MEASUREMENT Jordan has 5,280 feet of rope. Can he cut the rope into 9-foot pieces and use all of the rope? Explain.

Prerequisite Skills

Place Value and Decimals

Our number system is based on units of ten. Numbers like 1.35, 0.8, and 25.09 are called decimals.

You can use a place-value chart like the one at the right to help you read decimals and write them in words. Use the word and to represent the decimal point.

thousands1,000hundreds100ctens10cones10ones01ones0.01oneths0.01bhundredths0.001ten-thousandths0.0001hundred-0.0001hundred-0.0001		ten thousands	10,000
hundreds tens ones decimal point tenths hundredths thousandths ten-thousandths		thousands	1,000
tens ones decimal point tenths hundredths ten-thousandths hundred- thousandths		hundreds	100
ones decimal point tenths hundredths thousandths ten-thousandths hundred-	2	tens	10
decimal point tenths hundredths thousandths ten-thousandths hundred- thousandths	5	ones	-
tenths hundredths thousandths ten-thousandths hundred- thousandths	•	decimal point	
hundredths 	0	tenths	0.1
	9	hundredths	0.01
		thousandths	0.001
ths		ten-thousandths	0.0001
		hundred- thousandths	0.00001

thousandths hundredths

3 8

EXAMPLES Write Decimal in Words Write each decimal in words 20.09 6.738 decimal point point hundredths decimal tenths tenths ones ones tens 2 Ο Ο 9 6 7 six and seven hundred thirty-eight thousandths twenty and nine hundredths

You can also write decimals in expanded notation using place value and decimals or their fraction equivalents as shown at the right.

Decimal	0.1	0.01	0.001	0.0001
Fraction	<u>1</u> 10	$\frac{1}{10^2}$	$\frac{1}{10^3}$	$\frac{1}{10^4}$

EXAMPLE Write a Decimal in Expanded Notation

3 Write 2.814 in expanded notation using decimals and using fractions.

Write the product of each digit and its place value.

 $2.814 = (2 \times 1) + (8 \times 0.1) + (1 \times 0.01) + (4 \times 0.001)$ $2.814 = (2 \times 1) + \left(8 \times \frac{1}{10}\right) + \left(1 \times \frac{1}{10^2}\right) + \left(4 \times \frac{1}{10^3}\right)$

Replace the decimals with their fraction equivalents.

Exercises

Write each decimal in words.

1. 6.37	2 . 13.7	3 . 145.66	4. 92.03	5 . 4,280.899
6. 0.6	7 . 0.69	8 . 0.00012	9. 7.005	10. 2000.0002

Write each decimal in expanded notation using decimals and using fractions.

11. 0.8	12 . 5.3	13. 6.79	14. 9.132	15 . 65.002
16. 0.625	17. 0.0072	18. 100.001	19 . 548.845	20 . 4,260.705

21. BATS The northern blossom bat is one of the world's smallest bats. It weighs just 0.53 ounce. Write its weight in expanded notation using fractions.

Comparing and Ordering Decimals

To determine which of two decimals is greater, you can compare the digits in each place-value position, or you can use a number line.

EXAMPLES Order Decimals

Which is greater, 7.4 or 7.63?

METHOD 1 Use place value.

- 7.4 Line up the decimal points.
- 7.63 Starting at the left, compare the digits in each place-value position.

The digits in the tenths place are not the same.

Since 6 tenths > 4 tenths, 7.63 > 7.4.

METHOD 2 Use a number line.

Graph each decimal on a number line and compare.

On a number line, numbers to the right are greater than numbers to the left.

7.63 is to the right of 7.4, so 7.63 > 7.4.

Order 12.15, 12.08, and 12.103 from least to greatest.

12.15 Line up the decimal points.

12.08 is less than 12.15 and 12.103 since 0 < 1 in the tenths place.

12.103 12.103 is less than 12.15 since 0 < 5 in the hundredths place.

So, the numbers from least to greatest are 12.08, 12.103, and 12.15.

Exercises

Replace each ● with <, >, or = to make a true sentence.

1 . 1.22 1 .02	2 . 0.97 1 .06	3. 7.90 ● 7.9
4. 1.3 • 1.31	5. 4.03 • 4.01	6 . 0.77 ● 0.69
7. 0.8 • 0.08	8 . 0.68 • 0.680	9 . 3.28 • 3.279
10. 25.23 • 25.32	11 . 77.55 • 77.65	12 . 1.29 1 .43
13 . 310.36 • 310.3600	14. 0.0034 ● 0.034	15 . 9.09 ● 9

Order each group of decimals from least to greatest.

16. 5.13, 5.07, 5.009	17 . 7.9, 7.088, 8.02, 7.98
18 . 0.087, 0.901, 2, 1.001	19 . 12.3, 12.008, 12.54, 12
20. 60.5, 60.05, 60.55, 60.505	21 . 505.9, 505.09, 505.91, 505.99
22 . 0.02, 0.2, 0.022, 0.002	23 . 0.99, 0.90, 0.09, 0.999, 0.099



When a number has more decimal places than you want or need, you can **round** it. Use the rules below to round a number to any place value.

Rounding Look at the digit to the right of the place being rounded. • If the digit is 4 or less, the digit being rounded remains the same.

• If the digit is 5 or greater, the digit being rounded is rounded up.

EXAMPLES Round Decimals

Round 3.92 to the nearest tenth.

tenths place

¥

3.92 Look at the digit to the right of the tenths place. Since 2 is less than 5, the digit in the tenths place stays the same.

3.92 rounded to the nearest tenth is 3.9.

2 Round 46.297 to the nearest hundredth.

hundredths place

¥

46.297 Look at the digit to the right of the hundredths place. Since 7 is greater than 5, round 9 up.

46.297 rounded to the nearest hundredth is 46.30.

Exercises

Round each number to the given place value.

1.	0.315; tenth	2.	0.2456; hundredth	3.	17.499; tenth
4.	43.219; hundredth	5.	15.522; tenth	6.	9.6; ones
7.	7.0375; thousandth	8.	16.399; tenth	9.	6.95; tenth
10.	99.1283; thousandth	11.	1,000.37; tenth	12.	750.523; ones
13.	0.445; hundredth	14.	490.299; ones	15.	999.99; tenth
16.	476.835; hundredth	17.	682.596; tenth	18.	1,000.562; ones

Round each number to the underlined place-value position.

19. 0.7 <u>8</u> 9	20 . 0. <u>9</u> 6	21 . 1.5 <u>7</u> 246
22. 2 <u>3</u> .48	23 . 1.7 <u>0</u> 4	24. 0. <u>1</u> 63
25. 15. <u>4</u> 51	26. 4.52 <u>9</u> 88	27 . 0. <u>7</u> 87
28 . 3 <u>8</u> .56	29 . 5 <u>9</u> .61	30 . <u>0</u> .555
31 . 0. <u>5</u> 55	32. 0.5 <u>5</u> 5	33 . 10. <u>9</u> 29
34 . 10.929	35. 425.599	36 . 0.92929

- **37. HORSES** A trainer recorded a racehorse running at 47.54 miles per hour. Round this speed to the nearest mile per hour.
- **38. POPULATION** In 2000, the population of Texas was 20.85 million. Round to the nearest million.

Estimating with Decimals

Estimation can be used to provide quick answers when an exact answer is not necessary. It is also an excellent way to check whether your answer is reasonable. One method of estimating is to use rounding. Round numbers to any place value that makes estimation easier.

EXAMPLES Estimate by Rounding

Estimate by rounding. 23.485 \rightarrow 9.757 23.485 \rightarrow 23 $-9.757 \rightarrow -10$ 13 Round to the nearest whole numbers.

The difference is about 13.

6.43 + 2.17 + 9.1 + 4.87 $6.43 \rightarrow 6$ $2.17 \rightarrow 2$ Round to the nearest $9.1 \rightarrow 9$ whole numbers. $+ 4.87 \rightarrow + 5$ 22The sum is about 22.

Another way to estimate sums is to use **clustering**. This strategy is used when all the numbers are close to a common value.

EXAMPLE Estimate by Clustering

3 Estimate 9.775 + 9.862 + 9.475 + 9.724 by clustering.

All of the numbers are clustered around 10. There are four numbers. So, the sum is about 4×10 or 40.

Exercises

Estimate by rounding.

1. 8.56 + 5.34	2 . 34.84 - 17.69	3. 6.8 + 2.4
4. 40.79 - 6.8	5. 6.9 + 5.2	6 . 23.84 + 12.13
7. 34.3 - 18.9	8 . 7.5 + 8.4	9 . 65.48 - 9.3
10. 26.3 + 9.7	11. 33.21 - 8.23	12. 67.86 - 24.35
13 . 8.99 – 2.6	14. 121.5 + 487.8	15 . 32.5 + 81.4

Estimate by clustering.

16. $18.4 + 22.5 + 20.7$	17. 56.9 + 63.2 + 59.3 + 61.1
18. 42.3 + 41.5 + 39.8 + 40.4	19. 77.8 + 75.6 + 81.2 + 79.9
20. 239.8 + 242.43 + 236.20 + 240.77	21. 9.9 + 10.0 + 10.3 + 11.1 + 9.8 + 11.2
22. 50.4 + 51.1 + 48.9 + 49.5 + 50.8	23. 100.5 + 97.8 + 101.6 + 100.2 + 99.3

6 Adding and Subtracting Decimals

To add or subtract decimals, write the numbers in a column and line up the decimal points. In some cases, you may want to *annex*, or place zeros at the end of the decimals, to help align the columns. Then add or subtract as with whole numbers and bring down the decimal point. Always estimate first to see whether your answer is reasonable.

EXAMPLES Add and Subtract Decimals

Find each sum or difference.

C	12.6 + 4	5 Estimate 13 + 5 = 18	2 42.17 –	15.85 Estimate $42 - 16 = 26$
	12.6	Line up the decimal points.	42.17	Line up the decimal points.
	+4.5	Add.	- 15.85	Subtract.
	17.1	The sum is close to the estimate.	26.32	The difference is close to the estimate.
C	57.125 +			25 Estimate 25 - 15 = 10
		7.63 Estimate 57 + 8 = 65	() 25 – 15.	25 Estimate $25 - 15 = 10$
1	57.125	7.63 Estimate $57 + 8 = 65$		Annex a zero to align the columns.
	57.125	Annex a zero to align the columns.		
	57.125 <u>+ 7.630</u>		25.00 + 15.25	

Exercises

Find each sum or difference.

1.	$0.132 \\ -0.021$	2.	3.78 + 0.21		3.	13.2 + 12.8	4.	5.86 <u>- 1.51</u>		42.07 <u>- 38.78</u>
6.	14.7 + 351.82	7.	42.3 + 0.81		8.	12.3 <u>- 0.847</u>	9.	342.9 <u>- 0.18</u>		282.45 <u>- 111.3</u>
11.	100 - 0.48	12.	82.23 + 0.88		13.	128.01 <u>- 39.117</u>	14.	80.0 - 79.0		104.98 <u>- 0.12</u>
16.	0.42 + 0.68			17.	0.48 -	+ 2.901		18. 5	5.8 + 3.92	
19.	38.63 + 38.63			20.	8 - 2	.54		21 . 1	6.354 - 0.	2
22.	0.125 + 0.78			23.	8.2 –	6.9		24. 1	.245 + 3.8	42
25.	3.2 + 1.23			26.	0.889	- 0.3		27 . 2	22.22 + 1.4	75
28.	10 - 0.25			29.	33.16	- 0.08		30 . 1		
31.	44.698 - 14.9	03		32.	10 -	0.005		33. 7	722.86 + 0.	024
34.	100.211 + 8.0	04		35.	86.12	4 + 32.822		36 . 6	5.9 + 1.1	
37.	75 - 0.24			38.	13 –	0.324		39. ().8 + 1.2	

40. What is the sum of 35.009 and 3.6?

41. Find 9.1 minus 5.625.

42. AIR TRAVEL The numbers of passengers, in millions, passing through four airports in a recent year were 80.2, 72.1, 68.5, and 60.7. Find the total number of passengers for the four airports.

Multiplying Decimals

To multiply decimals, multiply as with whole numbers. The product has the same number of decimal places as the sum of the decimal places of the factors. Use estimation to determine whether your answers are reasonable.

EXAMPLES Multiply Decimals

Multiply.

1.3 × 0.9 Estimate 1 × 1 = 1 1.3 ← 1 decimal place × 0.9 ← 1 decimal place 1.17 ← 2 decimal places The product is reasonable.

 $2 0.054 \times 1.6 \quad \text{Estimate} \quad 0 \times 2 = 0$

🛶 3 decimal places
\leftarrow 1 decimal place
Annex a zero on the left so the answer has
our decimal places. Compare to the estimate.

Exercises

Place the decimal point in each product. Add zeros if necessary.

	1	1	5	
1. $1.32 \times 4 =$	528	2 . $0.07 \times 1.1 = 77$	3. $0.4 \times 0.7 = 28$	
4. 1.9 × 0.6 =	: 114	5. $1.4 \times 0.09 = 126$	6. $5.48 \times 3.6 = 19728$	
7. 4.5×0.34	= 153	8. $0.45 \times 0.02 = 9$	9. $150.2 \times 32.75 = 49190$	50
Multiply.				
10. 0.2	11 . 0	3 12 . 0.45	13 . 0.0023 14 . 1.5	
<u>× 6</u>	$\times 0$	$\underline{9} \times 0.12$	\times 32 \times 2.7	
15. 10.1	16.	2 17. 6.78	18 . 200 19 . 0.0023	
$\times 9$	$\times 0$	<u>3</u> <u>× 1.3</u>	$\times 0.004 \times 0.35$	
20. 15.8 × 11		21. 88 × 2.5	22. 33 × 0.03	
23 . 36 × 0.46		24. 0.003 × 482	25 . 1.88 × 1.11	
26. 0.6 × 2		27 . 38.3 × 29.1	28. 0.7 × 18	
29. 8 × 0.3		30 . 12.2 × 12.4	31 . 380 × 1.25	
32. 42 × 0.17		33 . 0.4 × 16	34. 0.23×0.2	
35 . 0.44 × 0.5		36 . 0.44 × 55	37. 44 × 0.55	

38. JOBS Antonia earns \$10.75 per hour. What are her total weekly earnings if she works 34.5 hours? Round to the nearest cent.



You can use a pattern to mentally find the product of any number and a power of 10 that is greater than 1. Count the number of zeros in the power of 10 or use the exponent. Then move the decimal point that number of places to the right.

Decimal Power of 10	Product
19.7 $ imes$ 10 ¹ (or 10)	= 197
19.7 $ imes$ 10 ² (or 100)	= 1,970
19.7 $ imes$ 10 ³ (or 1,000)	= 19,700
19.7 $ imes$ 10 ⁴ (or 10,000)	= 197,000

0	q
00	CIN

EXAMPLES Use Mental Math to Multiply

	Multiply mentally.		
6	12.562 × 100		
	$12.562 \times 100 = 12.562$	Move the decimal point two places	
	= 1,256.2	to the right, since 100 has two zeros.	
E	$0.59 imes10^4$		
	$0.59 \times 10^4 = 0.5900$	Move the decimal point four places	
	= 5,900	to the right, since the exponent is 4.	

To mentally multiply by a power of ten that is less than 1, count the number of decimal places. Or, if the power is written as a fraction, use the exponent in the denominator. Then move the decimal point that number of places *to the left*.

Decimal Power of 10	Product
$19.7 \times 0.1 \left(\text{or} \frac{1}{10^1} \right)$	= 1.97
$19.7 \times 0.01 \left(\text{or} \frac{1}{10^2} \right)$	= 0.197
$19.7 \times 0.001 \left(\text{or} \frac{1}{10^3} \right)$	= 0.0197

EXAMPLES Use Mental Math to Multiply

Multiply mentally.

3 10.5 × 0.01

 $10.5 \times 0.01 = 10.5$ = 0.105

Move the decimal point two places to the left.

 $5,284 \times 0.00001 = 05284$ Move the decimal point = 0.05284 five places to the left.

Exercises

Multiply mentally.

1 . 12.53 × 10	2. 4.6×10^3	3 . 78.4 × 0.01
4 . 0.05 × 100	5. 4.527 × 100	6 . 2.78 × 1,000
7. 13.58 × 0.01	8. 5.49×10^3	9. 0.1×0.8
10. 0.925 × 10	11. 99.44×10^2	12. 0.01 × 16
13. 1.32×10^3	14 . 0.56 × 10,000	15. 1.4×0.001
16. 11.23×10^5	17 . 68.94 × 0.01	18. 0.8×10^4
19. 28.1×0.01	20. 9.3×10^7	21 . 625,799 × 0.0001

9 Dividing Decimals

To divide two decimals, use the following steps.

- If necessary, change the divisor to a whole number by moving the decimal point to the right. You are multiplying the divisor by a power of ten.
- Move the decimal point in the dividend the same number of places to the right. You are multiplying the dividend by the same power of ten.
- Divide as with whole numbers.

EXAMPLES Divide Decimals

Divide.

Π

25.8 \div **2 Estimate** 26 \div 2 = 13 12.9 2)25.8The divisor, 2, is already a whole number, so you do not need to move the decimal point. Divide as with - 2 whole numbers. Then place the decimal directly 5 above the decimal point in the dividend. - 4 18 - 18 0 Compared to the estimate, the quotient, 12.9, is reasonable. **199.68** \div **9.6 Estimate** 200 \div 10 = 20 20.8 9.6)199.68 Move each decimal point one place to the right.

$\frac{\overline{7\ 68}}{-\ 7\ 68}$

- 192

Compare the answer to the estimate.

Exercises

Divide.

1 . 0.3)9.81	2 . 12)0.12	3 . 3.2)5.76	4 . 0.22)0.0132	5 . 0.04)0.008
6 . 3.18)0.636	7 . 0.2)8.24	8 . 82.3)823	9 . 12.02)24.04	10 . 0.5)85
11. 74.9)5.992	12 . 19.2)4.416	13 . 1.9)38.57	14 . 13.8)131.1	15. 6.48)259.2
16 . 812 ÷ 0.4	17 . 0.34 ÷ 0.2	18 . 14.4	÷ 0.12 19.	$90.175 \div 2.5$
20 . 39.95 ÷ 799	21 . 88.8 ÷ 444	22 . 613.8	8 ÷ 66 23.	2,445.3 ÷ 33
24 . 20.24 ÷ 2.3	25. 45 ÷ 0.09	26. 2.475	5 ÷ 0.03 27.	$4.6848 \div 0.366$
28 . 180 ÷ 0.36	29 . 97.812 ÷ 1.	1 30 . 23 ÷	- 0.023 31 .	$1,680.042 \div 44.2$

- **32. OLYMPICS** In the 2000 Olympics, Michael Johnson of the U.S. ran the 400-meter run in 43.84 seconds. To the nearest hundredth, find his speed in meters per second.
- **33. EARTH SCIENCE** It takes Pluto 247.69 Earth years to revolve once around the Sun. It takes Jupiter 11.86 Earth years to revolve once around the Sun. About how many times longer does it take Pluto than Jupiter to revolve once around the Sun?

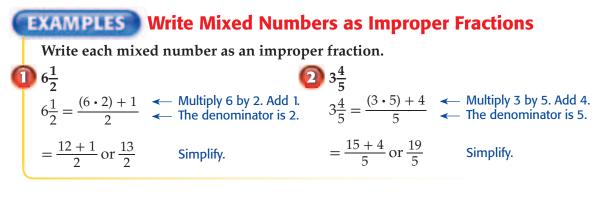
10 Mixed Numbers and Improper Fractions

A **mixed number** is the sum of a whole number and a fraction. An **improper fraction** is a fraction with a numerator that is greater than or equal to the denominator.

mixed number: $8\frac{1}{2}$ improper fraction: $\frac{17}{2}$

To write a mixed number as an improper fraction, use the following steps.

- Multiply the whole number by the denominator.
- Add the numerator.
- Write the sum as the numerator of the improper fraction.



To write an improper fraction as a mixed number, divide the numerator by the denominator. Write the remainder as the numerator of the fraction.

EXAMPLE Write Improper Fractions as Mixed Numbers

 $\boxed{3}$ Write $\frac{7}{4}$ as a mixed number.

 $7 \div 4 = 1 \text{ R} 3$ Divide the numerator by the denominator.

Write the remainder as the numerator of the function.

Exercises

So, $\frac{7}{4} = 1\frac{3}{4}$.

Write each mixed number as an improper fraction.

1. $2\frac{1}{3}$	2. $1\frac{5}{8}$	3. $4\frac{5}{7}$	4. $3\frac{3}{4}$	5. $9\frac{1}{3}$
6. $1\frac{1}{10}$	7. $10\frac{2}{3}$	8. $12\frac{1}{4}$	9. $6\frac{3}{8}$	10. $11\frac{1}{2}$
11. $2\frac{3}{8}$	12. $20\frac{3}{5}$	13. $5\frac{7}{8}$	14. $27\frac{1}{3}$	15. $5\frac{2}{3}$
Write each in	nproper fraction	as a mixed numb	er.	
16. $\frac{15}{2}$	17. $\frac{9}{7}$	18. $\frac{15}{8}$	19. $\frac{100}{3}$	20. $\frac{28}{5}$
21. $\frac{3}{3}$	22. $\frac{19}{8}$	23. $\frac{17}{10}$	24. $\frac{51}{3}$	25 . $\frac{17}{6}$
26 . $\frac{5}{3}$	27. $\frac{99}{3}$	28. $\frac{25}{7}$	29 . $\frac{46}{9}$	30. $\frac{27}{4}$

11 Measuring and Drawing Angles

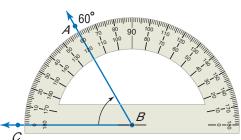
An angle is formed by two rays with a common endpoint, called a **vertex**. The measure of the "tilt" of one side of the angle compared to the other can be given in degrees measured with a **protractor**. Angles can be classified by their measure.

- Angles with measures less than 90° are called **acute** angles.
- Angles with measures of exactly 90° are called **right** angles.
- Angles with measures between 90° and 180° are called **obtuse** angles.
- Angles with measures of exactly 180° are called straight angles.

EXAMPLE Measure an Angle

1 Use a protractor to measure $\angle ABC$. State whether the angle is acute, right, obtuse, or straight.

- Step 1Place the center point of the
protractor's base on vertex B.
Align the straight side with side
 \overrightarrow{BC} so that the marker for 0° is
on side \overrightarrow{BC} .
- **Step 2** Use the scale that begins with 0° at *BC*. Read where the other side of the angle, *BA*, crosses this scale.

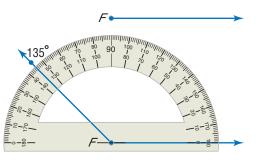


The measure of angle *ABC* is 60°. Using symbols, $m \angle ABC = 60^{\circ}$. Since $m \angle ABC < 90^{\circ}$, the angle is acute.

EXAMPLE Draw an Angle

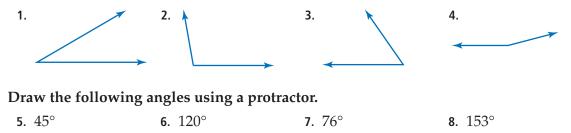
Draw $\angle F$ having a measure of 135°.

- **Step 1** Draw a ray. Label the endpoint *F*.
- **Step 2** Place the center point of the protractor's base on point *F*. Align the mark labeled 0 with the ray.
- **Step 3** Use the scale that begins with 0. Locate the mark labeled 135. Then draw the other side of the angle.



Exercises

Measure the following angles and state whether they are acute or obtuse.



678 Prerequisite Skills

Extra Practice

Lesson 1-1

- 1. The Reyes family rode their bicycles for 9 miles to the park. The ride back was along a different route for 14 miles. How many miles did they ride in all?
- **2**. A farmer planted 389 acres of land with 78,967 corn plants. How many plants were planted per acre?
- **3.** A group of 251 people is eating dinner at a school fund-raiser. If each person pays \$8.00 for their meal, how much money is raised?
- 4. When Tamika calls home from college, she talks ten minutes per call for 3 calls per week. How many minutes does she call in a 15-week semester?
- 5. Darren runs at 6 feet per second and Kim runs at 7 feet per second. If they both start a race at the same time, how far apart are they after one minute?

Lesson 1-2				Pages 30–33
Write each power as	s a product of th	e same factor.		
1 . 13 ⁴	2. 9 ⁶		3. 1 ⁷	
4. 12 ²	5. 5 ⁸		6. 15 ⁴	
Evaluate each expre	ession.			
7. 5 ⁶	8. 17 ³	9. 2 ¹²	10. 3 ⁵	
11. 1 ⁴	12. 5 ³	13. 10 ²	14. 2 ⁸	
15. 8 ²	16. 7 ⁴	17. 20 ³	18 . 42 ³	
Write each product	in exponential f	form.		
19 . 2 • 2 • 2 • 2 • 2	20. 3 •	3	21 . 1 • 1 • 1 • 1 • 1 • 1	1
22 . 18 • 18 • 18 • 18	23 . 9 •	9•9•9•9•9•9•9•9	24 . 10 • 10 • 10 • 10	• 10 • 10
Lesson 1-3				Pages 34–37
Find the square of e	each number.			
1 . 4	2. 19	3. 13	4. 25	
5. 9	6. 2	7. 14	8. 24	
9. 40	10. 50	11. 100	12. 250	
Find each square ro	oot.			
13. $\sqrt{324}$	14. $\sqrt{900}$	15 . $\sqrt{2,500}$	16 . $\sqrt{576}$	
17. $\sqrt{8,100}$	18 . $\sqrt{676}$	19 . $\sqrt{100}$	20 . $\sqrt{784}$	
21. $\sqrt{1,024}$	22 . $\sqrt{841}$	23 . $\sqrt{2,304}$	24 . $\sqrt{3,025}$	

Evaluate each expression.

1 . $14 - (5 + 7)$	2 . $(32 + 10) - 5 \times 6$	3 . $(50-6) + (12+4)$
4 . 12 − 2 • 3	5. $16 + 4 \times 5$	6. $(5+3) \times 4 - 7$
7. $2 \times 3 + 9 \times 2$	8 . $6 \cdot (8+4) \div 2$	9. $7 \times 6 - 14$
10. $8 + (12 \times 4) \div 8$	11. $13 - 6 \cdot 2 + 1$	12 . (80 ÷ 10) × 8
13. $14 - 2 \cdot 7 + 0$	14. $156 - 6 \times 0$	15. $30 - 14 \cdot 2 + 8$
16. $3 \times 4 - 3^2$	17. $10^2 - 5$	18. $3 + (10 - 5 + 1)^2$
19. $(4+3)^2 \div 7$	20. 8×10^3	21. $10^4 \times 6$
22. 4.5×10^3	23. 1.8×10^2	24. $3 + 5(1.7 + 2.3)$
25. $4(3.6 + 5.4) - 9$	26. 10 + 3(6.1 + 3.7)	27 . 6(7.5 + 2.1) - 2.3
Lesson 1-5		Pages 42–43

Lesson 1-5

Use the guess and check strategy to solve each problem.

- 1. **NUMBERS** A number is divided by 3. Then 8 is added to the quotient. The result is 15. What is the number?
- **3. MONEY** A theater is charging \$5 for children under 12 and \$8 for everyone else. If the total for a group of people was \$36, how many people under the age of 12 were in the group?
- 5. **MONEY** Penny has 14 coins totaling \$1.55. She has one more nickel than she has dimes, and three less quarters than nickels. How many quarters, dimes, and nickels does she have if these are the only coin types she has?

- 2. **NUMBERS** Benny is thinking of two numbers. Their product is 32 and their difference is 4. Find the numbers.
- 4. **PLACE VALUE** Mindy wrote down a decimal number. The digit in the tenth's place is half the digit in the hundredth's place. If the product of the two digits is 18, what is the number?
- 6. **FRUIT** Mason places 4 apples and 3 oranges into each fruit basket he makes. If he has used 24 apples and 18 oranges, how many fruit baskets has he made?

Lesson 1-6

Pages 44-47

Evaluate each expression if $a = 3$, $b = 4$, $c = 12$, and $d = 1$.				
1 . <i>a</i> + <i>b</i>	2. $c - d$	3. $a + b + c$	4. <i>b</i> − <i>a</i>	
5. <i>c</i> – <i>ab</i>	6. $a + 2d$	7. $b + 2c$	8. <i>ab</i>	
9. <i>a</i> + 3 <i>b</i>	10. 6 <i>a</i> + <i>c</i>	11. $\frac{c}{d}$	12 . <i>abc</i>	
13. $2(a + b)$	14. $\frac{2c}{b}$	15. 144 – <i>abc</i>	16. 2 <i>ab</i>	
17. $\frac{b}{2}$	18. a^2	19. $c_2^2 - 100$	20. $a^3 + 3$	
21. $2b^2$	22. $b^3 + c$	23. $\frac{a^2}{d}$	24. $5a^2 + 2d^2$	
25. $\frac{4d^2}{b}$	26. $\frac{15}{a}$	27. $3a^2$	28. 10 <i>d</i> ³	
29. $\frac{ab}{c}$	30. $\frac{(a+b)}{d}$	31. 2.5 <i>b</i> + <i>c</i>	32. $\frac{10}{d}$	
33. $\frac{(2c+b)}{b}$	34. $\frac{(b^2+2d)}{a}$	35. $\frac{(2c+ab)}{c}$	36. $\frac{(3.5c+2)}{11}$	

1 . $b + 7 = 12$	2 . $a + 3 = 15$	3 . <i>s</i> + 10 = 23	4 . $9 + n = 13$
5. $20 = 24 - n$	6. $4x = 36$	7. $2y = 10$	8 . 15 = 5 <i>h</i>
9. $j \div 3 = 2$	10. $14 = w - 4$	11. $24 \div k = 6$	12 . $b - 3 = 12$
13. $c \div 10 = 8$	14. $6 = t \div 5$	15. $14 + m = 24$	16. $3y = 39$
17. $\frac{f}{2} = 12$	18. $16 = 4v$	19. $81 = 80 + a$	20. $9 = \frac{72}{x}$
21. $\overline{66} = 22m$	22. $77 - 12 = a$	23. 9 <i>k</i> = 81	24. $95 + d = 100$
25. $b = \frac{72}{6}$	26. <i>z</i> = 15 + 22	27 . 15 <i>b</i> = 225	28 . 43 + <i>s</i> = 57
29. $4w = 52$	30 . $e - 10 = 0$	31. $62 - d = 12$	32 . 14 <i>f</i> = 14
33. $48 \div n = 8$	34. $a - 82 = 95$	35. $\frac{x}{2} = 36$	36. $99 = c \div 2$

Lesson 1-8

Use the Distributive Property to evaluate each expression.				
1 . 3(4 + 5)	2. $(2+8)6$	3. $4(9-6)$		
4. 8(6 – 3)	5 . 5(200 - 50)	6. $20(3+6)$		
7 . (20 - 5)8	8 . 50(8 + 2)	9 . 15(1,000 - 200)		
10. 3(2,000 + 400)	11. 12(1,000 + 10)	12 . 7(1,000 - 50)		
Find each expression mentally. Justify each step.				
13 . (5 + 17) + 25	14 . 13 + (22 + 17)	15 . (8 + 18) + 92		
16. (11 + 32) + 9	17 . 4 + (15 + 76)	18 . (25 + 56) + 75		
19 . (4 • 21) • 25	20 . 5 • (40 • 8)	21 . (2 • 38) • 50		

23. $25 \cdot (12 \cdot 4)$ **24.** $(15 \cdot 9) \cdot 2$

Lesson 1-9

22. (12 • 7) • 5

Pages 57–61

Describe the relationshi	p between the terms in ea	ch arithmetic
sequence. Then write th	e next three terms in each	sequence.
1 . 5, 9, 13, 17,	2 . 3, 5, 7, 9,	3 . 10, 15, 2

1 . 5, 9, 13, 17,	2 . 3, 5, 7, 9,	3 . 10, 15, 20, 25,
4 . 90, 93, 96, 99,	5. 8, 14, 20, 26,	6 . 4.5, 5.4, 6.3, 7.2,
7 . 0.3, 0.4, 0.5,	8 . 2.3, 3.4, 4.5, 5.6,	9 . 8.9, 9.1, 9.3, 9.5,
10 . 3, 11, 19, 27,	11 . 350, 375, 400, 425,	12 . 620, 635, 650, 665,
13 . 2, 7, 12, 17,	14. 10, 17, 24, 31,	15 . 0, 7, 14, 21,
16 . 1, 7, 13, 19,	17 . 95, 101, 107, 113,	18 . 9, 90, 171, 252,
19 . 2.6, 2.8, 3.0, 3.2,	20 . 4.1, 4.6, 5.1, 5.6,	21 . 6.6, 7.7, 8.8, 9.9,
22 . 19.5, 21, 22.5, 24,	23 . 14.5, 14.8, 15.1, 15.4,	24 . 0.1, 0.4, 0.7, 1.0,

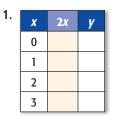
Extra Practice

Pages 49–52

Pages 53–56

Lesson 1-10

Copy and complete each function table. Then identify the domain and range.



3.	x	<i>x</i> – 2	у	l
	3			
	4			
	5			
	6			

2.	x	3 <i>x</i> + 1	y
	1		
	2		
	3		
	4		

4.	x	<i>x</i> + 0.1	y
	2		
	3		
	4		
	5		

Lesson 2-1

Write an integer for each situation.				
1. seven degrees be	1. seven degrees below zero 2. a loss of 3 pounds			
4 . a profit of \$25	5 . 112°F above 0		6 . 2,830 feet above sea level	
Graph each set of integers on a number line.				
7 . {-2, 0, 2}	8 . {1, 3, 5}	9 . {−2, −5, 3}	10. {7, −1, 4}	
Evaluate each expression.				
11 . 1	12. -8	13 . 0	14. -82	
15 . 64	16. -128	17 . −22 +5	18 . $ -40 - 8$	
19 . -18 + 10	20. $ -7 + -1 $	21. 98 - -5	22. $ -49 - -10 $	

Lesson 2-2

Pages 84-87

Pages 80-83

Replace each \bullet with < or > to make a true sentence.			
1 . 7 ● −7	2 . −8 ● 4	3 . −4 ● −9	4 . −3 ● 0
5 . 8 ● 10	6 . −5 ● −4	7 . 6 ● −7	8. −12 ● −13
9 . 3 ● 1	10 . −2 ● 2	11 . 7 ● −1	12 . −15 • −20
13 . −40 ● 30	14. 0 ● −3	15 . −5 ● 0	16. 85 ● −17

Order the integers from least to greatest.

17 2, -8, 4, 10, -6, -12	18 . 19, -19, -21, 32, -14, 18
19 . 18, 23, 95, -95, -18, -23, 2	20 . 46, -48, -47, -52, -18, 12
21 . 0, -10, -6, -8, 12	22 15, 18, -1, 0, 14, -20

Lesson 2-3

	pair for each point gra adrant or axis on whic		
1. A (3, -1), IV	2. <i>B</i>	3. <i>C</i>	
4 . D	5. <i>E</i>	6. <i>F</i>	
7 . G	8. <i>H</i>	9. I	
10. <i>J</i>	11. <i>K</i>	12. <i>L</i>	
On graph paper, di	raw a coordinate plan	e. Then graph and	label each point.
13 . <i>N</i> (-4, 3)	14 . <i>K</i> (2 <i>,</i> 5)	15 . W(−6, −2)	16. $X(5, 0)$
17. <i>Y</i> (4, −4)	18 . <i>M</i> (0, −3)	19. Z(-2, 0.5)	20. <i>S</i> (-1, -3)
21. <i>A</i> (0, 2)	22. C(-2, -2)	23 . <i>E</i> (0, 1)	24 . <i>G</i> (1, -1)
Lesson 2-4			Pages 95–99
Add.			
1 . $-4 + 8$	2. 14 + 16	:	3 7 + (-7)
4. $-9 + (-6)$	5 . $-18 + 1$	1	6. $-36 + 40$
7 . 42 + (-18)	8 42 + 2	9	9. 18 + (-32)
10. 12 + (-9)	11. $-24 + 9$	1.	2. $-7 + (-1)$
Evaluate each expr	ession if $a = 6, b = -2$	2, $c = -6$, and $d =$	3.
13 . −96 + <i>a</i>	14. $b + (-5)$) 1	5. $c + (-32)$
16 . <i>d</i> + 98	17 120 +	b 18	8. $-120 + c$
19 . 5 + <i>b</i>	20. <i>a</i> + <i>d</i>	2	1. <i>c</i> + <i>a</i>
22. $d + (-9)$	23 . <i>b</i> + <i>c</i>	24	4. $d + c$
Lesson 2-5			Pages 103–106
Subtract.			
1. 3 – 7	2 . $-5-4$:	3 . −6 − 2
4. 8 – 13	5. $6 - (-4)$)	6 . 12 – 9
7 . −2 − 23	8. 63 – 78	9	9. $0 - (-14)$
10. 15 – 6	11. 18 – 20	1	2 . $-5-8$
13 . 21 - (-37)	14. $-60 - 3$	2 1	5 . 57 – 63
Evaluate each expr	ession if $k = -3$, $p =$	6, <i>n</i> = 1, and <i>d</i> = -	-8.
16. 55 - k	17 . <i>p</i> – 7	1	8 . <i>d</i> − 15
19 . <i>n</i> − 12	20. $-51 - d$	2	1 . <i>k</i> − 21

22. <i>n</i> – <i>k</i>	23 99 - k	24 . <i>p</i> - <i>k</i>
25. $d - (-1)$	26. <i>k</i> – <i>d</i>	27 . <i>n</i> – <i>d</i>

Extra Practice 683

Multiply

winnpry.			
1 . 5(-2)	2 . 6(-4)	3. 4(21)	4 11(-5)
5 6(5)	6 50(0)	7 5(-5)	8 4(8)
9 . 3(-13)	10 . 12(-5)	11 9(-12)	12. 15(-8)
13. $(-6)^2$	14. $(-2)^2$	15. $(-4)^3$	16. $(-5)^3$
Evaluate each expression if $a = -5$, $b = 2$, $c = -3$, and $d = 4$.			
17 . −2 <i>d</i>	18. 6 <i>a</i>	19 . <i>3ab</i>	20. -12 <i>d</i>
21. $-4b^2$	22 . –5 <i>cd</i>	23. a^2	24. 13 <i>ab</i>

Lesson 2-7

in week 6?

Pages 112-113

Solve using the *look for a pattern* strategy.

 NUMBERS Determine the next three numbers in the pattern below.
 15, 21, 27, 33, 39, ...

3. MONEY The table shows Abigail's

what will be the total amount

Week

1

2

3

4

5

6

savings. If the pattern continues,

Total (\$)

\$400

\$800

\$1,200

\$1,600

\$2,000

2. TIME Determine the next two times in the pattern below.

2:30 A.M., 2:50 A.M., 3:10 A.M., 3:30 A.M., ...

4. **SCIENCE** A single rotation of Earth takes about 24 hours. Copy and complete the table to determine the number of hours in a week.

Number of Days	Number of Hours
1	24
2	48
3	72
4	
5	
6	
7	

Pages 114–118

Lesson 2-8

Divide.			
1 . $4 \div (-2)$	2 . 16 ÷ (−8)	3 . −14 ÷ (−2)	4. $\frac{32}{8}$
5 . 18 ÷ (−3)	6 . −18 ÷ 3	7. $8 \div (-8)$	8 . $0 \div (-1)$
9 . −25 ÷ 5	10. $\frac{-14}{-7}$	11. $-32 \div 8$	12 . $-56 \div (-8)$
13 . −81 ÷ 9	14 . $-42 \div (-7)$	15 . 121 ÷ (−11)	16 . $-81 \div (-9)$
17 . 18 ÷ (−2)	18 . $\frac{-55}{11}$	19. $\frac{25}{-5}$	20 . −21 ÷ 3
Evaluate each expression if $a = -2$, $b = -7$, $x = 8$, and $y = -4$.			·•

21. $-64 \div x$	22. $\frac{16}{y}$	23. <i>x</i> ÷ 2	24. $\frac{a}{2}$
25. $ax \div y$	26. $\frac{bx}{y}$	27 . 2 <i>y</i> ÷ 1	28. $\frac{x}{ay}$
29 . − <i>y</i> ÷ <i>a</i>	30. $x^2 \div y$	31. $\frac{ab}{1}$	32. $\frac{xy}{a}$

Lesson 3-1

3. the quotient of *a* and *b*

9. the difference of *f* and 9

6. \$1,000 divided by *z*

12. two less than x

Write each phrase as an algebraic expression.

- 1. six less than *p* 2. twenty more than *c*
- 4. Juana's age plus 6
- 5. *x* increased by twelve

11. 19 decreased by z

8. the product of 7 and *m*

- **7**. 3 divided into *y*
- **10**. twenty-six less q

Write each sentence as an algebraic equation.

- **13**. Three times a number less four is 17. **1**
- Twenty more than twice a number is −30.
- **17**. Four plus three times a number is 18.
- **19**. Eight times a number plus twelve is 36.
- Lesson 3-2

- 14. The sum of a number and 6 is 5.
- **16.** The quotient of a number and -2 is -42.
- **18**. Five times a number minus 15 is 92.
- **20**. The difference of a number and 24 is -30.

Pages 136-141

	y o di o o i	
1 . $r - 3 = 14$	2 . $t + 3 = 21$	3. $s + 10 = 23$
4. $7 + a = -10$	5. $14 + m = 24$	6. $-9 + n = 13$
7. $s - 2 = -6$	8. $6 + f = 71$	9. $x + 27 = 30$
10. $a - 7 = 23$	11. $-4 + b = -5$	12. $w + 18 = -4$
13 . $k - 9 = -3$	14. $j + 12 = 11$	15. $-42 + v = -42$
16. $s + 1.3 = 18$	17. $x + 7.4 = 23.5$	18. $p + 3.1 = 18$
19. $w - 3.7 = 4.63$	20. $m - 4.8 = 7.4$	21. $x - 1.3 = 12$
22 . $y + 3.4 = 18$	23. $7.2 + g = 9.1$	24. $z - 12.1 = 14$
25. $v - 18 = 13.7$	26. $w - 0.1 = 0.32$	27. $r + 6.7 = 1.2$

Lesson 3-3

Solve each equation. Check your solution.

1 . 2 <i>m</i> = 18	2 . $-42 = 6n$	3 . $72 = 8k$
4. $-20r = 20$	5. $420 = 5s$	6. $325 = 25t$
7 . $-14 = -2p$	8 . 18 <i>q</i> = 36	9 . 40 = 10 <i>a</i>
10. 100 = 20 <i>b</i>	11 . 416 = 4 <i>c</i>	12. $45 = 9d$
13. 0.5 <i>m</i> = 3.5	14. $1.8 = 0.6x$	15. $0.4y = 2$
16. $1.86 = 6.2z$	17. $-8x = 24$	18. $8.34 = 2r$
19. $1.67t = 10.02$	20. 243 = 27 <i>a</i>	21. $0.9x = 4.5$
22. $4.08 = 1.2y$	23 . 8 <i>d</i> = 112	24 . 5 <i>f</i> = 180.5
25 . 59.66 = 3.14 <i>m</i>	26 . $98.4 = 8p$	27. $208 = 26k$

Pages 142-146

Lesson 3-4

Use the work backward strategy to solve each problem.

- 1. **NUMBERS** A number is divided by 2. Then 4 is added to the quotient. Next, the sum of these numbers is multiplied by 3. The result is 21. Find the number.
- 3. TIME Timothy gets to school at 9:00 A.M. It takes him 45 minutes to get ready and 25 minutes for him to walk to the school. At what time did Timothy get up?
 did she have initially?
 4. LOGIC A small container has 4 tennis balls inside of it. There are 6 of these small boxes inside a medium sized box. There are 8 medium sized boxes
- 5. **FOOD** After four days, 0.5 pound of lunch meat was left in the refrigerator. If half this amount was eaten on each of the previous four days, how much lunch meat was initially in the refrigerator?
- Lesson 3-5

Lesson 3-6

- MONEY Holly spent \$13.76 on a birthday present for her mom. She also spent \$3.25 on a snack for herself. If she now has \$7.74, how much money did she have initially?
- 4. **LOGIC** A small container has 4 tennis balls inside of it. There are 6 of these small boxes inside a medium sized box. There are 8 medium sized boxes inside each large box, and there are 100 large boxes shipped in a large semi-truck. How many tennis balls are on the truck?

3. -10 + 2d = 8

6. 5t - 4 = 6

9. 15 = 6y + 3

12. 13 + 3p = 7

15. -9m - 9 = 9

21. 2g - 16 = -9

24. 8z + 15 = -1

27. 1.1i + 2 = 7.5

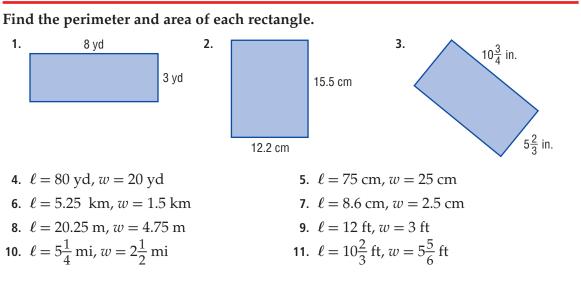
18. -0.25x + 0.5 = 4

Pages 151-155

Solve each equation. Check your solution.

1. 3x + 6 = 62. 2r - 7 = -14. 2b + 4 = -85. 5w - 12 = 37. 2q - 6 = 48. 2g - 3 = -9**10.** 3s - 4 = 8**11.** 18 - 7f = 4**13.** 7.5r + 2 = -2814. 4.2 + 7z = 2.8**16.** 32 + 0.2c = 117. 5t - 14 = -14**19.** 5w - 4 = 8**20.** 4d - 3 = 9**22.** 4k + 13 = 20**23.** 7 = 5 - 2x**25.** 92 - 16b = 12**26.** 14e + 14 = 28

Pages 156–161



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Extra Practice

Page

Pages 181–184

Graph the function represented by the table.

1.	Total Cost of Tennis Balls			
	Number of Tennis Balls Total Cost (
	3	6		
	4	8		
	5	10		
	6	12		

2.	Convert Gallons to Quarts			
	Gallon Quarts			
	1	4		
	2	8		
	3	12		
	4	16		

Graph each equation.

3 . $y = 3x$	4. $y = 2x + 3$	5. $y = -x$
6. $y = 0.5x + 2$	7. $y = -x + 3$	8. $y = 0.25x + 6$
9. $y = -3x + 6$	10. $y = -x + 1$	11. $y = 5 - 0.5x$

Lesson 4-1

Determine whether each number is *prime* or *composite*.

1.	32	2.	41	3.	52
4.	21	5.	71	6.	102
7.	239	8.	93	9.	123
Fin	d the prime factorization	of	each number.		
10.	81	11.	72	12.	144
13.	245	14.	423	15.	525
16.	750	17.	914	18.	975
Fac	tor each expression.				
19.	35 <i>xy</i>	20.	$14a^2$	21.	30 <i>n</i>
22.	27 <i>c</i> d ²	23.	$4s^2t^2$	24.	$60p^2qr$

Lesson 4-2

Find the GCF of each set of numbers.

1 . 12, 16	2. 63, 81	3 . 225, 500
4. 37, 100	5. 32, 240	6. 412, 640
7. 36, 81	8 . 140, 350	9 . 72, 170
10 . 12, 18, 42	11 . 24, 56, 120	12. 48, 60, 84
13 . 32, 80, 96	14 . 14, 49, 70	15 . 8, 10, 20

Find the GCF of each set of expressions.

16. 18 <i>b</i> , 24 <i>b</i>	17. 2 <i>a</i> , 3 <i>a</i>	18 . 5 <i>n</i> , 5 <i>mn</i>
19. 12 <i>cd</i> , 24 <i>c</i>	20. $30x, 50x^2$	21. 15 <i>az</i> , 25 <i>az</i>
22. 2 <i>c</i> , 4 <i>ac</i> , 8 <i>a</i>	23. d , $6c^2d$, $12d$	24 . 10 <i>ab</i> , 15 <i>bc</i> , 20 <i>b</i> ²

Pages 186-189

Lesson 4-3

Use the *make a list* strategy to solve each problem.

 FOOD The table shows the choices for ordering a deli sandwich at The Sandwich Shop. How many different subs could be made using one choice from just bread and meat?

The Sandwich Shop		
Bread	White, Wheat, Whole Grain	
Meat Ham, Turkey, Roast Beef		
Cheese	American, Swiss	
Dressing	Italian, Ranch	

- 2. SHOPPING Charmaine went to the store and bought a yellow shirt, a blue shirt, and a red shirt. She also bought a pair of jeans and a pair of khaki dress pants. How many different outfits can be made using one shirt and one pair of pants?
- **3. WORK** The following five numbers are used for employee identification numbers at a small company: 0, 1, 2, and 3. How many different employee identification numbers can be made?

Lesson 4-4	Lesson 4-4 Pages 192–19				
Write each f	raction in simple	st form.			
1. $\frac{14}{28}$	2. $\frac{15}{25}$	3. $\frac{100}{130}$	4. $\frac{14}{35}$	5. $\frac{9}{51}$	
6. $\frac{54}{56}$	7. $\frac{75}{90}$	8. $\frac{24}{40}$	9. $\frac{180}{270}$	10. $\frac{312}{390}$	
11. $\frac{240}{448}$	12. $\frac{71}{82}$	13. $\frac{333}{900}$	14. $\frac{85}{255}$	15. $\frac{84}{128}$	
16. $\frac{64}{96}$	17 . $\frac{99}{99}$	18. $\frac{3}{99}$	19. $\frac{44}{55}$	20. $\frac{57}{69}$	
21 . $\frac{15}{37}$	22. $\frac{204}{408}$	23. $\frac{5}{125}$	24. $\frac{144}{216}$	25. $\frac{15}{75}$	

Lesson 4-5

Pages 196-200

Write each fraction or mixed number as a decimal. Use bar notation if the decimal is a repeating decimal.

1. $\frac{16}{20}$	2. $\frac{30}{120}$	3. $1\frac{7}{8}$	4. $\frac{1}{6}$
5. $\frac{11}{40}$	6. $5\frac{13}{50}$	7. $\frac{55}{300}$	8. $1\frac{1}{2}$
1. $\frac{16}{20}$ 5. $\frac{11}{40}$ 9. $\frac{5}{9}$	10. $2\frac{3}{4}$	11. $\frac{9}{11}$	12. $4\frac{1}{9}$

Write each decimal as a fraction or mixed number in simplest form.

13 . 0.26	14 . 0.75	15. 0.4	16. 0.1
17. 4.48	18. 9.8	19 . 0.91	20 . 11.15

Lesson 4-6

Write each ratio as	a percent.			
1 . 39 out of 100	2. $\frac{23}{100}$		3 . 17:100	
4 . 72 per 100	5. 4 to 1	100	6 . 98 in 100	
Write each fraction	n as a percent.			
7. $\frac{1}{2}$	8. $\frac{2}{5}$	9. $\frac{60}{100}$	10. $\frac{17}{20}$	
11. $\frac{7}{25}$	12. $\frac{1}{20}$	13. $\frac{8}{100}$	14. $\frac{\frac{7}{7}}{7}$	
	-0		/	
15. $\frac{9}{10}$	16. $\frac{1}{100}$	17. $\frac{50}{50}$	18. $\frac{49}{50}$	
Write each percent	t as a fraction in sir	nplest form.		
19. 12%	20. 23%	21. 1%	22. 94%	
23. 36%	24. 4%	25. 72%	26. 100%	
27. 65%	28. 47%	29. 15%	30. 48%	
Lesson 4-7			Down 20	VC 210
			Pages 20	10-210
Write each percent	t as a decimal.			
1. 42%	2. 100%	3. 8%	4. 20%	
5. 35%	6. 3%	7. 62%	8. 50%	
9. 28%	10. 87%	11. 7.5%	12 . 87.5%	
13. 1.8%	14. 99.9%	15. $85\frac{1}{4}\%$	16. $24\frac{1}{2}\%$	
17. $64\frac{4}{5}\%$	18. $36\frac{3}{4}\%$	19. $1\frac{1}{5}$ %	16. $24\frac{1}{2}\%$ 20. $2\frac{1}{2}\%$	
Write each decima	l as a percent.			
21 . 0.16	22. 0.1	23 . 0.5	24. 0.98	
25 . 0.31	26. 0.76	27. 0.07	28. 0.8	
29 . 0.07	30 . 0.10	31 . 0.90	32 . 1.00	
33. 0.666	34. 0.725	35. 0.138	36 . 0.899	

Lesson 4-8

37. 0.256

Find the LCM of each set of numbers.

38. 0.038

1 . 4, 9	2 . 6, 16	3. 24, 36	4 . 48, 84
5 . 8, 9	6 . 49, 56	7. 42,66	8 . 15, 39
9 . 56, 64	10. 24, 42	11. 80, 250	12 . 16, 24
13 . 13, 14	14 . 36, 48	15 . 10, 100	16 . 25, 200
17. 1, 2, 5	18 . 2, 3, 7	19. 1, 9, 27	20 . 2, 24, 36
21 . 7, 21, 35	22 . 12, 18, 28	23 . 32, 80, 96	24 . 5, 18, 45
25 . 11, 22, 33	26 . 35, 70, 140	27 . 25, 200, 400	28 . 100, 200, 300

39. 0.0525

Pages 202-205

Pages 211-214

40. 0.017

Lesson 4-9

Replace each \bullet with < , >, or = to make a true sentence.

1. $-\frac{1}{5} \bullet -\frac{3}{5}$	2 . $-\frac{7}{8} \bullet -\frac{5}{8}$	3. $-\frac{1}{6} \bullet -\frac{5}{6}$	4. $-\frac{3}{4} \bullet -\frac{1}{4}$
5. $-2\frac{1}{4} \bullet -2\frac{2}{8}$	6. $-4\frac{3}{7} \bullet -4\frac{2}{7}$	7. $-1\frac{4}{9} \bullet -1\frac{8}{9}$	8. $-3\frac{4}{5} \bullet -3\frac{2}{5}$
9. $\frac{7}{9} \bullet \frac{3}{5}$	10. $\frac{14}{25} \bullet \frac{3}{4}$	11. $\frac{8}{24} \bullet \frac{20}{60}$	12. $\frac{5}{12} \bullet \frac{4}{9}$
13 . $\frac{18}{24} \bullet \frac{10}{18}$	14. $\frac{4}{6} \bullet \frac{5}{9}$	15. $\frac{11}{49} \bullet \frac{12}{42}$	16. $\frac{5}{14} \bullet \frac{2}{6}$

Order each set of numbers from least to greatest.

17. 70%, 0.6, $\frac{2}{3}$	18. 0.8, $\frac{17}{20}$, 17%	19. $\frac{61}{100}$, 0.65, 61.5%
20. $0.\overline{42}, \frac{3}{7}, 42\%$	21 . 2.15, 2.105, 2 $\frac{7}{50}$	22 . 7 $\frac{1}{8}$, 7.81, 7.18

Lesson 5-1

Estimate.		
1. $\frac{3}{7} + \frac{6}{8}$	2. $\frac{3}{9} + \frac{7}{8}$	3. $\frac{1}{8} + \frac{8}{9}$
4. $3\frac{1}{8} + 7\frac{6}{7}$	5. $4\frac{2}{3} + 6\frac{7}{8}$	6. $3\frac{2}{3} \times 2\frac{1}{3}$
7. $\frac{4}{5} \cdot 3$	8. $9\frac{7}{8} - 6\frac{2}{3}$	9. $\frac{3}{7} - \frac{1}{15}$
10. $\frac{3}{4} \cdot \frac{7}{8}$	11. $7\frac{1}{4} \div \frac{2}{3}$	12. $\frac{5}{6} \div \frac{2}{3}$
13. $9\frac{3}{5} + 3\frac{1}{8}$	14. $5\frac{1}{3} - 2\frac{3}{4}$	15. $13\frac{7}{8} - 2\frac{1}{3}$
16. $\frac{13}{15} \cdot \frac{3}{8}$	17. $\frac{1}{9} \div 2$	18. $\frac{5}{8} - \frac{1}{16}$
19. $9\frac{2}{3} + 4\frac{7}{8}$	20. $\frac{1}{2} \cdot 25$	21. $35\frac{1}{3} \div 6\frac{3}{4}$

Lesson 5-2

Ad	Add or subtract. Write in simplest form.				
1.	$\frac{5}{11} + \frac{9}{11}$	2. $\frac{5}{8} - \frac{1}{8}$	3. $\frac{7}{10} + \frac{7}{10}$		
4.	$\frac{9}{12} - \frac{5}{12}$	5. $\frac{2}{9} + \frac{1}{3}$	6. $\frac{1}{2} + \frac{3}{4}$		
7.	$\frac{1}{4} - \frac{3}{12}$	8. $\frac{3}{7} + \frac{6}{14}$	9. $\frac{1}{4} + \frac{3}{5}$		
10.	$\frac{4}{9} + \frac{1}{2}$	11. $\frac{5}{7} - \frac{4}{6}$	12. $\frac{3}{4} - \frac{1}{6}$		
13.	$\frac{3}{5} + \frac{3}{4}$	14. $\frac{2}{3} - \frac{1}{8}$	15. $\frac{9}{10} + \frac{1}{3}$		
Evaluate each expression if $a = \frac{2}{3}$ and $b = \frac{7}{12}$.					
	$\frac{1}{5} + a$	17. $a - \frac{1}{2}$	18. $b + \frac{7}{8}$		
19.	$\frac{7}{8}-a$	20. <i>a</i> + <i>b</i>	21 . <i>a</i> – <i>b</i>		

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Pages 230-235

Pages 242-246

Add or subtrac	t. Write in	n simplest form.

1. $2\frac{1}{3} + 1\frac{1}{3}$	2. $5\frac{2}{7} - 2\frac{3}{7}$	3. $6\frac{3}{8} + 7\frac{1}{8}$
4. $2\frac{3}{4} - 1\frac{1}{4}$	5. $5\frac{1}{2} - 3\frac{1}{4}$	6. $2\frac{2}{3} + 4\frac{1}{9}$
7. $7\frac{4}{5} + 9\frac{3}{10}$	8. $3\frac{3}{4} + 5\frac{5}{8}$	9. $10\frac{2}{3} + 5\frac{6}{7}$
10. $17\frac{2}{9} - 12\frac{1}{3}$	11. $6\frac{5}{12} + 12\frac{5}{12}$	12. $7\frac{1}{4} + 15\frac{5}{6}$
13. $6\frac{1}{8} + 4\frac{2}{3}$	14. $7 - 6\frac{4}{9}$	15. $8\frac{1}{12} + 12\frac{6}{11}$
16. $7\frac{2}{3} + 8\frac{1}{4}$	17. $12\frac{3}{11} + 14\frac{3}{13}$	18. $21\frac{1}{3} + 15\frac{3}{8}$
19. $19\frac{1}{7} + 6\frac{1}{4}$	20. $9\frac{2}{5} - 8\frac{1}{3}$	21. $18\frac{1}{4} - 3\frac{3}{8}$
22. $1\frac{1}{8} + 2\frac{1}{12}$	23. $2\frac{1}{12} - 1\frac{1}{8}$	24. $10 - \frac{2}{3}$

Lesson 5-4

Eliminate possibilities to solve each problem.

- TRAINS A train passes through an intersection at the rate of 3 cars per 30 seconds. Assume that it takes 5 minutes for the train to completely pass through the intersection. How many cars does the train have altogether?
 - A 6 cars
 - **B** 15 cars
 - **C** 30 cars
 - D 45 cars

Lesson 5-5

Multiply. Write in simplest form.				
1. $\frac{2}{3} \times \frac{3}{5}$	2. $\frac{1}{6} \times \frac{2}{5}$	3. $\frac{4}{9} \times \frac{3}{7}$	4. $\frac{5}{12} \times \frac{6}{11}$	
5. $\frac{3}{8} \times \frac{8}{9}$	6. $\frac{2}{5} \times \frac{5}{8}$	7. $\frac{7}{15} \times \frac{3}{21}$	8. $\frac{5}{6} \times \frac{15}{16}$	
9. $\frac{2}{3} \times \frac{3}{13}$	10. $\frac{4}{9} \times \frac{1}{6}$	11. $3 \times \frac{1}{9}$	12. $5 \times \frac{6}{7}$	
13 . $\frac{3}{5} \times 15$	14. $3\frac{1}{2} \times 4\frac{1}{3}$	15. $\frac{4}{5} \times 2\frac{3}{4}$	16. $6\frac{1}{8} \times 5\frac{1}{7}$	
17. $2\frac{2}{3} \times 2\frac{1}{4}$	18. $\frac{7}{8} \times 16$	19. $5\frac{1}{5} \times 2\frac{1}{2}$	20. $7 \times \frac{1}{14}$	
21. $22 \times \frac{3}{11}$	22. $8\frac{2}{3} \times 1\frac{1}{2}$	23. $4 \times 6\frac{1}{2}$	24. $\frac{1}{2} \times 10\frac{2}{3}$	
25. $\frac{2}{3} \times 21\frac{1}{3}$	26. $\frac{7}{8} \times \frac{8}{7}$	27. $21 \times \frac{1}{2}$	28. $11 \times \frac{1}{4}$	

- PIZZA A pizza shop used 100 pounds of pizza dough to make 125 pizzas. If a large pizza requires 1 pound of dough and a medium pizza requires ¹/₂ pound, how many large and medium-sized pizzas were made?
 - F 40 large, 85 medium
 - G 65 large, 60 medium
 - H 55 large, 70 medium
 - J 75 large, 50 medium
- Pages 256-257

Find the multiplicative inverse of each number.			
1. $\frac{2}{3}$	2. $\frac{5}{4}$	3. 1	4. 10
5. $\frac{1}{7}$	6. $\frac{9}{16}$	7. $1\frac{1}{3}$	8. $3\frac{3}{4}$
9. $7\frac{3}{8}$	10. $6\frac{2}{5}$	11. $33\frac{1}{3}$	12. $66\frac{2}{3}$
Solve each equation. Check your solution.			
13 . $\frac{a}{13} = 2$	14. $\frac{8}{9}x = 24$	15. $\frac{3}{8}r = 36$	16. $\frac{3}{4}t = \frac{1}{2}$
17. $16 = \frac{h}{4}$	18. $\frac{m}{8} = 12$	19. $\frac{5}{8}n = 45$	20. $10 = \frac{b}{10}$
21. $\frac{1}{7}x = 7$	22. $5 = \frac{1}{5}y$	23 . $\frac{4}{3}m = 28$	24. $\frac{2}{3}z = 20$
25. $\frac{c}{9} = 81$	26. $\frac{m}{9} = 9$	27. $16 = \frac{4}{9}f$	28 . $\frac{15}{8}x = 225$

Lesson 5-7

Divide. Write in simplest form.			
1. $\frac{2}{3} \div \frac{3}{2}$	2. $\frac{3}{5} \div \frac{2}{5}$	3. $\frac{7}{10} \div \frac{3}{8}$	
4. $\frac{5}{9} \div \frac{2}{5}$	5. $4 \div \frac{2}{3}$	6. $8 \div \frac{4}{5}$	
7. $9 \div \frac{5}{9}$	8. $\frac{2}{7} \div 2$	9. $\frac{1}{14} \div 7$	
10. $15 \div \frac{3}{5}$	11. $\frac{9}{14} \div \frac{3}{4}$	12 . $\frac{7}{8} \div 10$	
13. $16 \div \frac{3}{4}$	14. $\frac{3}{8} \div 2\frac{1}{2}$	15. $5\frac{1}{2} \div 2\frac{1}{2}$	
16. $3\frac{1}{4} \div 5\frac{1}{2}$	17. $12\frac{5}{6} \div 2\frac{1}{6}$	18. $7\frac{1}{2} \div 3\frac{1}{2}$	

Lesson 6-1

Pages 282-286

Pages 265-270

LUNCH Use the survey results to write each ratio as a fraction in simplest form.

- 1. fish sticks:macaroni and cheese
- 2. pizza:macaroni and cheese
- 3. all votes: macaroni and cheese
- 4. pizza: all votes
- 5. other:hamburger

Favorite School Lunch	Votes
Pizza	64
Hamburger	15
Macaroni and Cheese	14
Fish Sticks	4
Other	3

Determine whether the following ratios are equivalent. Explain.

- **6**. 4 out of 6 balloons popped, 8 out of 12 balloons popped
- 7. 20 out of 25 students agree,
 - 16 out of 30 students agree

Lesson 6-2

Find each unit rate. Round to the nearest hundredth if necessary.

- 1. \$240 for 4 days
- **3**. 500 miles in 10 hours
- 5. 32 people in 8 cars
- 7. 245 tickets in 5 days
- 9. 60 people in 4 rows
- **11**. 20 people in 4 groups
- **13**. 45 miles in 60 minutes
- **15**. 360 miles for 12 gallons
- **17**. 24 cups for \$1.20
- **19**. \$60 for 5 books

Lesson 6-3

Complete.

- 2. 250 people in 5 buses
- 4. 18 cups for 24 pounds
- **6**. \$4.50 for 3 dozen
- 8. 12 classes in 4 semesters
- **10**. 48 ounces in 3 pounds
- **12**. 1.5 pounds for \$3.00
- 14. \$5.50 for 10 disks
- **16**. \$8.50 for 5 yards
- **18**. 160 words in 4 minutes
- **20**. \$24 for 6 hours

Pages 294-299

22. $3\frac{1}{8}c = 11$ fl oz	23. $2\frac{1}{4}$ mi = ft	24. $3\frac{2}{3}T = 1b$
19 . 7,480 yd = mi	20. $12\frac{1}{2}$ lb = oz	21. $7\frac{1}{2}$ qt = pt
16 . 13,200 ft = mi	17. 120 oz = lb	18. $9\frac{1}{4}$ gal = \blacksquare qt
13 . 10 gal = qt	14. $4 qt = \prod_{i=1}^{4} fl oz$	15. $4 \text{ pt} = \mathbf{c}$
10 . 10 pt = qt	11. $2\frac{1}{4}c = \prod fl oz$	12 . 6 lb = oz
7. 3 gal = 🔤 pt	8. $24 \text{ fl oz} = 100 \text{ c}$	9 . 8 pt = c
4 . 12,000 lb = ■ T	5. $\frac{1}{4}$ lb = oz	6. $12 \text{ pt} = c$
1. $4,000 \text{ lb} = T$	2. $5 T = lb$	3 . 5 lb = oz

Complete. Round to the nearest hundredth if necessary.

1 . $400 \text{ mm} = 100 \text{ cm}$	2. $4 \text{ km} = 100 \text{ m}$	3 . 660 cm = m
4. $0.3 \text{ km} = 100 \text{ m}$	5. $30 \text{ mm} = 100 \text{ cm}$	6 . 84.5 m = km
7. $m = 54 \text{ cm}$	8 . 18 km = cm	9 . mm = 45 cm
10. $4 \text{ kg} = 2 \text{ g}$	11. 632 mg = g	12 . 4,497 g = kg
13 . $mg = 0.51 \text{ kg}$	14. $0.63 \text{ kg} = 100 \text{ g}$	15 . k g = 563 g
16. $662 \text{ m} = 100 \text{ km}$	17. 5,283 mL = L	18 . 0.24 cm = mm
19 . 380 kL = L	20. $10.8 \text{ g} = 1000 \text{ mg}$	21 . 83,000 mL = L
22 . 56 in. ≈ cm	23 . 32.8 ft. ≈ m	24 . 609 yd ≈ ■ m
25 . 21.78 mi ≈ k m	26. $48 \text{ lb} \approx \blacksquare \text{g}$	27 . 2.3 T ≈ kg
28 . 8.5 c ≈ mL	29 . 33 gal ≈ L	30 . $1.8 \text{ qt} \approx 100 \text{ mL}$
31 . 11.3 cm \approx in.	32 . 15.6 m ≈ 1 ft	33 . 92.5 m ≈ y d
34 . 117 km ≈ m i	35 . 220 kg ≈ ∎ lb	36 . 770 mL ≈ c
37 . 1,088 mL ≈ ■ pt	38 . 3,000 mL ≈ ■ qt	39 . 99.5 L ≈ ■ gal

Lesson 6-5

Determine if the quantities in each pair of ratios are proportional. Explain.

- 1. MONEY 2 coins for every 3 bills and 6 coins for every 9 bills
- 2. SCALE 3 feet for every 1 in and 15 feet for every 6 in
- 3. FAMILY 2 children for every 1 adult and 8 children for every 3 adults
- 4. TRAVEL 1 hour for every 60 miles and 6 hours for every 360 miles
- **5. SHOPPING** 4 for \$1.60 and 9 for \$3.40
- 6. HOTEL \$159.95 for 1 night stay and \$315.90 for two night stay

Solve each proportion.

7. $\frac{u}{72} = \frac{2}{4}$	8. $\frac{12}{m} = \frac{15}{10}$	9. $\frac{36}{90} = \frac{16}{t}$
10. $\frac{g}{32} = \frac{8}{64}$	11. $\frac{5}{14} = \frac{10}{a}$	12. $\frac{k}{18} = \frac{5}{3}$
13. $\frac{15}{w} = \frac{60}{4}$	14. $\frac{81}{90} = \frac{y}{20}$	15. $\frac{45}{8} = \frac{36}{d}$
16. $\frac{125}{v} = \frac{20}{5}$	17. $\frac{4}{5} = \frac{x}{3}$	18. $\frac{45}{75} = \frac{j}{3}$

Lesson 6-6

Pages 314–315

Use the draw a diagram strategy to solve the following problems.

- 1. **DISTANCE** Alejandro and Pedro are riding their bikes to school. After 2 miles, they are $\frac{4}{5}$ of the way there. How much farther do they have to go?
- **3. RACES** Four girls are in a race. Anna is just ahead of Pilar. Pilar is two places behind Isabela. Isabela is a few seconds behind the leader, Mary. Place the girls in order from first to last.
- 2. **CARPENTRY** Six inches were cut from a board that is now 12 inches long. The board this piece was cut from is one of 4 boards of equal length cut from the original piece. How long was the original piece?
- 4. **FRACTIONS** Marta ate a quarter of a whole pie. Edwin ate $\frac{1}{4}$ of what was left. Cristina then ate $\frac{1}{3}$ of what was left. What fraction of the pie remains?

Lesson 6-7

Pages 316-322

On a map, the scale is 1 inch = 50 miles. For each map distance, find the actual distance.

1. 5 inches	2 . 12 inches	3. $2\frac{3}{8}$ inches	4 . $\frac{4}{5}$ inch
5. $2\frac{5}{6}$ inches	6 . 3.25 inches	7 . 4.75 inches	8. 5.25 inches

On a scale drawing, the scale is $\frac{1}{2}$ inch = 2 feet. Find the dimensions of each room in the scale drawing.

9 . 14 feet by 18 feet	10 . 32 feet by 6 feet
11 . 3 feet by 5 feet	12 . 20 feet by 30 feet

1. 32%	2. 89%	3. 72%	4. 11%
5. 1%	6. 28%	7. 55%	8. 18.5%
9. 22.75%	10. 25.2%	11. 75.5%	12. 48.25%
13. 6.5%	14. 1.25%	15 . 88.9%	16. $52\frac{1}{4}\%$

Write each fraction as a percent. Round to the nearest hundredth if necessary.

17. $\frac{14}{25}$	18. $\frac{28}{50}$	19. $\frac{14}{20}$	20. $\frac{7}{10}$
21. $\frac{17}{17}$	22. $\frac{80}{125}$	23. $\frac{9}{12}$	24. $\frac{4}{6}$
25. $\frac{11}{12}$	26. $\frac{9}{16}$	27. $\frac{8}{9}$	28. $\frac{3}{16}$
29. $\frac{5}{32}$	30. $\frac{1}{16}$	31. $\frac{8}{15}$	32. $\frac{9}{11}$

Lesson 6-9

Write each percent as a decimal and as a mixed number or fraction in simplest form.

1. 895%	2. 555%	3. 480%	4. 920%		
5. 122%	6. 825%	7. 0.3%	8. 0.42%		
9. 0.78%	10. 765%	11. 0.99%	12. 1,000%		
Write each deci	mal as a percent.				
13. 3.5	14. 12	15. 0.002	16 . 6.78		
17. 0.0056	18. 1.95	19. 0.0077	20 . 0.0102		
21. 14.0	22. 0.0064	23. 16.2	24. 44.3		
Write each mixed number or fraction as a percent.					
25. $\frac{1}{250}$	26. $\frac{7}{400}$	27. $1\frac{1}{4}$	28. $7\frac{9}{10}$		

25. $\frac{1}{250}$	26. $\frac{7}{400}$	27. $1\frac{1}{4}$	28. $7\frac{9}{10}$
29. $\frac{9}{10}$	30. $\frac{1}{500}$	31. $12\frac{1}{2}$	32. $\frac{1}{1,000}$
33. $4\frac{3}{4}$	34. 25	35. 900	36. $18\frac{2}{5}$

Lesson 7-1

Find each number. Round to the nearest tenth if necessary.

1.	5% of 40	2.	10% of 120	3.	12% of 150	4.	12.5% of 40
5.	75% of 200	6.	13% of 25.3	7.	250% of 44	8.	0.5% of 13.7
9.	600% of 7	10.	1.5% of \$25	11.	81% of 134	12.	43% of 110
13.	61% of 524	14.	100% of 3.5	15.	20% of 58.5	16.	45% of 125.5
17.	23% of 500	18.	80% of 8	19.	90% of 72	20.	32% of 54

Pages 329-332

Pages 344-348

				-
Find each number. I	Round to the nearest	tenth	n if necessary.	
1. What number is	25% of 280?	2.	38 is what per	rcent of 50?
3 . 54 is 25% of wha	t number?	4.	24.5% of wha	t number is 15?
5. What number is	80% of 500?	6.	12% of 120 is	what number?
7 . Find 68% of 50.		8.	What percent	of 240 is 32?
9. 99 is what percer	nt of 150?	10.	Find 75% of 1	
11 . What number is	$33\frac{1}{3}\%$ of 66?	12.	50% of 350 is	what number?
13. What percent of	0	14.	What number	c is $37\frac{1}{2}$ % of 32?
15 . 95% of 40 is wha	t number?		Find 30% of 2	—
17 . 9 is what percent	t of 30?	18.	52% of what i	number is 109.2?
19 . What number is	65% of 200?	20.	What number	c is 15.5% of 45?
Lesson 7-3				Pages 355–360
Estimate by using fr	actions.			
1. 28% of 48	2 . 99% of 65	5	3.	445% of 20
4. 9% of 81	5. 73% of 24	40	6.	65.5% of 75
7. 48.2% of 93	8 . 39.45% o	f 51	9.	287% of 122
10. 53% of 80	11 . 414% of 2	72	12.	59% of 105
Estimate by using 10	0%.			
13. 30% of 42	14. 70% of 104	15.	90% of 152	16. 67% of 70
17. 78% of 92	18 . 12% of 183	19.	51% of 221	20 . 23% of 504
21. 81% of 390	22. 41% of 60	23.	59% of 178	24 . 22% of 450
Estimate.				
25. 50% of 37	26. 18% of 90	0	27.	300% of 245
28. 1% of 48	29. 70% of 30	00	30.	35% of 35
31 . 60.5% of 60	32. $5\frac{1}{2}\%$ of 1	00	33.	40.01% of 16
	<u> </u>	10		

Lesson 7-4

34. 80% of 62

Pages 361-365

Pages 353-354

Write an equation for each problem. Then solve. Round to the nearest tenth if necessary.

35. 45% of 119

- **1**. Find 45% of 50.
- **3**. 16% of what number is 2?
- **5**. 5% of what number is 12?
- **7**. 90 is what percent of 95?
- **9**. Find 46.5% of 75.
- **11**. 80.5% of what number is 80.5?
- **13**. Find 122.5% of 80.

- 2. 75 is what percent of 300?
- 4. 75% of 80 is what number?

36. 14.81% of 986

- **6**. Find 60% of 45.
- 8. $28\frac{1}{2}\%$ of 64 is what number?
- **10**. What number is 55.5% of 70?
- **12.** $66\frac{2}{3}\%$ of what number is 40?
- **14**. 250% of what number is 75?

Lesson 7-2

Solve each problem using the *reasonable answers* strategy.

- **1. SKIING** Benito skied for 13.5 hours and **2. CLASS TRIP** The class trip at Wilson estimated that he spent 30% of his time on the ski lift. Did he spend about 4, 6, or 8 hours on the ski lift?
- Middle School costs \$145 per student. A fund-raiser earns 38% of this cost. Will each student have to pay about \$70, \$80, or \$90?
- **3. GAS MILEAGE** Miguel's car gets 38 miles **4. DINING** At a restaurant, the total cost of per gallon and has 2.5 gallons of gasoline left in the tank. Can he drive for 85, 95, or 105 more miles before he runs out of gas?
- a meal is \$87.50. Nadia wants to leave a 20% tip. Should she leave a total of \$95, \$105, or \$115?

Pages 369-374

Pages 375-378

Lesson 7-6

Find each percent of change. Round to the nearest whole percent if necessary. State whether the percent of change is an *increase* or decrease.

- 1. 450 centimeters to 675 centimeters
- **3.** 500 albums to 100 albums
- 5. 3.25 meters to 2.95 meters
- **7**. 180 dishes to 160 dishes
- 9. 700 grams 910 grams
- 11. 412 children to 1,339 children
- 13. 24 hours to 86 hours

- 2. 77 million to 200.2 million
- 4. 350 yards to 420 yards
- **6**. \$65 to \$75
- **8**. 450 pieces to 445.5 pieces
- **10**. 55 women to 11 women
- **12**. 464 kilograms to 20 kilograms
- 14. 16 minutes to 24 minutes

Lesson 7-7

Find the total cost or sale price to the nearest cent.

1. \$45 sweater; 6% tax	2 . \$18.99 CD; 15% discount	3 . \$199 ring; 10% discount
4. \$29 shirt; 7% tax	5 . \$19 purse; 25% discount	6 . \$145 coat; 6.25% tax
7 . \$12 meal; 4.5% tax	8. \$899 computer; 20% discount	9. \$105 skateboard; $7\frac{1}{2}\%$ tax
10 . \$599 TV; 12% discount	11. \$12,500 car; $3\frac{3}{4}$ % tax	12. \$49.95 gloves; $5\frac{1}{4}$ % tax

Find the percent of discount to the nearest percent.

13.	sneakers: regular price, \$72 sale price, \$60	14.	dress shirt: regular price, \$90 sale price, \$22.50
15.	portable game player: regular price, \$125 sale price, \$100	16.	car: regular price, \$25,000 sale price, \$22,000
17.	hiking boots: regular price, \$139 sale price, \$113.98	18.	airline tickets: regular price, \$556 sale price, \$500.40
19.	CD: regular price, \$15 sale price, \$9	20.	computer: regular price, \$600 sale price, \$450

Find the simple interest earned to the nearest cent for each principal, interest rate, and time.

1. \$2,000, 8%, 5 years2. \$500, 10%, 8 months3. \$750, 5%, 1 year4. \$175.50, $6\frac{1}{2}$ %, 18 months5. \$236.20, 9%, 16 months6. \$89, $7\frac{1}{2}$ %, 6 months7. \$800, 5.75%, 3 years8. \$225, $1\frac{1}{2}$ %, 2 years9. \$12,000, $4\frac{1}{2}$ %, 40 months

Find the simple interest paid to the nearest cent for each loan, interest rate, and time.

10.	\$750, 18%, 2 years	11.	\$1,500, 19%, 16 months	12.	\$300, 9%, 1 year
13.	\$4,750, 19.5%, 30 months	14.	\$2,345, 17%, 9 months	15.	\$689, 12%, 2 years
16.	\$390, 18.75%, 15 months	17.	\$1,250, 22%, 8 months	18.	\$3,240, 18%, 14 months

4.

Lesson 8-1

Pages 395-400

Display each set of data in a line plot. Identify any clusters, gaps, or outliers.

1.	Number of Pets in the Home				
	0	1	3	4	0
	2	1	0	1	1
	10	0	1	5	2

3.	Number	r of Storie	es for Bui	ildings in	Denver
	56	43	36	42	29
	54	42	32	34	
	52	40	32	32	

Source: The World Almanac and Book of Facts

2.	High Temperatures for 18 Days (°F)				(°F)	
	75	81	75	65	76	81
	77	80	65	65	80	80
	76	85	66	75	80	75

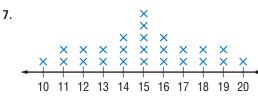
Ages o	of Childr	en at Si	unny Da	y Care ((years)
4	1	6	4	5	3
4	5	1	2	5	4
3	2	4	1	3	3

Lesson 8-2

Pages 401-407

Find the mean, median, and mode for each set of data.

- 1. 1, 5, 9, 1, 2, 6, 8, 2
- **3**. 82, 79, 93, 91, 95, 95, 81
- **5**. 256, 265, 247, 256



- **2**. 2, 5, 8, 9, 7, 6, 3, 5, 1, 4
- 4. 117, 103, 108, 120
- **6**. 47, 54, 66, 54, 46, 66

8.	Number of Absences	Tally	Frequency
	0	1111	4
	1	J## IIII	9
	2	1111	6
	3	,IIII	5

Display each set of data in a stem-and-leaf plot.

1. 23, 15, 39, 68, 57, 42, 51, 52, 41, 18, 29 **2**. 189, 182, 196, 184, 197, 183, 196, 194, 184

4.

4.

3.	Average Monthly High Temperatures in Albany, NY (°F)				
	21	46	72	50	
	24	58	70	40	
	34	67	61	27	

Supe	er Bowl	Winnin	g Score	s 1987-	2004
39	55	52	27	34	20
42	20	30	35	23	48
20	37	49	31	34	32

Source: The World Almanac and Book of Facts

Source: The World Almanac and Book of Facts

Lesson 8-4

Pages 414-420

Select the appropriate graph to display each set of data: bar graph or histogram. Then display the data in the appropriate graph.

Longest Snakes		
Snake Name	Length (ft)	
Royal python	35	
Anaconda	28	
Indian python	25	
Diamond python	21	
King cobra	19	
Boa constrictor	16	

Source: The Top 10 of Everything

3.	Cost of a	Movie Ticke	et at Selecte	d Theaters
	\$5.25	\$6.50	\$3.50	\$3.75
	\$7.50	\$9.25	\$10.40	\$4.75
	\$10.00	\$4.50	\$8.75	\$7.25
	\$3.50	\$6.70	\$4.20	\$7.50

2.	Least Densely Populated States		
	State	People Per Square Mile	
	Alaska	1	
	Wyoming	5	
	Montana	6	
	North Dakota	9	
	South Dakota	10	
	New Mexico	15	

Source: The Top 10 of Everything

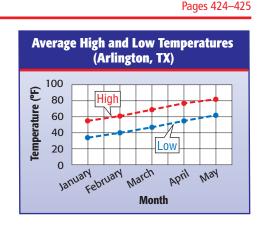
	lighest For Sele				
52	55	81	46	73	57
75	54	58	76	46	58
60	91	53	53	51	56
80	60	73	46	49	47

Source: The World Almanac and Book of Facts

Lesson 8-5

WEATHER For Exercises 1–3, solve by using the graph.

- In which month is the average high temperature about twice as high as the average low temperature for January?
- 2. What is the approximate difference between the average high temperature and the average low temperature each month?
- **3**. Predict the high and low temperatures for June based on the data given on the graph.



Extra Practice

Lesson 8-6

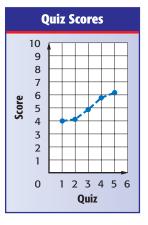
Pages 435-437

For Exercises 1–3, refer to the graph at the right which shows Rachel's quiz scores for six quizzes.

- 1. Describe the trend in Rachel's quiz scores.
- 2. If the trend continues, predict Rachel's score on the seventh quiz.
- **3.** If the trend continues, predict Rachel's score on the tenth quiz.

For Exercises 4–6, use the table which shows the average price paid to farmers per 100 pounds of sheep they sold.

- 4. Make a scatter plot of the data.
- **5.** Describe the relationship, if any, between the two sets of data.
- **6.** Predict the price per 100 pounds for 2010. Explain.



Year	Price Per 100 Pounds (\$)
1940	4
1950	12
1960	6
1970	8
1980	21
1990	23
2000	34

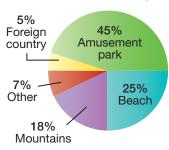
Source: The World Almanac and Book of Facts

Lesson 8-7

- 1. **SURVEYS** The table shows the results of a survey of students' favorite cookies. Predict how many of the 424 students at Scobey High School prefer chocolate chip cookies.
- 2. VACATION The circle graph shows the results of a survey of teens and where they would prefer to spend a family vacation. Predict how many of 4,000 teens would prefer to go to an amusement park.

Cookie	Number
chocolate chip	49
peanut butter	12
oatmeal	10
sugar	8
raisin	3

Vacation Survey



3. TRAVEL In 2000, about 29% of the foreign visitors to the U.S. were from Canada. If a particular hotel had 150,000 foreign guests in one year, how many would you predict were from Canada?

700 Extra Practice

Determine whether each conclusion is valid. Justify your answer.

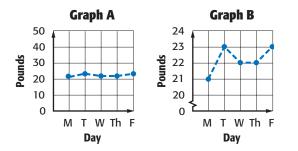
- To determine whether most students participate in after school activities, the principal of Humberson Middle School randomly surveyed 75 students from each grade level. Of these, 34% said they participate in after school activities. The principal concluded that about a third of the students at Humberson Middle School participate in after school activities.
- 2. To evaluate their product, the manager of an assembly line inspected the first 100 watches produced on Monday. Of these, 2 were defective. The manager concluded that about 2% of all watches produced are defective.
- **3**. A television program asked its viewers to dial one of two phone numbers indicating their preference for one of two brands of shampoo. Of those that responded, 76% said they prefer Brand A. The program concluded that Brand A was the most popular brand of shampoo.

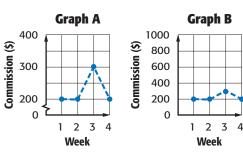
Lesson 8-9

Pages 444-449

Which graph could be misleading? Explain your reasoning.

- Both graphs show pounds of grapes sold to Westview School in one week.
- Both graphs show commissions made by Mr. Turner for a four-week pay period.





Lesson 9-1

Use the spinner at the right to find each probability. Write as a fraction in simplest form.

- 1. *P*(even number)
- **2**. *P*(prime number)
- **3**. *P*(factor of 12)
- 4. *P*(composite number)
- **5.** P(greater than 10)**6.** P(neither prime nor composite)

A package of balloons contains 5 green, 3 yellow, 4 red, and 8 pink balloons. Suppose you reach in the package and choose one balloon at random. Find the probability of each event. Write as a fraction in simplest form.

7. P(red balloon)
8. P(yellow balloon)
9. P(pink balloon)
10. P(orange balloon)
11. P(red or yellow balloon)
12. P(not green balloon)



Pages 460-464

Lesson 9-2

For each situation, find the sample space using a tree diagram.

- 1. rolling 2 number cubes
- 2. choosing an ice cream cone from waffle, plain, or sugar and a flavor of ice cream from chocolate, vanilla, or strawberry
- **3**. making a sandwich from white, wheat, or rye bread, cheddar or Swiss cheese and ham, turkey, or roast beef
- 4. tossing a penny twice
- **5**. choosing one math class from Algebra and Geometry and one foreign language class from French, Spanish, or Latin

Lesson 9-3

Pages 471-474

Use the Fundamental Counting Principle to find the total number of outcomes in each situation.

- 1. choosing a local phone number if the exchange is 398 and each of the four remaining digits is different
- choosing a way to drive from Millville to Westwood if there are 5 roads that lead from Millville to Miamisburg, 3 roads that connect Miamisburg to Hathaway, and 4 highways that connect Hathaway to Westwood
- 3. tossing a quarter, rolling a number cube, and tossing a dime
- 4. spinning the spinners shown below







Lesson 9-4

Pages 475-478

- 1. **RACES** Eight runners are competing in a 100-meter sprint. In how many ways can the gold, silver, and bronze medals be awarded?
- **2. LOCKERS** Five-digit locker combinations are assigned using the digits 1–9. In how many ways can the combinations be formed if no digit can be repeated?
- **3. SCHEDULES** In how many ways can the classes math, language arts, science, and social studies be ordered on student schedules as the first four classes of their day?
- 4. **TOYS** At a teddy bear workshop, customers can select from black, brown, golden, white, blue, or pink for their bear's color. If a father randomly selects two bear colors, what is the probability that a he will select a white bear for his son and a pink bear for his daughter? The father cannot pick the same color for both bears.
- **5. WRITING** If you randomly select three of your last seven writing assignments to submit to an essay contest, what is the probability that you will select your first, fourth, and sixth essays in that order?

- 1. **EXERCISE** How many ways can you choose to exercise three days of a week?
- 2. **BOOKS** In how many ways can six books be selected from a collection of 12?
- **3. REPORTS** In how many ways can you select three report topics from a total of 8 topics?
- 4. **GROUPS** How many ways can four students be chosen from a class of 26?
- **5. ROLLER COASTERS** In how many ways can you ride five out of nine roller coasters if you don't care in what order you ride them?

Lesson 9-6

Pages 484–485

Use the *act it out* strategy to solve each problem.

- STAIRS Lynnette lives on a certain floor of her apartment building. She goes up two flights of stairs to put a load of laundry in a washing machine on that floor. Then she goes down five flights to borrow a book from a friend. Next, she goes up 8 flights to visit another friend who is ill. How many flights up or down does Lynette now have to go to take her laundry out of the washing machine?
- 2. **LOGIC PUZZLE** Suppose you are on the west side of a river with a fox, a duck, and a bag of corn. You want to take all three to the other side of the river, but...
 - your boat is only large enough to carry you and either the fox, duck, or bag of corn.
 - you cannot leave the fox alone with the duck.
 - you cannot leave the duck alone with the corn.
 - you cannot leave the corn alone on the east side of the river because some wild birds will eat it.
 - the wild birds are afraid of the fox.
 - you cannot leave the fox, duck, and the corn alone.
 - you can bring something across the river more than once.

If there is no other way cross the river, how do you get everything to the other side?

Lesson 9-7

The frequency table shows the results of a fair number cube rolled 40 times.

- 1. Find the experimental probability of rolling a 4.
- 2. Find the theoretical probability of *not* rolling a 4.
- 3. Find the theoretical probability of rolling a 2.
- 4. Find the experimental probability of *not* rolling a 6.
- 5. Suppose the number cube was rolled 500 times. About how many times would it land on 5?

Face	Frequency
1	5
2	9
3	2
4	8
5	12
6	4

Pages 486-490

Lesson 9-8

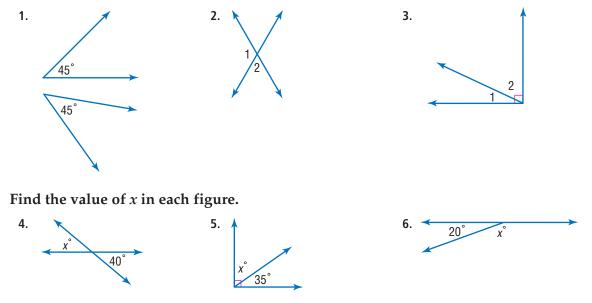
- **1. COINS** Two evenly balanced nickels are tossed. Find the probability that one head and one tail result.
- **2. MONEY** A wallet contains four \$5 bills, two \$10 bills, and eight \$1 bills. A bill is randomly selected. Find *P*(\$5 or \$1).
- **3. PROBABILITY** Two chips are selected from a box containing 6 blue chips, 4 red chips, and 3 green chips. The first chip selected is replaced before the second is drawn. Find *P*(red, green).
- **4. PROBABILITY** A bag contains 7 blue, 4 orange, 8 red, and 5 purple marbles. Suppose one marble is chosen and not replaced. A second marble is then chosen. Find *P*(purple, red).

Lesson 10-1 Classify each angle as *acute, right, obtuse,* or *striaght.* 1. 1 2 3 4 55. Identify a pair of vertical angles in the diagram at the right. 6. Identify a pair of adjacent angles in the diagram at the right. 6. Identify a pair of adjacent angles in the diagram at the right. 6. Identify a pair of adjacent angles in the diagram at the right. 6. Identify a pair of adjacent angles in the diagram at the right. 6. Identify a pair of adjacent angles in the diagram at the right. 6. Identify a pair of adjacent angles in the diagram at the right. 6. Identify a pair of adjacent angles in the diagram at the right. 6. Identify a pair of adjacent angles in the diagram at the right. 6. Identify a pair of adjacent angles in the diagram at the right. 6. Identify a pair of adjacent angles in the diagram at the right. 6. Identify a pair of adjacent angles in the diagram at the right. 6. Identify a pair of adjacent angles in the diagram at the right. 6. Identify a pair of adjacent angles in the diagram at the right. 6. Identify a pair of adjacent angles in the diagram at the right.

Lesson 10-2

Pages 514–517

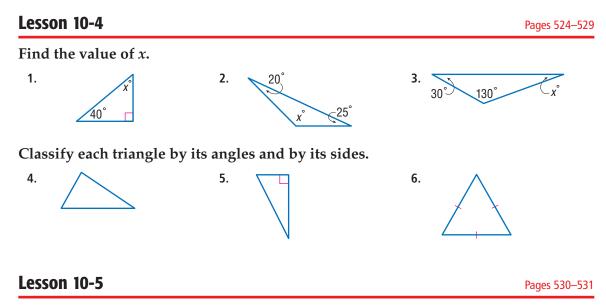
Classify each pair of angles as *complementary*, *supplementary*, or *neither*.



Display each set of data in a circle graph.

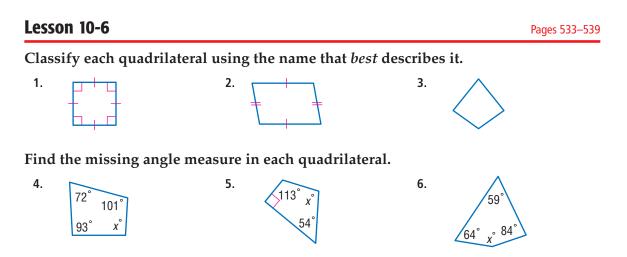
1.	Car Sales		
	Style	Percent	
	sedan	45%	
	SUV	22%	
	pickup truck	9%	
	sports car	13%	
	compact car	11%	

2.	Favorite Flavor of Ice Cream		
	Flavor	Number	
	vanilla	11	
	chocolate	15	
	strawberry	8	
	mint chip	5	
	cookie dough	3	

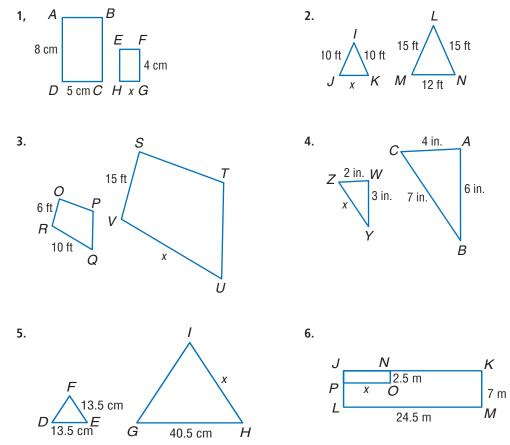


Use the *logical reasoning* strategy to solve each problem.

- 1. **HOUSE NUMBERS** Rico's house number contains four digits: 5, 8, 3, 2. If the number is odd, divisible by 3, and the middle two numbers are a perfect square, find the number.
- **2. FRUIT** Julio, Rashanda, and Perry each brought a fruit with their lunch. The fruits brought were a mango, a banana, and an orange. If Perry did not bring a banana and Julio brought a mango, what type of fruit did each student bring?



Lesson 10-7

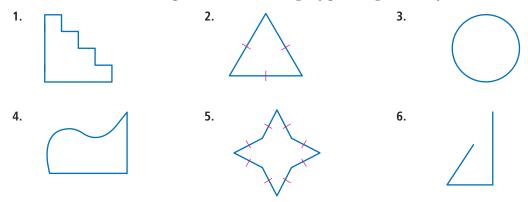


Find the value of *x* in each pair of similar figures.

Lesson 10-8

Pages 546-551

Determine whether each figure is a polygon. If it is, classify the polygon and state whether it is regular. If it is *not* a polygon, explain why.



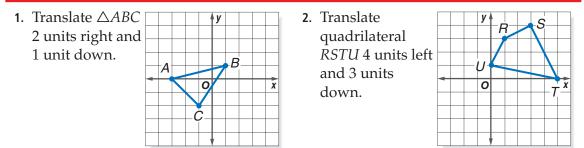
Find the measure of an angle in each polygon if polygon is regular. Round to the nearest tenth of a degree if necessary.

7. triangle	8. 30-gon	9 . 18-gon	10 . 14-gon
11. hexagon	12. nonagon	13 . 27-gon	14. octagon

Lesson 10-9

Pages 553-557

Pages 558-562

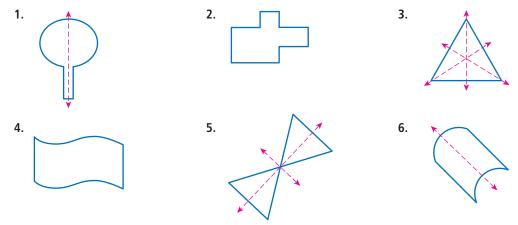


Triangle *TRI* has vertices T(1, 1), R(4, -2), and I(-2, -1). Find the vertices of T'R'I' after each translation. Then graph the figure and its translated image.

- 3. 2 units right, 1 unit down
- 4. 5 units left, 1 unit up
- 5. 3 units right
- 6. 2 units up

Lesson 10-10

Determine whether each figure has line symmetry. Write *yes* or *no*. If so, copy the figure and draw all lines of symmetry.



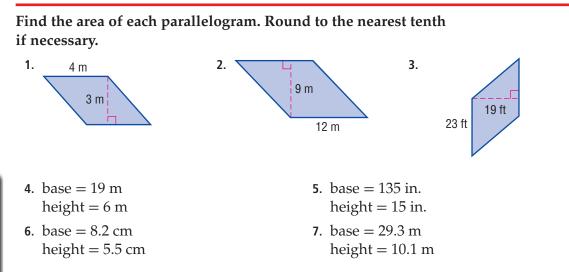
Graph each figure and its reflection over the *x*-axis. Then find the coordinates of the vertices of the reflected image.

- 7. quadrilateral *QUAD* with vertices Q(-1, 4), U(2, 2), A(1, 1), and D(-2, 2)
- **8**. triangle $\triangle ABC$ with vertices A(0, -1), B(4, -3), and C(-4, -5)

Graph each figure and its reflection over the *y*-axis. Then find the coordinates of the vertices of the reflected image.

- **9**. parallelogram *PARL* with vertices *P*(3, 5), *A*(5, 4), *R*(5, 1), and *L*(3, 2)
- **10.** pentagon *PENTA* with vertices P(-1, 3), E(1, 1), N(0, -2), T(-2, -2), and A(-3, 1)

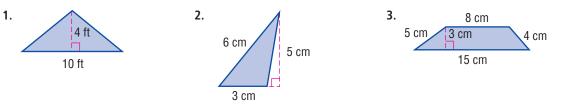
Lesson 11-1



Lesson 11-2

Pages 576-580

Find the area of each figure. Round to the nearest tenth if necessary.

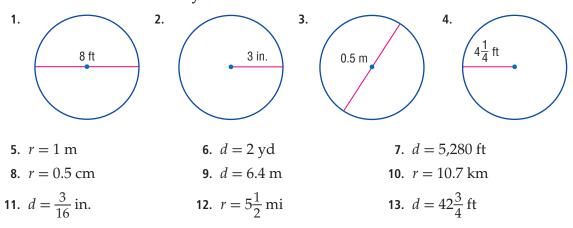


- 4. triangle: base = 5 in., height = 9 in.
- 5. trapezoid: bases = 3 cm and 8 cm, height = 12 cm
- **6**. trapezoid: bases = 10 ft and 15 ft, height = 12 ft
- 7. triangle: base = 12 cm, height = 8 cm
- 8. trapezoid: bases = 82.6 cm and 72.2 cm, height = 44.5 cm
- **9**. triangle: base = 500.5 ft, height = 254.5 ft

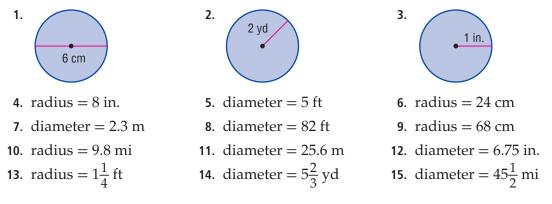
Lesson 11-3



Find the circumference of each circle. Use 3.14 or $\frac{22}{7}$ for π . Round to the nearest tenth if necessary.



Find the area of each circle. Round to the nearest tenth.



Lesson 11-5

Pages 592-593

Use the solve a simpler problem strategy to solve each problem.

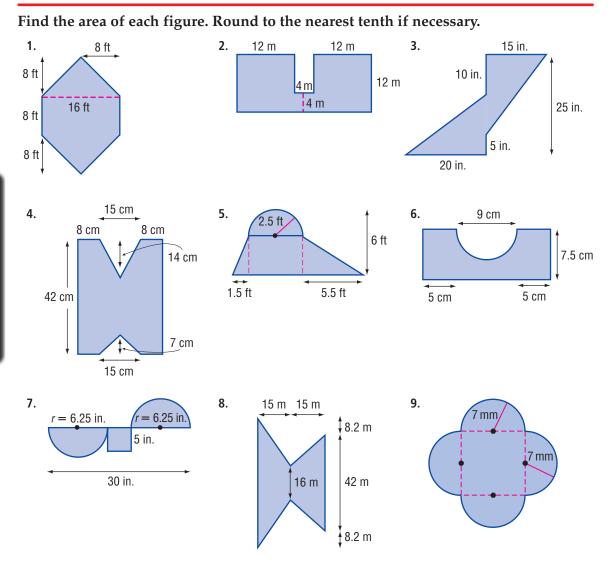
- 1. **EARNINGS** Cedric makes \$51,876 each year. If he is paid once every two weeks and actually takes home about 67% of his wages after taxes, how much does he take home each paycheck? Round to the nearest cent if necessary.
- 2. **CARS** Jorge plans to decorate the rims on his tires by putting a strip of shiny metal around the outside edge on each rim. The diameter of each tire is 17 inches, and each rim is 2.75 inches from the outside edge of each tire. If he plans to cut the four individual pieces for each tire from the same strip of metal, how long of a strip should he buy? Round to the nearest tenth.
- **3. SAVINGS** Erin's aunt invested a total of \$1,500 into three different savings accounts. She invested \$450 into a savings account with an annual interest rate of 3.25% and \$600 into a savings account with an annual interest rate of 4.75%. The third savings account had an annual interest rate of 4.375%. After 3 years, how much money will Erin's aunt have in the three accounts altogether if she made no more additional deposits or withdrawals? Round to the nearest cent.

BIOLOGY For Exercises 4–6, use the following information.

About five quarts of blood are pumped through the average human heart in one minute.

- **4**. At this rate, how many quarts of blood are pumped through the average human heart in one year? (Use 365 days = 1 year)
- **5.** If the average heart beats 72 times per minute, how many quarts of blood are pumped with each beat? Round to the nearest tenth.
- **6**. About how many total gallons of blood are pumped through the average human heart in one week?
- **7. LAND** A rectangular plot of land measures 1,450 feet by 850 feet. A contractor wishes to section off a portion of this land to build an apartment complex. If the complex is 425 feet by 550 feet, how many square feet of land will not be sectioned off to build it?

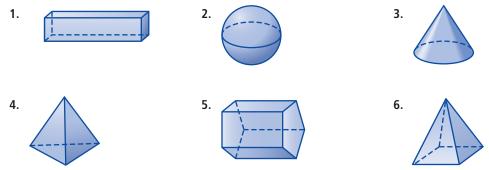
Lesson 11-6



Lesson 11-7

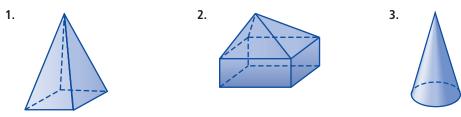
Pages 601-604

For each figure, identify the shape of the base(s). Then classify the figure.

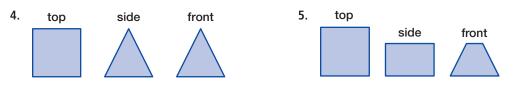


- **7. SOUP** Classify the shape of a soup can as a three-dimensional figure.
- **8**. **APPLIANCES** Classify the shape of a microwave oven as a three-dimensional figure.

Draw a top, a side, and a front view of each solid.



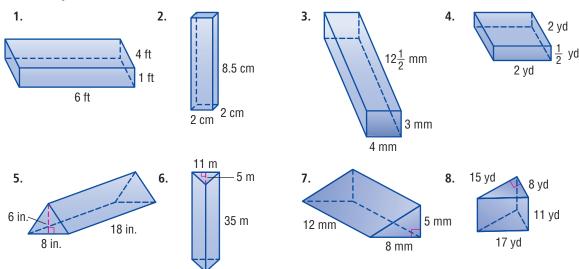
Draw each solid using the top, side, and front views shown. Use isometric dot paper.



Lesson 11-9

Pages 611-616

Find the volume of each prism. Round to the nearest tenth if necessary.

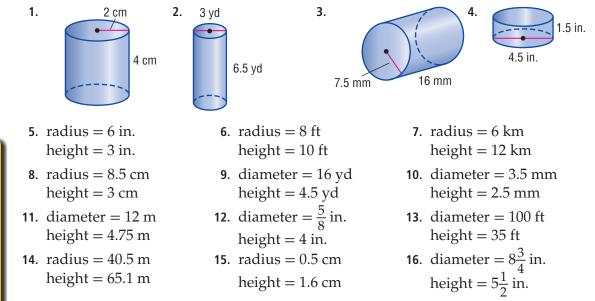


Find the volume of each rectangular prism. Round to the nearest tenth if necessary.

9. length = 3 ft width = 10 ft	10. length = 18 cm width = 23 cm	11. length = 25 mm width = 32 mm	12. length = 1.5 in. width = 3 in.
height $= 2$ ft	height $= 15$ cm	height $= 10 \text{ mm}$	height $= 6$ in.
13 . length = 4.5 cm	14 . length = 16 mm	15. length = $3\frac{1}{2}$ ft	16. length = $5\frac{1}{2}$ in.
width = 6.75 cm	width $= 0.7 \text{ mm}$	width $= 10$ ft	width $= 12$ in.
height $= 2 \text{ cm}$	height = 12 mm	height $= 6$ ft	height = $3\frac{3}{8}$ in.

- **17**. Find the volume of a rectangular prism with a length of 3 yards, a width of 5 feet, and a height of 12 feet.
- **18**. Find the volume of a triangular prism whose base has an area of 416 square feet and whose height is 22 feet.

Find the volume of each cylinder. Round to the nearest tenth.

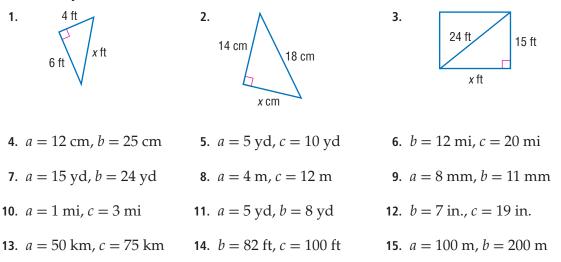


- **17**. Find the volume of a cylinder whose diameter is 6 inches and height is 2 feet. Round to the nearest tenth.
- **18**. How tall is a cylinder that has a volume of 2,123 cubic meters and a radius of 13 meters? Round to the nearest tenth.
- **19**. A cylinder has a volume of 310.2 cubic yards and a radius of 2.9 yards. What is the height of the cylinder? Round to the nearest tenth.
- **20**. Find the height of a cylinder whose diameter is 25 centimeters and volume is 8,838 cubic centimeters. Round to the nearest tenth.

Lesson 12-1		Pages 634–637
Estimate each squa	re root to the nearest whole	number.
1. $\sqrt{27}$	2 . $\sqrt{112}$	3 . $\sqrt{249}$
4. $\sqrt{88}$	5 . $\sqrt{1,500}$	6. $\sqrt{612}$
7. $\sqrt{340}$	8. $\sqrt{495}$	9. $\sqrt{264}$
10. $\sqrt{350}$	11. $\sqrt{834}$	12. $\sqrt{3,700}$
13 . $\sqrt{298}$	14. $\sqrt{101}$	15. $\sqrt{800}$
Use a calculator to f	find each square root to the r	nearest tenth.
16. $\sqrt{58}$	17. $\sqrt{750}$	18. $\sqrt{1,200}$
19. $\sqrt{1,000}$	20 . $\sqrt{5,900}$	21 . $\sqrt{999}$
22. $\sqrt{374}$	23 . $\sqrt{512}$	24. $\sqrt{3,750}$
25. $\sqrt{255}$	26. $\sqrt{83}$	27. $\sqrt{845}$
28. $\sqrt{200}$	29 . $\sqrt{500}$	30 . $\sqrt{10,001}$
		hile 1 (and h 4

- **31. ALGEBRA** Evaluate $\sqrt{a} b$ to the nearest tenth if a = 16 and b = 4.
- **32. ALGEBRA** Estimate the value of $\sqrt{x + y}$ to the nearest whole number if x = 64 and y = 25.

Find the missing measure of each triangle. Round to the nearest tenth if necessary.



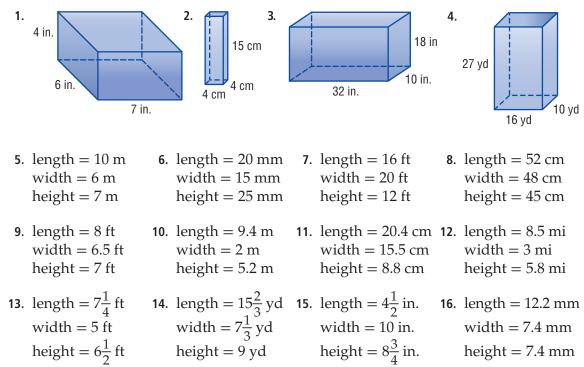
Lesson 12-3

Pages 644-645

Use the make a model strategy to solve each problem.

- 1. **ARCHITECTURE** An architect is designing a large skyscraper for a local firm. The skyscraper is to be 1,200 feet tall, 500 feet long, and 400 feet wide. If his model has a scale of 80 feet = 1 inch, find the volume of the model.
- 2. **STACKING BOXES** Box A has twice the volume of Box B. Box B has a height of 10 centimeters and a length of 5 centimeters. Box A has a width of 20 centimeters, a length of 10 centimeters, and a width of 5 centimeters. What is the width of Box B?
- **3. TRAVEL** On Monday, Mara drove 400 miles as part of her journey to see her sister. She drove 60% of this distance on Tuesday. If the distance she drove on Tuesday represents one third of her total journey, how many more miles does she still need to drive?
- 4. **PIZZA** On Monday, there was a whole pizza in the refrigerator. On Tuesday, Enrico ate $\frac{1}{3}$ of the pizza. On Wednesday, he ate $\frac{1}{3}$ of what was left. On Thursday, he ate $\frac{1}{2}$ of what remained. What fractional part of the pizza is left?
- 5. **GARDENS** Mr. Blackwell has a circular garden in his backyard. He wants to build a curved brick pathway around the entire garden. The garden has a radius of 18 feet. The distance from the center of the garden to the outside edge of the brick pathway will be 21.5 feet. Find the area of the brick pathway. Round to the nearest tenth.

Find the surface area of each rectangular prism. Round to the nearest tenth if necessary.

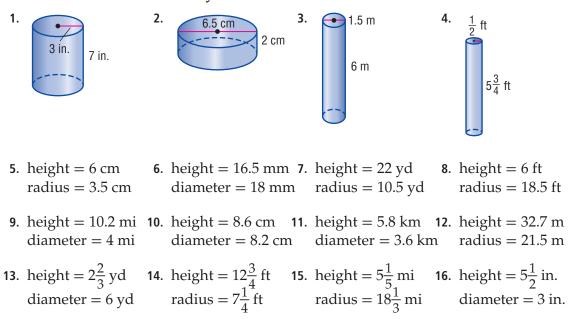


- **17**. Find the surface area of an open-top box with a length of 18 yards, a width of 11 yards, and a height of 14 yards.
- **18**. Find the surface area of a rectangular prism with a length of 1 yard, a width of 7 feet, and a height of 2 yards.

Lesson 12-5

Pages 654-657

Find the surface area of each cylinder. Round to the nearest tenth.



Mixed Problem Solving

Chapter 1 Introduction to Algebra and Functions

- 1. **HISTORY** In 1932, Amelia Earhart flew 2,026 miles in 14 hours 56 minutes. To the nearest mile, what was her speed in miles per minute? (Lesson 1-1)
- **2. LIGHT** The speed of light is about 67^3 kilometers per second. How many kilometers per second is this? (Lesson 1-2)
- **3. FARMING** Find the length of one side of a square field whose area is 180,625 square feet. (Lesson 1-3)
- 4. **SALES** A department store is having a back-to-school sale. The table shows the prices of three popular items.

Item	Price (\$)	
Jeans	37.99	
Sweatshirt	19.88	
Polo Shirt	22.50	

Latonia wants to buy 2 pairs of jeans, 3 sweatshirts, and 1 polo shirt. Write and evaluate a numerical expression that represents the total cost of all three items. (Lesson 1-4)

- 5. **MONEY** Mateo has \$2.58 in coins. If he has quarters, dimes, nickels, and pennies, how many of each coin does he have? Use the *guess and check* strategy. (Lesson 1-5)
- 6. **FITNESS** You can estimate how fast you walk in miles per hour by evaluating the expression $\frac{n}{30}$, where *n* is the number of steps you take in one minute. Find your speed in miles per hour if you take 96 steps in one minute. (Lesson 1-6)
- 7. **BASEBALL** Last year, Scott attended 13 Minnesota Twins baseball games. This year, he attended 24. Solve 13 + n = 24to find how many more games he attended this year than last. (Lesson 1-7)

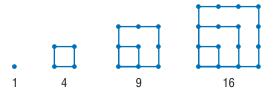
8. HOT AIR BALLOONS Miyoki paid \$140 for a four-hour hot air balloon ride over the Bridger Mountains. Solve 4h = 140 to find the cost per hour of the ride. (Lesson 1-7)

ENTERTAINMENT For Exercises 9 and 10, use the following information.

The five members of the Wolff family went to an amusement park. They each purchased an all-day ride pass and a water park pass, as shown below. (Lesson 1-8)

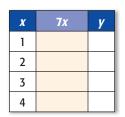
Item	Price (\$)
All-day Ride Pass	14.95
Water Park Pass	6.50

- 9. Use the Distributive Property to write two different expressions that represent the total cost for the family.
- **10**. Find the total cost of the passes.
- **11. NUMBER THEORY** Numbers that can be represented by a square arrangement of dots are called square numbers. The first four square numbers are shown below. (Lesson 1-9)



Write a sequence formed by the area of the first eight square numbers.

12. TIME Copy and complete the function table showing how many days *y* there are in various number of weeks *x*. Then identify the domain and range. (Lesson 1-10)



Pages 22-77

Chapter 2 Integers

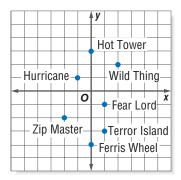
 AIR CONDITIONING Jacob turned on the air conditioning and the temperature in his apartment decreased 8 degrees. Write an integer to represent the change in temperature. (Lesson 2-1)

EARTH SCIENCE For Exercises 2 and 3, use the table below. It describes the deepest land depressions in the world in feet below sea level.

Depth (ft)				
220	436	511	282	
383	505	235	230	
Source: The Top 10 Everything				

- 2. Write an integer to represent each depth. (Lesson 2-1)
- 3. Order the integers from greatest depth to least depth. (Lesson 2-2)

ENTERTAINMENT For Exercises 4–8, use the diagram below. It shows the locations of several rides at the Outlook Amusement Park. (Lesson 2-3)



- 4. Which ride(s) is located in quadrant III?
- 5. Which ride(s) is located on the *y*-axis? Name the coordinates.
- **6**. Which ride(s) has coordinates in which the *x* coordinates and *y*-coordinates are equal?
- 7. In which quadrant is the Hurricane located?
- 8. A new ride is built with a location on the *x*-axis and 5 units left of the origin. Name the coordinates of this point.

- **9. CAVERNS** Adriana is 52 feet underground touring the Lewis and Clark Caverns. She climbs a ladder up 15 feet. What is her new location? (Lesson 2-4)
- **RECORDS** The lowest temperature recorded in Verkhoyansk, Russia, was about –90°F. The highest temperature was about 99°F. What is the difference between these temperatures? (Lesson 2-5)
- 11. **EARTH SCIENCE** The highest and lowest points in California are shown in the table. What is the difference in elevations? (Lesson 2-5)

Location	Elevation	
Mount Whitney	14,494 ft above sea level	
Death Valley	282 ft below sea level	
Common The Mind Alexandre (the U.C.A		

Source: The World Almanac of the U.S.A.

- 12. **RIDES** A glider ride over the Crazy Mountains has a maximum altitude of 12,000 feet. It is descending at a rate of about 300 feet per minute. At what altitude will the glider be 20 minutes later? (Lesson 2-6)
- **SPORTS** Every 12 times at bat, Simon hits the ball 3 times. About how many times will he hit the ball after 20 times at bat? 40? 84? Use the *look for a pattern* strategy. (Lesson 2-7)

Times at Bat	Number of Hits
12	3
20	
40	
84	

14. **TEMPERATURE** A temperature of -89° C was recorded in Antarctica. Use the expression $\frac{9C}{5}$ + 32, where *C* is the temperature in degrees Celsius, to find the temperature in degrees Fahrenheit. (Lesson 2-8)

Chapter 3 Algebra: Linear Equations and Functions

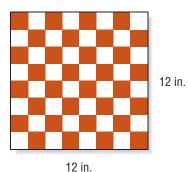
1. **TOURISM** The Statue of Liberty in New York, New York, and the Eiffel Tower in Paris, France, were designed by the same person. The Statue of Liberty is 152 feet tall. It is 732 feet shorter than the Eiffel Tower, *x*. Write an equation that models this situation. (Lesson 3-1)

ELECTIONS For Exercises 2 and 3, use the table below and the following information. New York has one more electoral vote than Texas. Pennsylvania has 9 fewer electoral votes than Texas. (Lesson 3-2)

Number of Electoral Votes 2000		
California	54	
New York	33	
Texas		
Florida	25	
Pennsylvania	23	

- 2. Write two different equations to find the number of electoral votes in Texas, *n*.
- **3**. Find the number of electoral votes
- 4. **ROLLER COASTERS** The track length of a popular roller coaster is 5,106 feet. The roller coaster has an average speed of about 2,000 feet per minute. At that speed, how long will it take to travel its length of 5,106 feet? Use the formula d = rt. (Lesson 3-3)
- 5. **NUMBERS** A number is halved. Then three is subtracted from the quotient, and 5 is multiplied by the difference. Finally, 1 is added to the product. If the ending number is 26, what was the beginning number? Use the *work backward* strategy. (Lesson 3-4)
- 6. **BUSINESS** Carla's Catering charges a \$25 fee to serve 15 or fewer people. In addition to that fee, they charge \$10 per appetizer. You are having a party for 12 people and can spend a total of \$85. How many appetizers can you order from Carla's Catering? (Lesson 3-5)

CHESS For Exercises 7–10, use the chess board below. (Lesson 3-6)



- 7. What is the perimeter of the chess board?
- 8. What is the area of the chess board?
- **9**. What is the area of each small square?
- **10**. A travel chess board has half the length and width of the board shown. What is the perimeter and area?
- 11. **FENCING** Mr. Hernandez will build a fence to enclose a rectangular yard for his horse. If the area of the yard to be enclosed is 1,944 square feet, and the length of the yard is 54 feet, how much fencing is needed? (Lesson 3-6)
- **12. GEOMETRY** The formula for the perimeter of a square is P = 4s, where *P* is the perimeter and *s* is the length of a side. Graph the equation. (Lesson 3-7)

AGES For Exercises 13–16, use the table below. It shows how Jared's age and his sister Emily's age are related. (Lesson 3-7)

Jared's age (yr)	1	2	3	4	5
Emily's age (yr)	7	8	9	10	11

- **13**. Write a verbal expression to describe how the ages are related.
- Write an equation for the verbal expression. Let *x* represent Jared's age and *y* represent Emily's age.
- Predict how old Emily will be when Jared is 10 years old.
- **16**. Graph the equation.

LAND For Exercises 1–3, use the information below.

A section of land is one mile long and one mile wide. (Lesson 4-1)

- 1. Write the prime factorization of 5,280.
- 2. Find the area of the section of land in square feet. (*Hint*: 1 mile = 5,280 feet)
- **3.** Write the prime factorization of the area that you found in Exercise 2.

DECORATIONS For Exercises 4 and 5, use the information below.

Benito is cutting streamers from crepe paper for a party. He has a red roll of crepe paper 144 inches long, a white roll 192 inches long, and a blue roll 360 inches long. (Lesson 4-2)

- 4. If he wants to have all colors of streamers the same length, what is the longest length that he can cut?
- **5.** If he cuts the longest possible length, how many streamers can he cut?
- 6. **PRIZES** By reaching into a bag that has the letters A, B, and C, George will select three winners in order. How many possible combinations are there of the people who could win? Use the *make an organized list* strategy. (Lesson 4-3)

OLYMPICS For Exercises 7 and 8, refer to the table below. It shows the medals won by the top three countries in the 2000 Summer Olympics.

Country	Medals		
Country	Gold	Silver	Bronze
United States	40	24	33
Russia	32	28	28
China	28	16	15

Source: The World Almanac

- Write the number of gold medals that Russia won as a fraction of the total number that Russia won in simplest form. (Lesson 4-4)
- **8.** Write the fraction that you wrote in Exercise 7 as a decimal. (Lesson 4-5)

9. SPORTS At Belgrade Intermediate School, 75 out of every 100 students participate in sports. What percent of students do *not* participate in sports? (Lesson 4-6)

ADVERTISING For Exercises 10–13, use the table below. It shows the results of a survey in which teens were asked which types of advertising they pay attention to.

Type of Advertising	Percent of Teens		
Television	80%		
Magazine	62%		
Product in a Movie	48%		
Ad in an E-mail	24%		
Sourcou E Doll			

Source: E-Poll

Write each percent as a fraction in simplest form. (Lesson 4-6)

- **10**. television **11**. magazine
- 12. product in a movie 13. ad in an e-mail

GEOMETRY For Exercises 14–16, refer to the grid at the right. (Lesson 4-7)

		\square

- 14. Write a decimal and a percent to represent the "T" shaded area.
- **15.** Write a decimal and a percent to represent the area shaded pink.
- 16. What percent of the grid is *not* shaded?
- FLOWERS Roses can be ordered in bunches of 6 and carnations in bunches of 15. If Ingrid wants to have the same number of roses as carnations for parent night, what is the least number of each flower that she must order? (Lesson 4-8)
- WATER The table at the right shows the fraction of each state that is water. Order the states from least to greatest fraction of water. (Lesson 4-9)

What Part is Water?		
State Fraction		
Alaska	$\frac{3}{41}$	
Michigan	<u>40</u> 97	
Wisconsin	$\frac{1}{6}$	

Source: The World Almanac of the U.S.A

Chapter 5 Applying Fractions

- 1. **MEALS** A box of instant potatoes contains 20 cups of flakes. A family-sized bowl of potatoes uses $3\frac{2}{3}$ cups of the flakes. Estimate how many family-sized bowls can be made from one box. (Lesson 5-1)
- **2. BAKING** A recipe calls for $2\frac{1}{3}$ cups of flour. Theo wants to make six batches of this recipe. About how much flour should he have available to use? (Lesson 5-1)
- 3. **CRAFTS** Kyle bought $\frac{5}{6}$ yard of fabric to make a craft item. He used $\frac{3}{4}$ yard in making the item. How much fabric was left over? (Lesson 5-2)

RAINFALL For Exercises 4 and 5, use the table. It shows the average annual precipitation for three of the driest locations on Earth. (Lesson 5-2)

Location	Precipitation (in.)
Arica, Chile	<u>3</u> 100
Iquique, Chile	$\frac{1}{5}$
Callao, Peru	<u>12</u> 25

Source: The Top 10 Everything

- 4. How much more rain does Iquique get per year than Arica?
- **5.** How much more annual rain does Callao get than Iquique?
- 6. **INTERIOR DESIGN** A living room wall is $16\frac{1}{4}$ feet long. A window runs from the floor to the ceiling and has a length along the floor of $6\frac{3}{8}$ feet. How long is the wall without the window? (Lesson 5-3)
- 7. **HEALTH** The human body is about $\frac{7}{10}$ water. About how much would a person weigh if they had 70 pounds of water weight? Use the *eliminate possibilities* strategy. (Lesson 5-4)

Α	200 pounds	С	150 pounds
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B 100 pounds **D** 70 pounds

8. **FOOD** The table below shows the carryout menu for a Benito's Restaurant.

Take-out	Price (\$)
Main Dish	5.00
Side Dishes	1.00
Dessert	2.00

A family of four spent \$24.00 dollars for a take-home meal. What combination is possible for their meal? Use the *eliminate possibilities* strategy. (Lesson 5-4)

- **F** 3 main dishes and 2 side dishes
- G 4 main dishes and 3 side dishes
- H 3 main dishes, 3 side dishes, and 3 desserts
- J 4 main dishes and 4 desserts
- 9. **STARS** The star Sirius is about $8\frac{7}{10}$ light years from Earth. Alpha Centauri is half this distance from Earth. How far is Alpha Centauri from Earth? (Lesson 5-5)
- **10. LIFE SCIENCE** Use the table below. It shows the average growth per month of hair and fingernails. Solve $3 = \frac{1}{2}t$ to find

how long it takes	hair to	grow 3	inches.
(Lesson 5-6)		0	

Average Monthly Growth				
Hair	$\frac{1}{2}$ in.			
Fingernails	$\frac{2}{25}$ in.			

- 11. **SEWING** Jocelyn has nine yards of fabric to make table napkins for a senior citizens' center. She needs $\frac{3}{8}$ yard for each napkin. Use $\frac{3}{8}c = 9$ to find the number of napkins that she can make with this amount of fabric. (Lesson 5-6)
- 12. WHALES During the first year, a baby whale gains about $27\frac{3}{5}$ tons. What is the average weight gain per month? (Lesson 5-7)

Chapter 6 Ratios and Proportions

- SCHOOLS In a recent year, Oregon had 924 public elementary schools and 264 public high schools. Write a ratio in simplest form comparing the number of public high schools to elementary schools. (Lesson 6-1)
- 2. **MONTHS** Write a ratio in simplest form comparing the number of months that begin with the letter J to the total number of months in a year. (Lesson 6-1)
- **3. EXERCISE** A person jumps rope 14 times in 10 seconds. What is the unit rate in jumps per second? (Lesson 6-2)
- 4. FOOD A 16-ounce box of cereal costs \$3.95. Find the unit price to the nearest cent. (Lesson 6-2)
- 5. **LIFE SCIENCE** An adult has about 5 quarts of blood. If a person donates 1 pint of blood, how many pints are left? (Lesson 6-3)
- 6. **COFFEE** In Switzerland, the average amount of coffee consumed per year is 1,089 cups per person. How many pints is this? (Lesson 6-3)
- 7. **BUILDINGS** A skyscraper is 0.484 kilometers tall. What is the height of the skyscraper in meters? (Lesson 6-4)
- 8. WATER A bottle contains 1,065 milliliters of water. About how many cups of water does the bottle hold? (Lesson 6-4)
- **9. PHOTOGRAPHS** Mandy is enlarging a photograph that is 3 inches wide and 4.5 inches long. If she wants the width of the enlargement to be 10 inches, what will be the length? (Lesson 6-5)
- **10. TILES** A kitchen is 10 feet long and 8 feet wide. If kitchen floor tiles are $2\frac{1}{2}$ inches by 3 inches, how many tiles are needed for the kitchen? Use the *draw a diagram* strategy. (Lesson 6-6)

- 11. **MAPS** Washington, D.C., and Baltimore, Maryland, are $2\frac{7}{8}$ inches apart on a map. If the scale is $\frac{1}{2}$ inch: 6 miles, what is the actual distance between the cities? (Lesson 6-7)
- 12. **MODELS** Ian is making a miniature bed for his daughter's doll house. The actual bed is $6\frac{3}{4}$ feet long. If he uses the scale $\frac{1}{2}$ inch = $1\frac{1}{2}$ feet, what will be the length of the miniature bed? (Lesson 6-7)
- POPULATION According to the U.S. Census Bureau, 6.6% of all people living in Florida are 10–14 years old. What fraction is this? Write in simplest form. (Lesson 6-8)
- 14. INTERNET In 2001, 50.5% of U.S. households had access to the Internet. Write this percent as a fraction in simplest form. (Lesson 6-8)

COINS For Exercises 15 and 16, use the table below. It shows the fraction of a quarter that is made up of the metals nickel and copper. Write each fraction as a percent. Round to the nearest hundredth if necessary. (Lesson 6-8)

Metal	Fraction of Quarter
Nickel	$\frac{1}{12}$
Copper	$\frac{11}{12}$

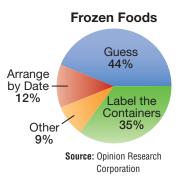
15. nickel

16. copper

- **17. FARMS** Approximately 0.0009 of the land in Montana is farmland. Write this as a percent. (Lesson 6-9)
- **POPULATION** In 2003, 0.1% of the U.S. population was of Hawaiian descent. Write this percent as a fraction in simplest form. (Lesson 6-9)
- HEIGHT Jackson is 1.4 times as tall as his sister. Write this decimal as a percent. (Lesson 6-9)

- 2. **SKIS** Toshiro spent \$520 on new twin-tip skis. This was 40% of the money he earned at his summer job. How much did he earn at his summer job? (Lesson 7-2)
- **3. GEOGRAPHY** In Washington, about 5.7% of the total area is water. If the total area of Washington is 70,637 square miles, estimate the number of square miles of water by using 10%. (Lesson 7-3)
- 4. **GOVERNMENT** Of the 435 members in the U.S. House of Representatives, 53 are from California and 13 are from North Carolina. To the nearest whole percent, what percent of the representatives are from California? from North Carolina? (Lesson 7-4)

FOOD For Exercises 5 and 6, use the graph below. It shows the results of a survey in which 1,200 people were asked how they determine how long food has been in their freezer. (Lesson 7-4)



- **5.** How many of the 1,200 surveyed guess to determine how long food has been in their freezer?
- **6**. How many of the 1,200 surveyed label their freezer containers?

DVDs A store has 1,504 DVDs in stock. The store sold 19.8% of the DVDs last month. About how many DVDs did they sell last month? Use the *reasonable answers* strategy. (Lesson 7-5)

SPORTS For Exercises 8 and 9, use the table below. It shows the number of participants ages 7 to 17 in the sports listed. (Lesson 7-6)

Sport	Number (millions)			
Sport	1990	2000		
In-line Skating	3.6	21.8		
Snowboarding	1.5	4.3		
Roller Hockey	1.5	2.2		
Golf	23.0	26.4		

Source: National Sporting Goods Association

- 8. What is the percent of change in in-line skaters 7 to 17 years old from 1990 to 2000? Round to the nearest percent and state whether the percent of change is an *increase* or *decrease*.
- **9**. Find the percent of change from 1990 to 2000 in the number of children and teens who played roller hockey. Round to the nearest percent.

COMPUTERS For Exercises 10 and 11, use the following information.

The Wares want to buy a new computer with a regular price of \$1,049. (Lesson 7-7)

- **10**. If the store is offering a 20% discount, what will be the sale price of the computer?
- 11. If the sales tax on the computer is 5.25%, what will be the total cost with the discount?

BANKING For Exercises 12–15, complete the table below. The interest earned is simple interest. (Lesson 7-8)

	Principal	Rate	Time (yr)	Interest Earned
12.	\$1,525.00	5%	$2\frac{1}{2}$	
13.	\$2,250.00	4%		\$337.50
14.		3.5%	4	\$498.40
15.	\$5,080.00		3	\$952.50

Pages 340–391

Chapter 8 Statistics: Analyzing Data

NUTRITION For Exercises 1–3, use the data below, that gives the grams of carbohydrates in fifteen different energy bars.

24, 16, 16, 16, 2, 20, 26, 14, 20, 20, 16, 16, 16, 15, 20

- 1. Make a line plot of the data. (Lesson 8-1)
- 2. What is the range of the data? (Lesson 8-1)
- **3**. Identify any clusters, gaps, or outliers and explain what they represent. (Lesson 8-1)

BASKETBALL For Exercises 4–5, refer to the table below. It shows the number of games played by Michael Jordan each year from 1986–1987 to 2001–2002.

Number of Games Played								
82	82	81	82	82	80	78	0	
17	82	82	82	0	0	0	60	

Source: www.nba.com

- 4. Find the mean, median, and mode of the data. (Lesson 8-2)
- Make a stem-and-leaf plot of the data. (Lesson 8-3)
- 6. **TOURISTS** The table shows the countries from which the most tourists in the United States came. Make a bar graph of the data. (Lesson 8-4)

Country	Visitors (millions)
Canada	14.6
Mexico	10.3
Japan	5.0
United Kingdom	4.7

Source: Department of Commerce

 LUNCHES Use the bar graph to determine on what day about twice as many lunches were sold as on Wednesday. (Lesson 8-5)



SWIMMING For Exercises 8 and 9, refer to the table. It shows the winning Olympic times for the Women's 4×100 -meter Freestyle Relay in swimming. (Lesson 8-6)

Year	Time (s)			
1976	225			
1980	223			
1984	224			
1988	221			
1992	220			
1996	219			
2000 217				
Source: ESPN Sport				

Almanac

- 8. Make a line graph of the data.
- 9. Predict the winning time in 2008.
- 10. **SURVEYS** A survey of randomly selected teens revealed that 68% have a personal cell phone. If there are 1,200 teens at Harrisburg Middle School, about how many have a personal cell phone? (Lesson 8-7)
- 11. **CATS** To determine what type of cat most customers prefer, the president of a cat food company mailed 250 surveys to cat owners. Of the 185 surveys that were returned, 52% preferred calico cats. The president concluded that about half of cat owners prefer calico cats. Determine whether this conclusion is valid. Justify your answers. (Lesson 8-8)
- 12. **CELL PHONES** The table shows the number of monthly minutes Mallory used on her cell phone during the past year. She claims that the average number of minutes used is about 324. Explain how this is misleading. (Lesson 8-9)

284	322	286	359	318	294
602	278	292	267	299	285

Chapter 9 Probability

1. **DENTISTS** A dental hygienist randomly chooses a toothbrush in a drawer containing 17 white, 12 green, and 5 blue toothbrushes. What is the probability that she chooses a green toothbrush? Write as a fraction in simplest form. (Lesson 9-1)

SURVEYS For Exercises 2 and 3, use the table below. It shows the results of a survey in which adults were asked how proud they were to be an American. (Lesson 9-1)

How Proud Are You?								
Response Number								
650								
250								
60								
30								
No Opinion 10								

Source: Gallup Poll

- 2. If one person participating in the survey is chosen at random, what is the probability that the person is extremely patriotic? Write as a fraction in simplest form.
- **3**. If one person participating in the survey is chosen at random, what is the probability that he is *not* moderately patriotic? Write as a fraction in simplest form.

RANCHING For Exercises 4 and 5, use the following information.

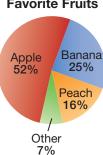
For Roger to reach his cattle pasture, he must pass through three consecutive gates. Any of the three gates can be either *open* or *closed*. (Lesson 9-2)

- 4. Make a tree diagram to show all of the possible positions of the gates.
- 5. What is the probability that all three gates will be closed when Roger visits this pasture? Write as a fraction.
- 6. SKATEBOARDS World Sports makes skateboards with different deck patterns. You can choose one of four deck lengths and one of six types of wheels. If they have 120 different skateboards, how many deck patterns are there? (Lesson 9-3)

- 7. **READING** Mr. Steadman plans to read eight children's novels to his second graders during the school year. In how many ways can he arrange the books to be read? (Lesson 9-4)
- 8. **CRAFTS** Marina has print fabric in pink, blue, magenta, green, yellow, and tan. How many different stuffed bears can she make if each bear has only four different fabrics, and the order of the fabrics is not important? (Lesson 9-5)
- 9. **TRAVEL** There are four seats in Pedro's car: two in the front and two in the back. If Benny, Carlita, and Juanita are all in the car with Pedro, how many ways can they be seated in the car if Pedro is driving? Use the *act it out* strategy. (Lesson 9-6)

10. FOOD The graph shows **Favorite Fruits** the results of a survey in which 7th graders

Apple 52% at Plentywood Middle School were asked to name their favorite fruit. If a 7th grader at the school is randomly selected, what is the



probability that they chose bananas as their favorite? Write as a fraction in simplest form. (Lesson 9-7)

MARBLES For Exercises 11 and 12, refer to the table. (Lesson 9-8)

11. What is the probability of randomly selecting one yellow marble and then one purple marble? Assume that the first marble is not replaced.

Color	Number
Red	10
Blue	6
Purple	10
Yellow	4
Green	2

12. What is the probability of randomly selecting two red marbles? Assume that the first marble is replaced.

Chapter 10 Geometry: Polygons

A

ART For Exercises 1 and 2, use the diagram of the Native American artifact.

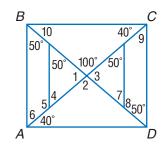
- Name a right angle and a straight angle. (Lesson 10-1)
- 2. If $m \angle AOB = 90^\circ$, what is $m \angle DOC$? (Lesson 10-2)

TELEVISION For Exercises 3 and 4, use the survey results shown in the table below. (Lesson 10-3)

Channels Families Watch					
Number	Percent				
5 or fewer	30%				
6-12	33%				
13–25	19%				
26 or more	14%				

- **3**. The fifth category in the survey is *no T.V. or no opinion*. What percent of the people surveyed were in this category?
- 4. Make a circle graph of the data.
- ART Victor drew a right triangle so that one of the acute angles measures 55°.
 Without measuring, describe how Victor can determine the measure of the other acute angle in the triangle. Then find the angle measure. (Lesson 10-4)
- 6. **GARDENING** Mr. Sanchez has a flower bed with a length of 10 meters and a width of 5 meters. If he can only change the width of the flower bed, describe what he can do to increase the perimeter by 12 meters. Use the *logical reasoning* strategy. (Lesson 10-5)
- RUNNING Four friends are entered in a race. Deirdre finishes directly ahead of Carlos. Mitchell finishes three places ahead of Tramaine and directly ahead of Deirdre. If Tramaine finishes fourth, place the runners in order from first to last. Use logical reasoning. (Lesson 10-5)

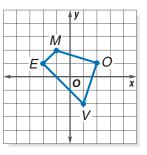
For Exercises 8 and 9, use the figure below.



- Find the measure of each angle numbered from 1–10. (Lesson 10-4)
- **9.** Find the *best* name to classify quadrilateral *ABCD*. Explain your reasoning. (Lesson 10-6)
- **10. CRAFTS** Priscilla makes porcelain dolls that are proportional to a real child. If Jody is $4\frac{2}{3}$ feet tall with a 23-inch waist, what should be the waist measure of a doll that is 13 inches tall? Round to the nearest inch. (Lesson 10-7)
- 11. **ART** Draw a tessellation using two of the polygons listed at the right. Identify the polygons and explain why the tessellation works. (Lesson 10-8)

regular triangles
quadrilaterals
pentagons
hexagons
octagons

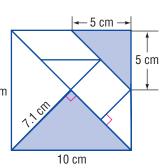
For Exercises 12 and 13, use the quadrilateral *MOVE* shown below.



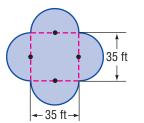
- 12. Describe the translation that will move M to the point at (2, -2). Then graph quadrilateral M'O'V'E' using this translation. (Lesson 10-9)
- Find the coordinates of the vertices of quadrilateral *MOVE* after a reflection over the *y*-axis. Then graph the reflection. (Lesson 10-10)

Chapter 11 Measurement: Two- and Three-Dimensional Figures

- 1. **CRAFTS** A quilt pattern uses 25 parallelogram-shaped pieces of fabric, each with a base of 4 inches and a height of $2\frac{1}{2}$ inches. How much fabric is used to make the 25 pieces? (Lesson 11-1)
- 2. **FURNITURE** A corner table is in the shape of a right triangle. If the side lengths of the tabletop are 3.5 feet, 3.5 feet, and 4.9 feet, what is the area? Round to the nearest tenth if necessary. (Lesson 11-2)
- 3. **PUZZLES** Find the area of each small and large shaded triangle. Round to the 10 cm nearest whole. (Lesson 11-2)



- 4. **EARTH SCIENCE** Earth has a diameter of 7,926 miles. Use the formula for the circumference of a circle to estimate the circumference of Earth at its equator. (Lesson 11-3)
- 5. **COOKIES** In New Zealand, a giant circular chocolate chip cookie was baked with a diameter of 81 feet 8 inches. To the nearest square foot, what was the area of the cookie? (Lesson 11-4)
- 6. **SPORTS PROFIT** A stadium seats 1,001,800 people. 22% of the tickets cost \$134.87 each. 45% of the tickets cost \$67.99 each. The remaining 33% cost only \$35.87 each. About how much revenue is made from one game which each seat is sold out? Use the *solve a simpler problem* strategy. (Lesson 11-5)
- LANDSCAPING Find the area of the flower garden shown in the diagram at the right. Round to the nearest square foot. (Lesson 11-6)



- 8. **GEOMETRY** A certain three-dimensional figure has four triangular faces and one square face. Classify this figure. (Lesson 11-7)
- **9. RECORDS** According to the *Guinness Book of World Records,* the tallest hotel in the world is the 1,053-foot sail-shaped Burj Al Arab in Dubai, United Arab Emirates.



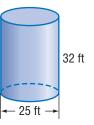
Draw possible sketches of the top, side, and front views of the hotel. (Lesson 11-8)

OCEANS For Exercises 10 and 11, use the following information.

The Atlantic Ocean has an area of about 33,420,000 square miles. Its average depth is 11,730 feet. (Lesson 11-9)

- 10. To the nearest hundredth, what is the average depth of the Atlantic Ocean in miles? (*Hint*: 1 mi = 5,280 ft)
- **11**. What is the approximate volume of the Atlantic Ocean in cubic miles?

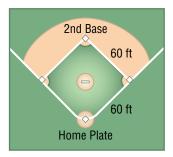
WATER For Exercises 12–13, use the cylindershaped water tank. (Lesson 11-10)



- **12**. Find the volume of the tank. Round to the nearest cubic foot.
- One cubic foot is approximately 7.48 gallons. Find the approximate volume of the water tank to the nearest gallon.

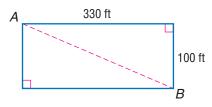
Chapter 12 Extending Geometry and Measurement

- 1. **OMELETS** In Japan, a gigantic omelet was made with an area of 1,383 square feet. If the omelet was a square, what would be its side lengths? Round to the nearest tenth. (Lesson 12-1)
- **2. SOFTBALL** A softball diamond is a square measuring 60 feet on each side.



How far does a player on second base throw when she throws from second base to home? Round to the nearest tenth. (Lesson 12-2)

3. BANDS Mr. Garcia is planning a band formation at a football game. The diagram shows the dimensions of the field.



To the nearest foot, what is the distance from A to B? (Lesson 12-2)

- 4. **GEOMETRY** Two right triangles are side by side such that they form a larger isosceles triangle. If the two right triangles are congruent and each have angle measures of 90°, 45°, and 45°, what type of triangle will the new isosceles triangle be? Use the *make a model* strategy. (Lesson 12-3)
- 5. **CUBES** A rectangular prism is formed from 48 centimeter cubes such that the height of the prism is one-half of the width and one-third of the length of the prism. Find the dimensions of the rectangular prism. Use the *make a model* strategy. (Lesson 12-3)

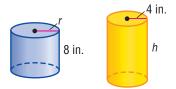
For Exercises 6 and 7, use the following information.

Liz is designing some gift boxes. The small box is 6 inches long, 4 inches wide, and 2.5 inches high. The medium box has dimensions that are each 3 times the dimensions of the small box. (Lesson 12-4)

- 6. Find the surface area of the small box.
- 7. What are the dimensions of the medium box? Then find the surface area of the medium box.

STORAGE For Exercises 8–10, use the following information.

The two canisters shown below each have a volume of about 628.3 cubic inches. (Lesson 12-5)



- 8. What is the radius of the blue canister? Round to the nearest tenth.
- **9.** What is the height of the yellow canister? Round to the nearest tenth.
- **10.** What is the difference between the surface areas of the two canisters?

HATS For Exercises 11–13, use the following information. (Lesson 12-5)

A certain cylinder-shaped hat box has a height of 9 inches and a radius of 5.5 inches. Its lid is also shaped as a cylinder, with a slightly larger diameter so that the lid fits over the box.

- How many square inches of material are needed to make the hat box, not including the lid? Round to the nearest tenth.
- **12.** If the lid has a height of 3.5 inches and a diameter of 11.8 inches, how many square inches of material are needed to make the lid? Round to the nearest tenth.
- 13. How many times more material is needed to make the hat box than the lid? Round to the nearest tenth.

Glossary/Glosario

	A mather www.math.glencoe. includes the follow	.com/multilir	• • •
Arabic	Haitian Creole	Russian	Vietnamese
Bengali	Hmong	Spanish	
Cantonese	Korean	Tagalog	
English	Portuguese	Urdu	

English

absolute value (p. 81) The distance the number is from zero on a number line.

acute angle (p. 511) An angle with a measure greater than 0° and less than 90°.



acute triangle (p. 525) A triangle having three acute angles.



Addition Property of Equality (p. 138) If you add the same number to each side of an equation, the two sides remain equal.

additive inverse (p. 96) The opposite of an integer. The sum of an integer and its additive inverse is zero.

adjacent angles (p. 511) Angles that have the same vertex, share a common side, and do not overlap.

algebra (p. 44) The branch of mathematics that involves expressions with variables.

algebraic expression (p. 44) A combination of variables, numbers, and at least one operation.

analyze (p. 397) To describe, summarize, and compare data.

Cómo usar el glosario en español:

- **1.** Busca el término en inglés que desees encontrar.
- 2. El término en español, junto con la definición, se encuentran en la columna de la derecha.

Español

valor absoluto Distancia a la que se encuentra un número de cero en la recta numérica.

ángulo agudo Ángulo que mide más de 0° y menos de 90° .



triángulo acutángulo Triángulo con tres ángulos agudos.



propiedad de adición de la igualdad Si sumas el mismo número a ambos lados de una ecuación, los dos lados permanecen iguales.

inverso aditivo El opuesto de un entero. La suma de un entero y su inverso aditivo es cero.

ángulos adyacentes Ángulos que comparten el mismo vértice y un común lado, pero no se sobreponen.

álgebra Rama de las matemáticas que involucra expresiones con variables.

expresión algebraica Combinación de variables, números y por lo menos una operación.

analizar Describir, resumir o comparar datos.

angle (p. 510) Two rays with a common endpoint form an angle. The rays and vertex are used to name the angle.



 $\angle ABC$, $\angle CBA$, or $\angle B$

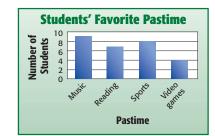
area (p. 157) The number of square units needed to cover a surface enclosed by a geometric figure.

arithmetic sequence (p. 57) A sequence in which each term is found by adding the same number to the previous term.

Associative Property (p. 54) The way in which three numbers are grouped when they are added or multiplied does not change their sum or product.

average (p. 402) The mean of a set of data.

bar graph (p. 415) A graphic form using bars to make comparisons of statistics.



bar notation (p. 197) In repeating decimals, the line or bar placed over the digits that repeat. For example, 2.63 indicates that the digits 63 repeat.

base (p. 30) In a power, the number used as a factor. In 10^3 , the base is 10. That is, $10^3 = 10 \times 10 \times 10$.

base (p. 572) The base of a parallelogram or triangle is any side of the figure. The bases of a trapezoid are the parallel sides.

base (p. 603) The top or bottom face of a threedimensional figure.

biased sample (p. 439) A sample drawn in such a way that one or more parts of the population are favored over others. **ángulo** Dos rayos con un extremo común forman un ángulo. Los rayos y el vértice se usan para nombrar el ángulo.



 $\angle ABC$, $\angle CBA$, 0 $\angle B$

área El número de unidades cuadradas necesarias para cubrir una superficie cerrada por una figura geométrica.

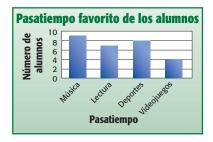
sucesión aritmética Sucesión en que cada término se encuentra sumando el mismo número al término anterior.

propiedad asociativa La manera de agrupar tres números al sumarlos o multiplicarlos no cambia su suma o producto.

promedio La media de un conjunto de datos.

B

gráfica de barras Forma gráfica que usa barras para hacer comparaciones estadísticas.



notación de barra Línea o barra que se coloca sobre los dígitos que se repiten en decimales periódicos. Por ejemplo, 2.63 indica que los dígitos 63 se repiten.

base En una potencia, el número usado como factor. En 10^3 , la base es 10. Es decir, $10^3 = 10 \times 10 \times 10$.

base La base de un paralelogramo o triángulo es el lado de la figura. Las bases de un trapecio son los lados paralelos.

base La cara inferior o superior de una figura tridimensional.

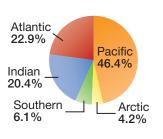
muestra sesgada Muestra en que se favorece una o más partes de una población.

center (p. 584) The given point from which all points on a circle or sphere are the same distance.

circle (p. 584) The set of all points in a plane that are the same distance from a given point called the center.

circle graph (p. 518) A type of statistical graph used to compare parts of a whole.

Area of Oceans



circumference (p. 584) The distance around a circle.

cluster (p. 397) Data that are grouped closely together.

coefficient (p. 45) The numerical factor of a term that contains a variable.

combination (p. 480) An arrangement, or listing, of objects in which order is not important.

common denominator (p. 215) A common multiple of the denominators of two or more fractions. 24 is a common denominator for $\frac{1}{3}$, $\frac{5}{8}$, and $\frac{3}{4}$ because 24 is the LCM of 3, 8, and 4.

Commutative Property (p. 54) The order in which two numbers are added or multiplied does not change their sum or product.

complementary angles (p. 514) Two angles are complementary if the sum of their measures is 90°.



 ${\sc l} 1$ and ${\sc l} 2$ are complementary angles.

centro Un punto dado del cual equidistan todos los puntos de un círculo o de una esfera.

círculo Conjunto de todos los puntos en un plano que equidistan de un punto dado llamado centro.

gráfica circular Tipo de gráfica estadística que se usa para comparar las partes de un todo.

Área de superficie de los océanos



circunferencia La distancia alrededor de un círculo.

agrupamiento Datos estrechamente agrupados.

coeficiente El factor numérico de un término que contiene una variable.

combinación Arreglo o lista de objetos donde el orden no es importante.

común denominador El múltiplo común de los denominadores de dos o más fracciones.

24 es un denominador común para $\frac{1}{3}$, $\frac{5}{8}$ y $\frac{3}{4}$ porque 24 es el mcm de 3, 8 y 4.

propiedad conmutativa El orden en que se suman o multiplican dos números no afecta su suma o producto.

ángulos complementarios Dos ángulos son complementarios si la suma de sus medidas es 90°.



 $\angle 1$ y $\angle 2$ son complementarios

complementary events (p. 462) The events of one outcome happening and that outcome not happening are complementary events. The sum of the probabilities of complementary events is 1.

complex figure (p. 596) A figure made of circles, rectangles, squares, and other two-dimensional figures.

composite number (p. 181) A whole number greater than 1 that has more than two factors.

compound event (p. 492) An event consisting of two or more simple events.

cone (p. 604) A three-dimensional figure with a curved surface and a circular base.



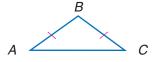
congruent angles (p. 511) Angles that have the same measure.



 $\angle 1$ and $\angle 2$ are congruent angles.

congruent figures (p. 554) Figures with equal corresponding sides of equal length and corresponding angles of equal measure.

congruent segments (p. 525) Segments having the same measure.



Side \overline{AB} is congruent to side \overline{BC} .

convenience sample (p. 439) A sample which includes members of the population that are easily accessed.

coordinate plane (p. 88) A plane in which a horizontal number line and a vertical number line intersect at their zero points. Also called a coordinate grid.

X	-ax	is	-3	\y	— y	'-a>	(is
•			-1	0			
-	-3	2-	-1	$\left \right\rangle$	or	<u>2</u> igir	3 X 1
		_	-2		0.	9	-

eventos complementarios Se dice de los eventos de un resultado que ocurren y el resultado que no ocurre. La suma de las probabilidades de eventos complementarios es 1.

figura compleja Una figura compuesta por círculos, rectángulos, cuadrados y otras dos figuras bidimencionales.

número compuesto Un número entero mayor que 1 que tiene más de dos factores.

evento compuesto Un evento que consiste en dos o más eventos simples.

cono Figura tridimensional con una superficie curva y una base circular.

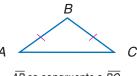


ángulos congruentes Ángulos que tienen la misma medida.

 $\angle 1$ y $\angle 2$ son congruentes.

figuras congruentes Figuras cuyos lados y ángulos correspondientes son iguales.

segmentos congruentes Segmentos que tienen la misma medida.



 \overline{AB} es congruente a \overline{BC} .

muestra de conveniencia Muestra que incluye miembros de una población fácilmente accesibles.

plano de coordenadas Plano en el cual se han trazado dos rectas numéricas, una horizontal y una vertical, que se intersecan en sus puntos cero. También conocido como sistema de coordenadas.

eje x	-3 -2 -1	y .← 0	— e	je	y
-3-2-	1 2 3	\ ,	or	2 (ige	3 x n

corresponding angles (p. 540) Congruent angles of similar figures.

corresponding sides (p. 540) Congruent or proportional sides of similar figures.

counterexample (p. 56) An example showing that a statement is not true.

cross product (p. 306) In a proportion, a cross product is the product of the numerator of one ratio and the denominator of the other ratio.

cubed (p. 30) The product in which a number is a factor three times. Two cubed is 8 because $2 \times 2 \times 2 = 8$.

cylinder (p. 604) A three-dimensional figure with two parallel congruent circular bases.

ángulos correspondientes Ángulos iguales de figuras semejantes.

lados correspondientes Lados iguales o proporcionales de figuras semejantes.

contraejemplo Ejemplo que demuestra que un enunciado no es verdadero.

productos cruzados En una proporción, un producto cruzado es el producto del numerador de una razón y el denominador de la otra razón.

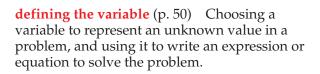
al cubo El producto de un número por sí mismo, tres veces. Dos al cubo es 8 porque $2 \times 2 \times 2 = 8$.

cilindro Figura tridimensional que tiene dos bases circulares congruentes y paralelas.



data (p. 376) Pieces of information, which are often numercical.

decagon (p. 546) A polygon having ten sides.



degrees (p. 510) The most common unit of measure for angles. If a circle were divided into 360 equal-sized parts, each part would have an angle measure of 1 degree.

dependent events (p. 493) Two or more events in which the outcome of one event affects the outcome of the other event(s).

diameter (p. 584) The distance across a circle through its center.



disjoint events (p. 494) Events that cannot happen at the same time.

datos Información, la cual a menudo se presenta de manera numérica.

decágono Un polígono con diez lados.



definir una variable El elegir una variable para representar un valor desconocido en un problema y usarla para escribir una expresión o ecuación para resolver el problema.

grados La unidad más común para medir ángulos. Si un círculo se divide en 360 partes iguales, cada parte tiene una medida angular de 1 grado.

eventos dependientes Dos o más eventos en que el resultado de un evento afecta el resultado de otro u otros eventos.

diámetro La distancia a través de un círculo pasando por el centro.



eventos disjuntos Eventos que no pueden ocurrir al mismo tiempo.

Distributive Property (p. 53) To multiply a sum by a number, multiply each addend of the sum by the number outside the parentheses.

Division Property of Equality (p. 142) If you divide each side of an equation by the same nonzero number, the two sides remain equal.

domain (p. 63) The set of input values for a function.

propiedad distributiva Para multiplicar una suma por un número, multiplica cada sumando de la suma por el número fuera del paréntesis.

propiedad de igualdad de la división Si divides ambos lados de una ecuación entre el mismo número no nulo, los lados permanecen iguales.

dominio El conjunto de valores de entrada de una función.

edge (p. 603) The segment formed by intersecting faces of a three-dimensional figure.

equation (p. 49) A mathematical sentence that contains an equals sign, =.

equilateral triangle (p. 525) A triangle having three congruent sides.



arista Segmento de recta formado por la intersección de las caras en una figura tridimensional.

ecuación Enunciado matemático que contiene un signo de igualdad, =.

triángulo equilátero Triángulo con tres lados congruentes.



equivalent expressions (p. 53) Expressions that have the same value.

equivalent fractions (p. 192) Fractions that have the same value. $\frac{2}{3}$ and $\frac{4}{6}$ are equivalent fractions.

equivalent ratios (p. 288) Two ratios that have the same value.

evaluate (p. 31) To find the value of an expression.

experimental probability (p. 486) An estimated probability based on the relative frequency of positive outcomes occurring during an experiment.

exponent (p. 30) In a power, the number that tells how many times the base is used as a factor. In 5^3 , the exponent is 3. That is, $5^3 = 5 \times 5 \times 5$.

exponential form (p. 31) Numbers written with exponents.

expresiones equivalentes Expresiones que tienen el mismo valor.

fracciones equivalentes Fracciones que tienen el mismo valor. $\frac{2}{3}$ y $\frac{4}{6}$ son fracciones equivalentes.

razones equivalentes Dos razones que tienen el mismo valor.

evaluar Calcular el valor de una expresión. probabilidad experimental

probabilidad experimental Estimado de una probabilidad que se basa en la frecuencia relativa de los resultados positivos que ocurren durante un experimento.

exponente En una potencia, el número que indica las veces que la base se usa como factor. En 5^3 , el exponente es 3. Es decir, $5^3 = 5 \times 5 \times 5$.

forma exponencial Números escritos usando exponentes.

face (p. 603) The flat surface of a threedimensional figure.

factors (p. 30) Two or more numbers that are multiplied together to form a product.

factor tree (p. 182) A diagram showing the prime factorization of a number. The factors branch out from the previous factors until all of the factors are prime numbers.

fair game (p. 469) A game in which players of equal skill have an equal chance of winning.

formula (p. 144) An equation that shows the relationship among certain quantities.

function (p. 63) A relation in which each element of the input is paired with exactly one element of the output according to a specified rule.

function rule (p. 63) The operation performed on the input of a function.

function table (p. 63) A table used to organize the input numbers, output numbers, and the function rule.

Fundamental Counting Principle (p. 471) Uses multiplication of the number of ways each event in an experiment can occur to find the number of possible outcomes in a sample space.

gram (p. 300) A unit of mass in the metric system equivalent to 0.001 kilogram.

graph (p. 80) The process of placing a point on a number line at its proper location.

greatest common factor (GCF) (p. 186) The greatest of the common factors of two or more numbers. The GCF of 18 and 24 is 6.

cara Superficies planas de una figura tridimensional.

factores Dos o más números que se multiplican entre sí para formar un producto.

diagrama de árbol Diagrama que muestra la factorización prima de un número. Los factores se ramifican a partir de los factores previos hasta que todos los factores son números primos.

juego justo Juego en que jugadores con la misma habilidad tienen igual oportunidad de ganar.

fórmula Ecuación que muestra la relación entre ciertas cantidades.

función Relación en que cada elemento de entrada es apareado con un único elemento de salida, según una regla específica.

regla de función Operación que se efectúa en el valor de entrada.

tabla de funciones Tabla que organiza las entradas, la regla y las salidas de una función.

Principio Fundamental de Contar Este principio usa la multiplicación del número de veces que puede ocurrir cada evento en un experimento para calcular el número de posibles resultados en un espacio muestral.

G

gramo Unidad de masa del sistema métrico. Un gramo equivale a 0.001 de kilogramo.

graficar Proceso de dibujar o trazar un punto en una recta numérica en su ubicación correcta.

máximo común divisor (MCD) El mayor factor común de dos o más números. El MCD de 18 y 24 es 6.

A

height (p. 572) The length of the segment perpendicular to the base with endpoints on opposite sides. In a triangle, the distance from a base to the opposite vertex.

height

altura Longitud del segmento perpendicular a la base y con extremos en lados opuestos. En un triángulo, es la distancia desde una base al vértice opuesto.

altura

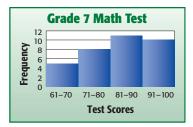
 $\left(\right)$

heptagon (p. 546) A polygon having seven sides.

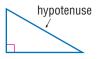
hexagon (p. 546) A polygon having six sides.



histogram (p. 416) A special kind of bar graph in which the bars are used to represent the frequency of numerical data that have been organized in intervals.



hypotenuse (p. 640) The side opposite the right angle in a right triangle.



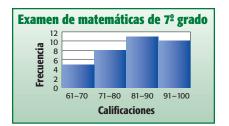
heptágono Polígono con siete lados.



hexágono Polígono con seis lados.



histograma Tipo especial de gráfica de barras que usa barras para representar la frecuencia de los datos numéricos, los cuales han sido organizados en intervalos iguales.



hipotenusa El lado opuesto al ángulo recto en un triángulo rectángulo.



Identity Property (p. 54) The sum of an addend and 0 is the addend. The product of a factor and 1 is the factor.

independent events (p. 492) Two or more events in which the outcome of one event does not affect the outcome of the other event(s).

indirect measurement (p. 542) Finding a measurement by using similar triangles and writing a proportion.

integer (p. 80) Any number from the set {..., -4, -3, -2, -1, 0, 1, 2, 3, 4, ...}

inverse operations (p. 136) Operations that "undo" each other. Addition and subtraction are inverse operations.

irrational number (p. 637) A number that cannot be written as a fraction.

propiedad de identidad La suma de un sumando y 0 es el sumando mismo. El producto de un factor y 1 es el factor mismo.

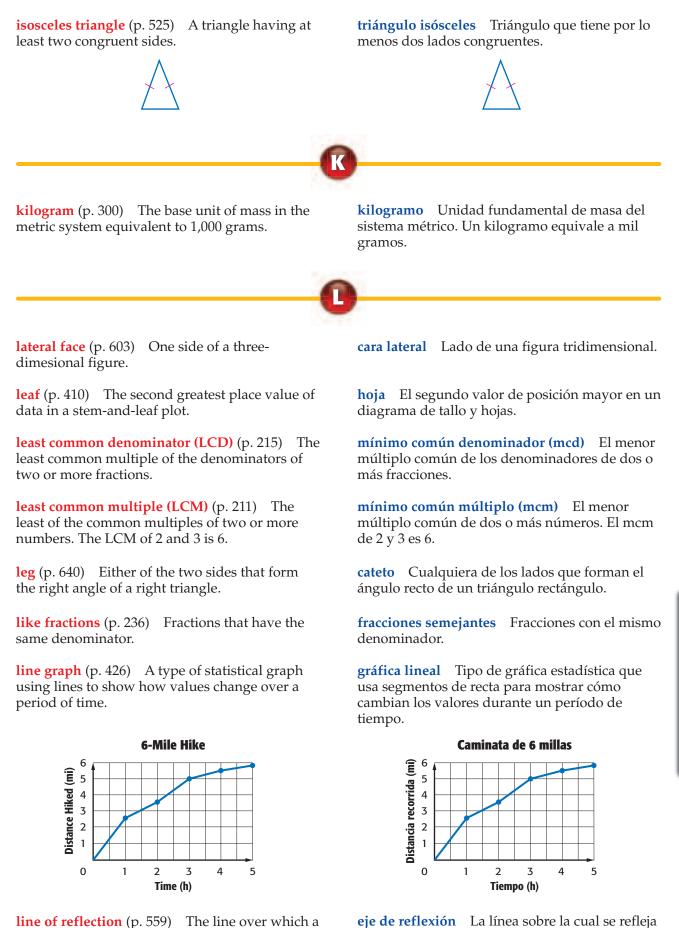
eventos independientes Dos o más eventos en los cuales el resultado de uno de ellos no afecta el resultado de los otros eventos.

medida indirecta Técnica que se usa para calcular una medida a partir de triángulos semejantes y proporciones.

entero Todo número del conjunto {..., -4, -3, -2, -1, 0, 1, 2, 3, 4, ...}

operaciones inversas Operaciones que se "anulan" mutuamente. La adición y la sustracción son operaciones inversas.

número irracional Número que no se puede escribir como fracción.



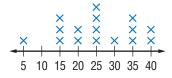
una figura.

line of reflection (p. 559) The line over which a figure is reflected.

line of symmetry (p. 558) A line that divides a figure into two halves that are reflections of each other.



line plot (p. 396) A diagram that shows the frequency of data. An \times is placed above a number on a number line each time that number occurs in a set of data.



line symmetry (p. 558) Figures that match exactly when folded in half have line symmetry.

linear equation (p. 164) An equation for which the graph is a straight line.

liter (p. 300) The base unit of capacity in the metric system. A liter is a little more than a quart.

mean (p. 402) The sum of the data divided by the number of items in the data set.

measures of central tendency (p. 402) Numbers that are used to describe the center of a set of data. These measures include the mean, median, and mode.

median (p. 403) The middle number in a set of data when the data are ordered from least to greatest. If the data has an even number of items, the median is the mean of the two numbers closer to the middle.

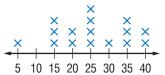
meter (p. 300) The base unit of length in the metric system.

metric system (p. 300) A base-ten system of measurement using the base units: meter for length, kilogram for mass, and liter for capacity.

eje de simetría Recta que divide una figura en dos mitades que son reflexiones entre sí.



esquema lineal Grafica que muestra la frecuencia de datos. Se coloca una × sobre la recta numérica, cada vez que el número aparece en un conjunto de datos.



simetría lineal Exhiben simetría lineal las figuras que coinciden exactamente al doblarse una sobre otra.

ecuación lineal Ecuación cuya gráfica es una recta.

litro Unidad básica de capacidad del sistema métrico. Un litro es un poco más de un cuarto de galón.

media La suma de los datos dividida entre el número total de artículos en el conjunto de datos.

medidas de tendencia central Números que se usan para describir el centro de un conjunto de datos. Estas medidas incluyen la media, la mediana y la moda.

mediana El número del medio en un conjunto de datos cuando los datos se ordenan de menor a mayor. Si los datos tienen un número par de artículos, la mediana es la media de los dos números más cercanos al medio.

metro Unidad fundamental de longitud del sistema métrico.

sistema métrico Sistema de medidas de base diez que usa las unidades fundamentales: metro para longitud, kilogramo para masa y litro para capacidad.

mode (p. 403) The number or numbers that appear most often in a set of data. If there are two or more numbers that occur most often, all of them are modes.

multiple (p. 211) The product of a number and any whole number.

Multiplication Property of Equality (p. 259) If you multiply each side of an equation by the same nonzero number, the two sides remain equal.

multiplicative inverse (p. 258) The product of a number and its multiplicative inverse is 1. The multiplicative inverse of $\frac{2}{3}$ is $\frac{3}{2}$.

moda El número o números que aparece con más frecuencia en un conjunto de datos. Si hay dos o más números que ocurren con más frecuencia, todosellos son modas.

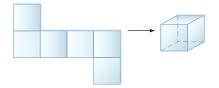
múltiplo El producto de un número y cualquier número entero.

propiedad de multiplicación de la igualdad Si multiplicas ambos lados de una ecuación por el mismo número no nulo, lo lados permanecen iguales.

inverso multiplicativo El producto de un número y su inverso multiplicativo es 1. El inverso multiplicativo de $\frac{2}{3}$ es $\frac{3}{2}$.

negative integer (p. 80) An integer that is less than zero.

net (p. 600) A two-dimensional figure that can be used to build a three-dimensional figure.

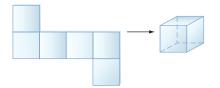


nonagon (p. 546) A polygon having nine sides.

numerical expression (p. 38) A combination of numbers and operations.

entero negativo Un entero menor que cero.

red Figura bidimensional que sirve para hacer una figura tridimensional.



enágono Polígono que tiene nueve lados.

expresión numérica Combinación de números y operaciones.

obtuse angle (p. 511) Any angle that measures greater than 90° but less than 180°.



obtuse triangle (p. 525) A triangle having one obtuse angle.



ángulo obtuso Cualquier ángulo que mide más de 90° pero menos de 180°.



triángulo obtusángulo Triángulo que tiene un ángulo obtuso.



octagon (p. 546) A polygon having eight sides.

octágono Polígono que tiene ocho lados.



opposites (p. 96) Two integers are opposites if they are represented on the number line by points that are the same distance from zero, but on opposite sides of zero. The sum of two opposites is zero.

order of operations (p. 38) The rules to follow when more than one operation is used in a numerical expression.

- 1. Evaluate the expressions inside grouping symbols
- 2. Evaluate all powers
- 3. Multiply and divide in order from left to right.
- 4. Add and subtract in order from left to right.

ordered pair (p. 88) A pair of numbers used to locate a point in the coordinate plane. An ordered pair is written in the form (*x*-coordinate, *y*-coordinate).

origin (p. 88) The point at which the *x*-axis and the *y*-axis intersect in a coordinate plane.

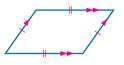
outcome (p. 460) One possible result of a probability event. For example, 4 is an outcome when a number cube is rolled.

outlier (p. 397) A piece of data that is quite separated from the rest of the data.

parallel lines (p. 533) Lines in a plane that do not intersect.



parallelogram (p. 533) A quadrilateral with opposite sides parallel and opposite sides congruent.





opuestos Dos enteros son opuestos si, en la recta numérica, están representados por puntos que equidistan de cero, pero en direcciones opuestas. La suma de dos opuestos es cero.

orden de operaciones Reglas a seguir cuando se usa más de una operación en una expresión numérica.

- 1. Primero ejecuta todas las operaciones dentro de los símbolos de agrupamiento
- 2. Evalúa todas las potencias antes que las otras operaciones.
- 3. Multiplica y divide en orden de izquierda a derecha.
- 4. Suma y resta en orden de izquierda a derecha.

par ordenado Par de números que se utiliza para ubicar un punto en un plano de coordenadas. Se escribe de la siguiente forma: (coordenada *x*, coordenada *y*).

origen Punto en que el eje *x* y el eje *y* se intersecan en un plano de coordenadas.

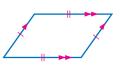
resultado Uno de los resultados posibles de un evento probabilístico. Por ejemplo, 4 es un resultado posible cuando se lanza un dado.

valor atípico Dato que se encuentra muy separado del resto de los datos.

líneas paralelas Rectas situadas en un mismo plano y que no se intersecan.



paralelogramo Cuadrilátero cuyos lados opuestos son paralelos y congruentes.



parte En una proporción porcentual, el número que se compara con la cantidad total.

pentagon (p. 546) A polygon having five sides.

pentágono Polígono que tiene cinco lados.



percent (p. 202) A ratio that compares a number to 100.

percent equation (p. 361) An equation that describes the relationship between the part, whole, and percent. part = percent • whole

percent of change (p. 369) A ratio that compares the change in a quantity to the original amount.

percent of decrease (p. 369) A percent of change when the original quantity decreased.

percent of increase (p. 369) A percent of change when the original quantity increased.

percent proportion (p. 350) Compares part of a quantity to the whole quantity using a percent.

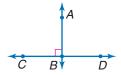
 $\frac{\text{part}}{\text{whole}} = \frac{\text{percent}}{100}$

perfect squares (p. 34) Numbers whose square roots are whole numbers. 25 is a perfect square because the square root of 25 is 5.

perimeter (p. 156) The distance around a closed geometric figure.

permutation (p. 475) An arrangement, or listing, of objects in which order is important.

perpendicular lines (p. 512) Lines that meet to form right angles.



pi (π) (p. 584) The ratio of the circumference of a circle to its diameter. An approximation often used for π is 3.14.

polygon (p. 546) A simple closed figure in a plane formed by three or more line segments.



por ciento Razón que compara un número con 100.

ecuación porcentual Ecuación que describe la relación entre la parte, el todo y el por ciento. parte = por ciento • todo.

porcentaje de cambio Razón que compara el cambio en una cantidad, con la cantidad original.

porcentaje de disminución Porcentaje de cambio cuando disminuye la cantidad original.

porcentaje de aumento Porcentaje de cambio cuando aumenta la cantidad original.

proporción porcentual Comparar partes de una cantidad, a la cantidad entera, usando un porcentaje.

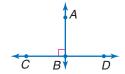
$$\frac{\text{parte}}{\text{todo}} = \frac{\text{porcentaje}}{100}$$

cuadrados perfectos Números cuya raíz cuadrada es un número entero. 25 es un cuadrado perfecto porque la raíz cuadrada de 25 es 5.

perímetro La distancia alrededor de una figura geométrica cerrada.

permutación Arreglo o lista en que el orden es importante.

rectas perpendiculares Rectas que al encontrarse forman ángulos rectos.



pi (π) Razón entre la circunferencia de un círculo y su diámetro. A menudo, se usa 3.14 como aproximación del valor de π .

polígono Figura simple cerrada en un plano, formada por tres o más segmentos de recta.

population (p. 434) The entire group of items or individuals from which the samples under consideration are taken.

positive integer (p. 80) An integer that is greater than zero.

powers (p. 30) Numbers expressed using exponents. The power 3² is read *three to the second power, or three squared.*

prime factorization (p. 182) Expressing a composite number as a product of prime numbers. For example, the prime factorization of 63 is $3 \times 3 \times 7$.

prime number (p. 181) A whole number greater than 1 that has exactly two factors, 1 and itself.

principal (p. 379) The amount of money deposited or invested.

prism (p. 601) A three-dimensional figure with at least three rectangular lateral faces and top and bottom faces parallel.

probability (p. 460) The chance that some event will happen. It is the ratio of the number of ways a certain event can occur to the number of possible outcomes.

properties (p. 54) Statements that are true for any number or variable.

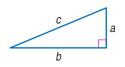
proportion (p. 306) An equation that shows that two ratios are equivalent.

proportional (p. 306) The relationship between two ratios with a constant rate or ratio.

protractor (p. 680) An instrument used to measure angles.

pyramid (p. 603) A three-dimensional figure with at least three lateral faces that are triangles and only one base.

Pythagorean Theorem (p. 640) In a right triangle, the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the legs. $c^2 = a^2 + b^2$



población El grupo total de individuos o de artículos del cual se toman las muestras bajo estudio.

entero positivo Un entero mayor que cero.

potencias Números que se expresan usando exponentes. La potencia 3² se lee *tres a la segunda potencia o tres al cuadrado.*

factorización prima Escritura de un número compuesto como el producto de números primos. La factorización prima de 63 es $3 \times 3 \times 7$.

número primo Número entero mayor que 1 que sólo tiene dos factores, 1 y sí mismo.

capital La cantidad de dinero depositada o invertida.

prisma Figura tridimensional que tiene por lo menos tres caras laterales rectangulares y caras paralelas superior e inferior.

probabilidad La posibilidad de que suceda un evento. Es la razón del número de maneras en que puede ocurrir un evento al número total de resultados posibles.

propiedades Enunciados que se cumplen para cualquier número o variable.

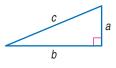
proporción Ecuación que muestra que dos razones son equivalentes.

proporcional Relación entre dos razones con una tasa o razón constante.

transportador Instrumento que sirve para medir ángulos.

pirámide Figura tridimensional que tiene por lo menos tres caras laterales triangulares que son triángulos y una sola base.

Teorema de Pitágoras En un triángulo rectángulo, el cuadrado de la longitud de la hipotenusa es igual a la suma de los cuadrados de las longitudes de los catetos. $c^2 = a^2 + b^2$



quadrant (p. 88) One of the four regions into which the two perpendicular number lines of the coordinate plane separate the plane.

		y	ax	is /	1				
Q	ua	dra	nt			Qua	adr	ant	t I
+				0			X	(-a)	(is
Q	ua	dra	nt		Q	ua	dra	nt	IV
					,				

quadrilateral (p. 533) A closed figure having four sides and four angles.

U

radical sign (p. 35) The symbol used to indicate a nonnegative square root, $\sqrt{\ }$.

radius (p. 584) The distance from the center of a circle to any point on the circle.



random (p. 461) Outcomes occur at random if each outcome is equally likely to occur.

range (p. 63) The set of output values for a function.

range (p. 397) The difference between the greatest and least numbers in a data set.

rate (p. 287) A ratio that compares two quantities with different kinds of units.

rate of change (p. 293) A ratio that shows a change in one quantity with respect to a change in another quantity.

ratio (p. 202) A comparison of two numbers by division. The ratio of 2 to 3 can be written as

2 out of 3, 2 to 3, 2 : 3, or $\frac{2}{3}$.

cuadrante Una de las cuatro regiones en que dos rectas numéricas perpendiculares dividen el plano de coordenadas.

			eje	y'					
Сι	uac	Irar	nte		С	ua	dra	inte	e I
+				0				eje	x
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				,	,				\square

cuadrilátero Figura cerrada que tiene cuatro lados y cuatro ángulos.

signo radical Símbolo que se usa para indicar una raíz cuadrada no negativa, $\sqrt{}$.

radio Distancia desde el centro de un círculo hasta cualquier punto del mismo.



aleatorio Un resultado ocurre al azar si la posibilidad de ocurrir de cada resultado es equiprobable.

rango Conjunto de los valores de salida de una función.

rango La diferencia entre el número mayor y el menor en un conjunto de datos.

tasa Razón que compara dos cantidades que tienen distintas unidades de medida.

tasa de cambio Razón que representa el cambio en una cantidad con respecto al cambio en otra cantidad.

razón Comparación de dos números mediante división. La razón de 2 a 3 puede

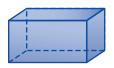
escribirse como 2 de cada 3, 2 a 3, 2:3 ó $\frac{2}{3}$.

rational number (p. 216) A number that can be expressed as a fraction.

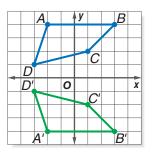
reciprocal (p. 258) The multiplicative inverse of a number.

rectangle (p. 533) A parallelogram having four right angles.

rectangular prism (p. 611) A solid figure that has two parallel and congruent bases that are rectangles.



reflection (p. 559) A type of transformation in which a figure is flipped over a line of symmetry.



regular polygon (p. 546) A polygon that has all sides congruent and all angles congruent.



repeating decimals (p. 197) A decimal whose digits repeat in groups of one or more. Examples are 0.181818... and 0.83333....

rhombus (p. 533) A parallelogram having four congruent sides.



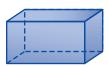
right angle (p. 511) An angle that measures 90°.

número racional Número que puede expresarse como fracción.

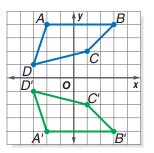
recíproco El inverso multiplicativo de un número.

rectángulo Paralelogramo con cuatro ángulos rectos.

prisma rectangular Figura sólida con dos bases paralelas y congruentes que son rectángulos.



reflexión Tipo de transformación en el que se da vuelta a una figura sobre un eje de simetría.



polígono regular Polígono con todos los lados y todos los ángulos congruentes.



decimales periódicos Decimal cuyos dígitos se repiten en grupos de uno o más. Por ejemplo: 0.181818... y 0.83333... .

rombo Paralelogramo que tiene cuatro lados congruentes.



ángulo rect Ángulo que mide exactamente 90°.



right triangle (p. 525) A triangle having one right angle.

triángulo rectángulo Triángulo que tiene un ángulo recto.





sample (p. 438) A randomly selected group chosen for the purpose of collecting data.

sample space (p. 465) The set of all possible outcomes of a probability experiment.

sampling (p. 312) A practical method used to survey a representative group.

scale (p. 316) On a map, intervals used representing the ratio of distance on the map to the actual distance.

scale drawing (p. 316) A drawing that is similar but either larger or smaller than the actual object.

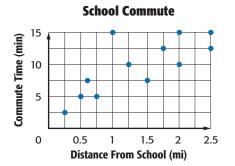
scale factor (p. 318) A scale written as a ratio in simplest form.

scale model (p. 316) A model used to represent something that is too large or too small for an actual-size model.

scalene triangle (p. 525) A triangle having no congruent sides.



scatter plot (p. 427) In a scatter plot, two sets of related data are plotted as ordered pairs on the same graph.



muestra Grupo escogido al azar o aleatoriamente que se usa con el propósito de recoger datos.

espacio muestral Conjunto de todos los resultados posibles de un experimento probabilístico.

muestreo Método conveniente que facilita la elección y el estudio de un grupo representativo.

escala En un mapa, los intervalos que se usan para representar la razón de las distancias en el mapa a las distancias verdaderas.

dibujo a escala Dibujo que es semejante, pero más grande o más pequeño que el objeto real.

factor de escala Escala escrita como una tasa en forma reducida.

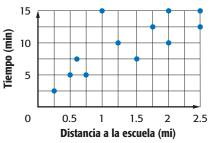
modelo a escala Réplica de un objeto real, el cual es demasiado grande o demasiado pequeño como para construirlo de tamaño natural.

triángulo escaleno Triángulo sin lados congruentes.



diagrama de dispersión Diagrama en que dos conjuntos de datos relacionados aparecen graficados como pares ordenados en la misma gráfica.

Tiempo para llegar a la escuela



sequence (p. 57) A list of numbers in a certain order, such as 0, 1, 2, 3, or 2, 4, 6, 8.

similar figures (p. 540) Figures that have the same shape but not necessarily the same size.



simple event (p. 460) One outcome or a collection of outcomes.

simple interest (p. 425) The amount paid or earned for the use of money. The formula for simple interest is I = prt.

simple random sample (p. 438) A sample where each item or person in the population is as likely to be chosen as any other.

simplest form (p. 192) A fraction is in simplest form when the GCF of the numerator and the denominator is 1.

simulate (p. 491) A way of acting out or modeling a problem situation.

solution (p. 49) A value for the variable that makes an equation true. The solution of 12 = x + 7 is 5.

solving an equation (p. 49) The process of finding a solution to an equation.

sphere (p. 604) A three-dimensional figure in which all points are equal distance from the center.

square (p. 34) The product of a number and itself. 36 is the square of 6.

square (p. 533) A parallelogram having four right angles and four congruent sides.

square root (p. 35) One of the two equal factors of a number. The square root of 9 is 3.

standard form (p. 31) Numbers written without exponents.

semicírculo Mitad de un círculo con el mismo diámetro.

sucesión Lista de números en cierto orden, tales como 0, 1, 2, 3 ó 2, 4, 6, 8.

figuras semejantes Figuras que tienen la misma forma, pero no necesariamente el mismo tamaño.

eventos simples Un resultado o una colección de resultados.

interés simple Cantidad que se paga o que se gana por el uso del dinero. La fórmula para calcular el interés simple es I = prt.

muestra aleatoria simple Muestra de una población que tiene la misma probabilidad de escogerse que cualquier otra.

forma reducida Una fracción está escrita en forma reducida si el MCD de su numerador y denominador es 1.

simulación Manera de modelar o representar un problema.

solución Valor de la variable de una ecuación que hace verdadera la ecuación. La solución de 12 = x + 7 es 5.

resolver una ecuación Proceso de encontrar el número o números que satisfagan una ecuación.

esfera Figura tridimensional en que todos los puntos están equidistantes del centro.

cuadrado El producto de un número por sí mismo. 36 es el cuadrado de 6.

cuadrado Paralelogramo con cuatro ángulos rectos y cuatro lados congruentes.

raíz cuadrada Uno de dos factores iguales de un número. La raíz cuadrada de 9 es 3.

forma estándar Números escritos sin exponentes.

statistics (p. 396) The branch of mathematics that deals with collecting, organizing, and interpreting data.

stem (p. 410) The greatest place value common to all the data values is used for the stem of a stem-and-leaf plot.

stem-and-leaf plot (p. 410) A system used to condense a set of data where the greatest place value of the data forms the stem and the next greatest place value forms the leaves.

straight angle (p. 511) An angle that measures exactly 180°.

Subtraction Property of Equality (p. 136) If you subtract the same number from each side of an equation, the two sides remain equal.

supplementary angles (p. 514) Two angles are supplementary if the sum of their measures is 180°.

 $\angle 1$ and $\angle 2$ are supplementary angles.

surface area (p. 649) The sum of the areas of all the surfaces (faces) of a three-dimensional figure.

survey (p. 434) A question or set of questions designed to collect data about a specific group of people.

term (p. 57) Each number in a sequence.

terminating decimals (p. 197) A decimal whose digits end. Every terminating decimal can be written as a fraction with a denominator of 10, 100, 1,000, and so on.

tessellation (p. 548) A repetitive pattern of polygons that fit together with no holes or gaps.

estadística Rama de las matemáticas cuyo objetivo primordial es la recopilación, organización e interpretación de datos.

tallo El mayor valor de posición común a todos los datos es el que se usa como tallo en un diagrama de tallo y hojas.

diagrama de tallo y hojas Sistema que se usa para condensar un conjunto de datos y en el cual el mayor valor de posición de los datos forma el tallo y el segundo mayor valor de posición de los datos forma las hojas.

ángulo llano Ángulo que mide exactamente 180°.



propiedad de sustracción de la igualdad Si restas el mismo número de ambos lados de una ecuación, los dos lados permanecen iguales.

ángulos suplementarios Dos ángulos son suplementarios si la suma de sus medidas es 180°.

 $\angle 1$ y $\angle 2$ son suplementarios.

área de superficie La suma de las áreas de todas las superficies (caras) de una figura tridimensional.

encuesta Pregunta o conjunto de preguntas diseñadas para recoger datos sobre un grupo específico de peronas.

término Cada número en una sucesión.

decimales terminales Decimal cuyos dígitos terminan. Todo decimal terminal puede escribirse como una fracción con un denominador de 10, 100, 1,000, etc.

teselado Un patrón repetitivo de polígonos que coinciden perfectamente, sin dejar huecos o espacios.

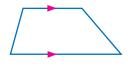
theoretical probability (p. 486) The ratio of the number of ways an event can occur to the number of possible outcomes.

three-dimensional figures (p. 603) A figure with length, width, and depth (or height).

transformation (p. 553) A movement of a geometric figure.

translation (p. 553) One type of transformation where a geometric figure is slid horizontally, vertically, or both.

trapezoid (p. 533) A quadrilateral with one pair of parallel sides.



tree diagram (p. 466) A diagram used to show the total number of possible outcomes in a probability experiment.

triangle (p. 524) A polygon that has three sides and three angles.

triangular prism (p. 615) A prism that has bases that are triangles.



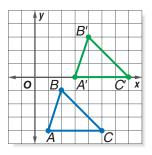
two-step equation (p. 151) An equation having two different operations.

probabilidad teórica La razón del número de maneras en que puede ocurrir un evento al número total de resultados posibles.

figuras tridimensionales Figuras que poseen largo, ancho y profundidad (o altura).

transformación Movimientos de figuras geométricas.

traslación Tipo de transformación en que una figura se desliza horizontal o verticalmente o de ambas maneras.



trapecio Cuadrilátero con un único par de lados paralelos.

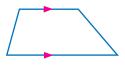
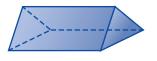


diagrama de árbol Diagrama que se usa para mostrar el número total de resultados posibles en experimento probabilístico.

triángulo Polígono que posee tres lados y tres ángulos.

prisma triangular Prisma cuyas bases son triángulos.



ecuación de dos pasos Ecuación que contiene dos operaciones distintas.

Glossary/Glosario

unbiased sample (p. 438) A sample representative of the entire population.

unit rate (p. 287) A rate with denominator of 1.

unit ratio (p. 295) A unit rate where the denominator is one unit.

unlike fractions (p. 237) Fractions with different denominators.

muestra no sesgada Muestra que se selecciona de modo que se representativa de la población entera.

tasa unitaria Una tasa con un denominador de 1.

razón unitaria Tasa unitaria en que el denominador es la unidad.

fracciones con distinto denominador Fracciones cuyos denominadores son diferentes.

variable (p. 44) A placeholder, usually a letter, used to represent an unspecified value in mathematical expressions or sentences. In 3 + a = 6, *a* is a variable.

Venn diagram (p. 186) A diagram that uses overlapping circles to show how elements among sets of numbers or objects are related.

vertex (p. 510) A vertex of an angle is the common endpoint of the rays forming the angle.

vertex

vertex (p. 603) The point where the edges of a three dimensional figure intersect.

vertical angles (p. 511) Opposite angles formed by the intersection of two lines.



 $\angle 1$ and $\angle 2$ are vertical angles.

volume (p. 613) The number of cubic units needed to fill the space occupied by a solid.

voluntary response sample (p. 439) A sample which involves only those who want to participate in the sampling.

variable Marcador de posición, por lo general, una letra, que se usa para representar un valor desconocido en expresiones o enunciados matemáticos. En 3 + a = 6, *a* es una variable.

diagrama de Venn Diagrama que usa círculos para mostrar la relación entre los elementos en un conjunto de números u objetos

vértice El vértice de un ángulo es el extremo común de los rayos que lo forman.



vértice Punto donde se intersecan las aristas de una figura tridimensional.

ángulos opuestos por el vértice Ángulos opuestos que se forman de la intersección de dos rectas.



∠1 y ∠2 son ángulos opuestos por el vértice.

volumen Número de unidades cúbicas que se requieren para llenar el espacio que ocupa un sólido.

muestra de respuesta voluntaria Muestra que involucra sólo aquellos que quieren participar en el muestreo.

	W
whole (p. 350) In a percent proportion, the number to which the part is being compared.	todo En una proporción porcentual, el número con que se compara la parte.
x-axis (p. 88) The horizontal number line in a coordinate plane.	eje <i>x</i> La recta numérica horizontal en el plano de coordenadas.
<i>x</i> -coordinate (p. 88) The first number of an ordered pair. It corresponds to a number on the <i>x</i> -axis.	coordenada <i>x</i> El primer número de un par ordenado. Corresponde a un número en el eje <i>x</i> .
y-axis (p. 88) The vertical number line in a	eje <i>y</i> La recta numérica vertical en el plano de
coordinate plane.	coordenadas.
<i>y</i> -coordinate (p. 88) The second number of an ordered pair. It corresponds to a number on the <i>y</i> -axis.	coordenada <i>y</i> El segundo número de un par ordenado. Corresponde a un número en el eje <i>y</i> .
	2
zero pair (p. 93) The result when one positive counter is paired with one negative counter.	par nulo Resultado que se obtiene cuando una ficha positiva se aparea con una ficha negativa.
+	+
(+)	+

Selected Answers

Chapter 1 Introduction to Algebra and Functions

 Page 23
 Chapter 1
 Getting Ready

 1. 105.8
 3. 60.64
 5. \$72.94
 7. 2.5
 9. 6.2
 11. 29.4

 13. 10.2
 15. 5.3
 17. 4.46

Pages 27-29

Lesson 1-1

1. 4 times; $16,000 \div 4,000 = 4$ **3.** 3,000 **5.** \$4,169



9. every 45 minutes 11. 1:30 P.M. 15. 21 wk
17. Sample answer: For the school bake sale, Samantha bakes 79 cookies and 42 brownies. If two other students baked the same amount of cookies and brownies, how many items did they bake altogether? 19. C 21. 100 23. 625

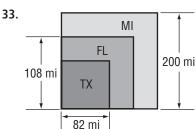
Pages 31–33 Lesson 1-2

1. 9 • 9 • 9 **3.** 8 • 8 • 8 • 8 • 8 **5.** 49 **7.** Sample answer: 282,000,000 people **9.** 1^4 **11.** 1 • 1 • 1 • 1 • 1 **13.** 3 • 3 • 3 • 3 • 3 • 3 • 3 **15.** 9 • 9 • 9 **17.** 64 **19.** 2,401 **21.** 1 **23.** 1,000,000 **25.** 3^2 **27.** 1^8 **29.** 4 • 4 • 4 • 4 • 4 **31.** 1,296 **33.** 1^3 , 2^3 , 3^3 , 4^3 , 5^3 **35.** $5^4 \cdot 4^3$ **37.** 1^{14} , 17^3 , 6^5 , 4^{10} **39.** 7^2 , 5^3 , 2^{11} , 4^6 **41.** 50; 50 cannot be expressed as a power: $4 = 2^2$, $9 = 3^2$, $16 = 4^2$ **43.** Sample answer: The pattern is that each successive term is $\frac{1}{2}$ of the previous one, so $2^0 = 1$

and $2^{-1} = \frac{1}{2}$. **45.** about twice as many **47.** 4 **49.** 25

Pages 36–37 Lesson 1-3

1. 36 **3.** 289 **5.** 3 **7.** 11 **9.** 24 in. by 24 in. **11.** 1 **13.** 121 **15.** 400 **17.** 1,156 **19.** 4 **21.** 10 **23.** 16 **25.** 25 **27.** 40 ft **29.** 361 **31.** 96,721 mi²



Pages 40–41 Lesson 1-4

1. 11; Sample answer: Subtract first since 5 - 2 is in parentheses. Then add 8. **3.** 11; Sample answer: Multiply 2 by 6 first since multiplication comes before addition or subtraction. Then subtract and add in order from left to right. 5. Sample answer: Evaluate 10^2 first since it is a power. Then multiply by 4. **7**. Sample answer: Subtract first since 6 - 3 is in parentheses. Then multiply the difference by 2 and multiply 3 by 4 since multiplication comes before addition or subtraction. Finally, add 17 + 6and subtract 12 in order from left to right. 9. 3(0.05) + 2(0.25) + 2(0.10) + 7(0.01); \$0.92 **11.** Sample answer: Add first since 3 + 4 is in parentheses. Then subtract. 13. Sample answer: Subtract first since 11 - 2 is in parentheses. Then divide. **15.** Sample answer: Divide first since division comes before addition or subtraction. Then subtract 1 and add 7 in order from left to right. **17**. Sample answer: Multiply first since multiplication comes before addition or subtraction. Then subtract the product from 118 and add 5. **19.** Sample answer: Evaluate 10⁴ first since it is a power. Then multiply by 3. **21**. Sample answer: Evaluate 7² first since it is a power. Then multiply by 8 since multiplication comes before subtraction. Finally, subtract. **23.** Sample answer: Evaluate 9² since it is a power. Then divide 14 by 7 and multiply the quotient by 3 since multiplication and division occur from left to right. Finally, subtract. 25. Sample answer: Add first since 6 + 5 is in parentheses. Then subtract 6 from 8 since 8 – 6 is in parentheses. Finally, multiply. **27.** Sample answer: Add first since 4 + 7 is in parentheses. Then multiply the sum by 3. Next, multiply 5 by 4 and divide the product by 2 since multiplication and division occur in order from left to right. Finally, subtract. **29.** 3(2) + 2(3) + 4; 16 h/wk **31.** 19; Sample answer: Evaluate 3³ first since it is a power. Then add 8. Next subtract 6 from 10 since 10 – 6 is in parentheses. Then square the difference since the power is 2. Finally subtract 16 from 35. **33.** 64; Sample answer: Subtract first since 4 - 3.2 is in parentheses. Multiply 7 by 9 next since multiplication occurs from left to right. Then subtract 0.8 from the product, 63, and add 1.8 since addition and subtraction occur from left to right. **35.** Sample answer: $2 + 3(4) - 6 \div 2$ **37**. $72 \div (9 + 27) - 2 =$ 0 39. C 41. H 43. 45 45. 32 million

Pages 42–43 Lesson 1-5

1. Sample answer: You need to keep track of what numbers you have already guessed, so that you do not make the same guess twice. You also need to know what numbers produce answers that are too large or too small, so you can make better guesses. **3.** 9 cars and 7 SUVs **5.** Songs B, C, D, E, G, and H run for a total of 29.65 minutes, or 29 minutes and 39 seconds. **7.** The circumference of Earth is 24,900 miles long at

the Equator. **9.** 512 and 1,024 **11.** addition; 324.8 in. of snow.

Pages 46-47Lesson 1-6

1. 10 **3.** 2 **5.** 32 **7.** 22 **9.** 7 **11.** 3 **13.** 4 **15.** 7 **17.** 5 **19.** 12 **21.** 48 **23.** 4 **25.** 18 **27.** 36 **29.** 5 **31.** 118 **33.** 5.1 **35.** 19.99d + 0.17m **37.** 64 ft **39.** Sample answer: 5x - 37 if x = 8 **41.** Sample answer: sometimes; x - 3 and y - 3 represent the same value only when x = y **43.** G **45.** 28 **47.** 56 **49.** 19 **51.** false

Pages 51–52 Lesson 1-7

1. 3 **3.** 54 **5.** \$2.25 **7.** 7 **9.** 28 **11.** 46 **13.** 33 **15.** 64 **17.** 7 **19.** 11 **21.** m = the number of miles Derrick walked on Monday; m + 2.5 = 6.3; 3.8 mi **23.** 5.4 **25.** 4.4 **27.** 1.2 **29.** 5,000 - 1,500 = n or 5,000 = 1,500 + n; 3,500 mi **31.** Ivan; 75 - 25 = 50 is a true statement. 25 - 25 \neq 50 **33.** A **35.** 15 **37.** 29 **39.** 58 tables **41.** 72 **43.** 168

Pages 55–56 Lesson 1-8

1. 7(4) + 7(3); 49 **3.** 3(9 + 6); 45 **5.** 4(12 + 5); \$68; Sample answer: The expression 12 + 5 represents the cost of one ticket and one hot dog. The expression 4(12 + 5) represents the cost of four tickets and four hot dogs. Since $4 \times 12 = 48$ and $4 \times 5 = 20$, find 48 +20, or 68, to find the total cost of four tickets and four hot dogs. **7.** Sample answer: Rewrite 44 + (23 + 16)as 44 + (16 + 23) using the Commutative Property of Addition. Rewrite 44 + (16 + 23) as (44 + 16) + 23using the Associative Property of Addition. Find 44 + 16, or 60, mentally. Then find 60 + 23, or 83, mentally. 9. 2(6) + 2(7); 26 11. 4(3 + 8); 44 **13.** Sample answer: Rewrite (8 + 27) + 52 as (27 + 8)+ 52 using the Commutative Property of Addition. Rewrite (27 + 8) + 52 as 27 + (8 + 52) using the Associative Property of Addition. Find 8 + 52, or 60, mentally. Then find 60 + 27, or 87, mentally. **15.** Sample answer: Rewrite 91 + (15 + 9) as 91 + (9 + 15) using the Commutative Property of Addition. Rewrite 91 + (9 + 15) as (91 + 9) + 15 using the Associative Property of Addition. Find 91 + 9, or 100, mentally. Then find 100 + 15, or 115, mentally. **17.** Sample answer: Rewrite (4 • 18) • 25 as (18 • 4) • 25 using the Commutative Property of Multiplication. Rewrite $(18 \cdot 4) \cdot 25$ as $18 \cdot (4 \cdot 25)$ using the Associative Property of Multiplication. Find 4 • 25, or 100, mentally. Then find 100 • 18, or 1,800, mentally. **19.** Sample answer: Rewrite $15 \cdot (8 \cdot 2)$ as $15 \cdot (2 \cdot 8)$ using the Commutative Property of Multiplication. Rewrite $15 \cdot (2 \cdot 8)$ as $(15 \cdot 2) \cdot 8$ using the Associative Property of Multiplication. Find 15 • 2, or 30, mentally. Then find 30 • 8, or 240, mentally. **21**. Sample answer: Rewrite $5 \cdot (30 \cdot 12)$ as $5 \cdot (12 \cdot 30)$ using the Commutative Property of Multiplication. Rewrite 5 • $(12 \cdot 30)$ as $(5 \cdot 12) \cdot 30$ using the Associative Property of Multiplication. Find 5 • 12, or 60, mentally. Then find 60 \cdot 30, or 1,800, mentally. **25.** 7(9 - 3); 42 **27.** 9(7 - 3); 36 **29.** y + 5 **31.** 32b **33.** 2x + 6 **35.** 6*c* + 6 **37.** 610 + 195 = 195 + 610 **39.** Sample

answer: (5 + z) + 9 = 5 + (z + 9) **41**. Sample answer: Since $24 \div (12 \div 2) = 4$ and $(24 \div 12) \div 2 = 1, 24 \div (12 \div 2) \neq (24 \div 12) \div 2$. **43**. B **45**. 11.3 **47**. 84 yr **49**. 10 **51**. 4.6

Pages 59–61 Lesson 1-9

1. 9 is added to each term; 36, 45, 54 **3.** 0.1 is added to each term; 1.4, 1.5, 1.6 **5.** 3*n*; 36 in. **7.** 6 is added to each term; 25, 31, 37 9. 12 is added to each term; 67, 79, 91 **11.** 5 is added to each term; 53, 58, 63 **13.** 0.8 is added to each term; 5.6, 6.4, 7.2 **15.** 1.5 is added to each term; 10.5, 12.0, 13.5 **17.** 4 is added to each term; 20.6, 24.6, 28.6 **19.** 7*n*; 42 laps **21.** 25 is added to each term; 120, 145, 170 23. 256, 1,024, 4,096 25. 324, 972, 2,916 27. 1,200 29. 4,950 31. The Fibonacci sequence is 1, 1, 2, 3, 5, 8, 13, In this sequence, each term after the second term is the sum of the two terms before it. Fibonacci numbers occur in many areas of nature, including pine cones, shell spirals, and branching plants. **33.** + 2, + 4, + 6, + 8, ...; 30, 42, 56 **35.** Sample answer: paper/pencil; Write the equation that represents this situation, 15n. Since 2 years = 24 months, evaluate the expression when *n* is 24. 15(24) =360. So, after 2 years, \$360 will be saved. **37.** D **39.** 48; Sample answer: Rewrite (23 + 18) + 7 as (18 + 23) + 7 using the Communicative Property of Addition. Rewrite (18 + 23) + 7 as 18 + (23 + 7) using the Associative Property of Addition. Find 23 + 7, or 30, mentally. Then find 18 + 30, or 48, mentally. **41**. 29 **43**. 20 **45**. 8 **47**. 3

Pa	ges 65–67	' L	esson 1-10	0
1.	x	3 <i>x</i>	Y	; domain: {1, 2, 3, 4};
	1	3 • 1	3	range: {3, 6, 9, 12}
	2	3 • 2	6	
	3	3 • 3	9	
	4	3•4	12	
3.	v	8 <i>x</i>		; domain: {1, 2, 3, 4};
	X		У	range: {8, 16, 24, 32}
	1	8•1	8	8- (-,,,
	2	8•2	16	
	3	8•3	24	
	4	8•4	32	
5.	320 feet			
7.	X	6 <i>X</i>	y	; domain: {1, 2, 3, 4};
	1	6•1	6	range: {6, 12, 18, 24}
	2	6•2	12	
	3	6•3	18	
	4	6•4	24	
9.	X	25 <i>x</i>	у	; domain: {1, 2, 3, 4};
	1	25 • 1	25	range: {25, 50, 75, 100}
	2	25 • 2	50	
	3	25 • 3	75	
	4	25•4	100	

11.	c = 20i	<i>m</i> 13.	t = t	35 <i>m</i>		
15.	X	x —	1	y	,	; domain: {1, 2, 3, 4};
	1	1 –	1	C)	range: {0, 1, 2, 3}
	2	2 —	1	1		
	3	3 —	1	2	2	
	4	4 —	1	3	6	
17			_			[amain: (0, 1, 2, 2)]
17.	X	x + 0.25	5	y		lomain: {0, 1, 2, 3};
	0	0 + 0.2	5 0	.25	ra.	nge: {0.25, 1.25, 2.25, 3.25}
	1	1 + 0.25	5 1	.25		
	2	2 + 0.2	5 2	.25		
	3	3 + 0.2	5 3	.25		
40		_			_	
19.	Width	6w		Area		
	(units)		(sq	units)	
	2	6 • 2		12		
	3	6•3		18		
	4	6•4		24		
	5	6•5		30		

21. m = 8s **23.** 480 mi; 1,140 mi; Sample answer: The equation m = 8s gives the number of miles Jupiter travels in *s* seconds. Substituting 60 for *s* yields $m = 8 \times 60$, or 480 miles. The equation m = 19s gives the number of miles Earth travels in *s* seconds. Substituting 60 for *s* yields $m = 19 \times 60$, or 1,140 miles. **25.** y = 3x **27.** Sample answer: Sam charges \$3 for each dog that he walks. In the equation y = 3x, *x* represents the number of dogs and *y* represents the total amount of money earned. **29.** C **31.** 63, 72, 81 **33.** (12)4 + (4)4; 64 **35.** 10(6 - 5); 10 **37.** 7 **39.** 7

Pages 70–74 Chapter 1 Study Guide and Review

1. false, equivalent expressions **3.** false, domain 5. true 7. false, square 9. \$89.40 11. 3 • 3 • 3 • 3 **13.** 5 **15.** 5 • 5 • 5 • 5 **17.** 40,353,607 **19.** 324 **21.** 100 **23.** 8 **25.** 169 **27.** 18 **29.** 25 **31.** 33 **33.** 36 ÷ 4 + 12 ÷ 3; 13 **35.** 22 **37.** 5 **39.** 48 **41.** 8 **43.** 108 **45.** 9 + *x* = 15; 6 tickets **47.** 68; Sample answer: Rewrite 14 + (38 + 16) as 14 + (16 + 38) using the Commutative Property of Addition. Rewrite 14 + (16 + 38) as (14 + 16) + 38 using the Associative Property of Addition. Find 14 + 16, or 30, mentally. Then find 30 + 38, or 68, mentally. **49.** \$2(15 + 12); \$54; Sample answer: The expression 15 + 12 represents the total number of roses Wesley sold. The expression 2(15 + 12) represents the total amount of money Wesley earned. Since $$2 \times 15 = 30 and $$2 \times 12 = 24 , find 30 + 24, or 54, to find the total amount Wesley earned. 51. Each term is found by adding 0.8 to the previous term; 6.6, 7.4, 8.2 **53.** \$4.50*n*

55.	X	4 <i>x</i>	y	; The domain is {5, 6, 7, 8}.
	5	4(5)	20	The range is {20, 24, 28, 32}.
	6	4(6)	24	
	7	4(7)	28	
	8	4(8)	32	

Chapter 2 Integers

 Page 79
 Chapter 2
 Getting Ready

 1. < 3. < 5. Garrett</td>
 7. 20
 9. 9
 11. 216
 13. 29

 15. 1,900 mi
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Pages 82-83 Lesson 2-1 111 3. 16 521					
7 . → • • • • • • • • • 					
9. 8 11. 9 13. -53 15. -2 17. 12 19. -7					
21. $-3 - 2 - 1 0 1$					
23. -10 -8 -6 -4 -2 0 2 4 6 8 10					
25. 10 27. 2 29. 14 31. 25 33. 5 35. 17 positive charges: 17; 25 negative charges: -25 37. false; 0 39. D					
41. x x - 4 y 4 4 - 4 0 5 5 - 4 1 ; domain: {4, 5, 6, 7}; range: {0, 1, 2, 3}.					

43.	X	5 <i>x</i> + 1	y	; domain: {1, 2, 3, 4};
	1	$5 \cdot 1 + 1$	6	range: {6, 11, 16, 21}
	2	$5 \cdot 2 + 1$	11	
	3	$5 \cdot 3 + 1$	16	
	4	5 • 4 + 1	21	

2

3

6 — 4

7 - 4

45. > 47. **>**

6

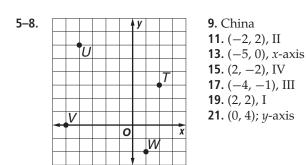
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Pages 85–87 Lesson 2-2

•		
1. > 3. >	41–44.	- 1
5. {-18, -16, -10, 12, 19}		10 +
7. < 9. > 11. > 13. <		8 T
15 . {-8, -5, -3, 6, 11}		°T
17. {-7, -6, -4, 1, 3, 5}		$\frac{4}{2}$
19. Sunlight, Twilight,		
Midnight, Abyssal, Hadal		-2 I
21. < 23. < 25. Jan. 7, Jan. 5,		_4
Jan. 6, Jan. 8, Jan. 4, Jan. 9, Jan. 3		-6+
27. +15, -13, +10, -4, +13, -5		-8 +
29 . true 31 . true 33 1		-10 +
35 . C 37 . −9 39 . <i>r</i> = 6 <i>t</i>		•

 Pages 90-92
 Lesson 2-3

 1. (-2, -4), III
 3. (0, 3), y-axis



23-34. _N(−2, 10) T(-3, 7)M (5, 6) . Y (-6.5, 6.5) _**S** (0, 6)____ +Q(3, 0)0 **↓** U (5, -2) X(1.5, -3)

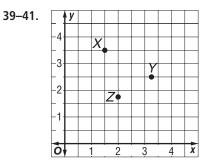
V (8, 1)

P(7, -8)

35. Children's Zoo **37.** (-3, -2)

R(-1)

W(-5, -7)



43. Sample answer: Rene Descarte is often credited with inventing the coordinate plane and so the coordinate plane is sometimes called the Cartesian plane, in his honor. The myth is that while a child, Descarte lay in bed one day watching a fly crawling around on the ceiling. In wondering how to tell someone else where the fly was, he realized that he could describe its position by its distance from the walls of the room. 45. Sample answer: Sometimes; both (-2, 0) and (2, 0) lie on the x-axis.

47. Sample answer: Using the graphic, you can see that an ordered pair such as (-5, -4) is in Quadrant III.

			-	y				
Qua (-	dra -, -	nt -)		_C)ua (+	dra ,		۱_
-			0					x
Quad	drar -, -	nt I -) [−]		Q	uac [(+	dra ,	nt _)	V

49. Sample answer: Point *A* is 1 unit to the right and 2 units down from the origin, in quadrant IV. Point *B* is 2 units to the left and 1 unit up from the origin, in

quadrant II. 51. G 53. > 55. < 57. 48 mi **59.** 1,326 **61.** 11,737

Pages 98–99 Lesson 2-4

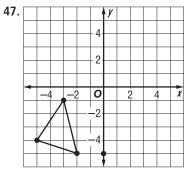
1. -14 **3.** 7 **5.** -4 **7.** 0 **9.** -\$25 + \$18; -\$7;Camilia still owes her brother 7. 11. -25 13. 28**15.** -6 **17.** -13 **19.** -2 **21.** 2 **23.** 0 **25.** 22 **27.** -19 **29.** 8 + (-14); -6; Hakeem is now 6 feet below street level. **31.** -5 + (-15) + 12; The team has lost a total of 8 yards. **33.** –13 **35.** –18 **39.** *a* **41.** m + (-15) **43.** Sample answer: Look at the signs. If the numbers being added are both positive, the sum is positive. If the numbers being added are both negative, the sum is negative. If the numbers being added have different signs, subtract their absolute values and give the sum the sign of the number with the greatest absolute value. If the numbers being added are opposites, the sum is zero. 45. J **47.** (0, -2); *y*-axis **49.** (1, 1); I **51.** 162 **53.** 3,265

Pages 105-106 Lesson 2-5

1. -3 **3**. -12 **5**. 24 **7**. -2 **9**. -21 **11**. 22 **13**. -10 **15.** -14 **17.** 23 **19.** 31 **21.** -14 **23.** -30 **25.** 104 **27.** 6 **29.** 0 **31.** 0 **33.** 15 **35.** 11 **37.** 8,757 ft **39.** 5,066 ft **41.** -31 **43.** 23 **45.** Mitsu; Alicia did not add the additive inverse of -19. **47**. Sample answer: To subtract an integer, add its additive inverse. **49.** J **51.** -11 **53.** -14 **55.** 8 **57.** -24 **59.** -26

Pages 107-111 Lesson 2-6

1. -60 **3.** -28 **5.** 45 **7.** 64 **9.** -12 **11.** 100(-3)= -300; Monifa's investment is now worth \$300 less than it was before the price of the stock dropped. **13.** 70 **15.** -220 **17.** -70 **19.** -50 **21.** 80 **23.** -125 **25.** 81 **27.** -45 **29.** 49 **31.** -24 **33.** 24 **35.** 64 **37.** -160 **39.** 5(-650) = -3,250; Ethan burns 3,250 Calories each week. 41. -243 43. 88



Sample answer: new triangle P'O'R' is on the other side of the origin (in quadrant III) from original triangle PQR (which is in quadrant I). **49.** Sample answer: $-6 \times 3 = -18$

51. Sample answer: 1; (-1)(-1) = 1. Since there are $50 \div 2 = 25$ pairs of (-1) factors, (-1)⁵⁰ = 1²⁵. One raised to any power is still 1. **53.** Sample answer: The product of three integers is positive when exactly two integers are negative or all three integers are positive. **55.** J **57.** 8 **59.** -21 **61.** -6 **63.** -9 **65.** 52, 47, 36, 27, 13, 0, -2, -3, -6, -14

Pages 112-113 Lesson 2-7

1. Sample answer: Use the look for a pattern strategy when there is a data table, a series of numbers, or a

geometric pattern as part of the problem. **3.** Sample answer: Amanda has \$2 in change in her bank. If she adds \$0.50 each week for 7 weeks, how much money will be in her bank? \$5.50 **5.** 9, 12, 18 **7.** Sample answer: 1 half-dollar, 3 quarters, 1 nickel, and 2 pennies **9.** 2 letters and 10 postcards **11.** multiplication; 8,524,425 **13.** division; 0.5 m

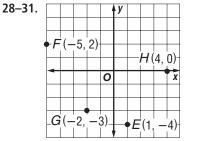
Pages 116–118 Lesson 2-8

1. -4 **3.** -6 **5.** 5 **7.** -3 **9.** -42.8° C **11.** -7**13.** -9 **15.** 10 **17.** -7 **19.** -9 **21.** 9 **23.** 5 **25.** -12 **27.** -3 **29.** 2 **31.** -1 **33.** -10° F **35.** 8 **37.** 1 **39.** -\$18 million **41.** $-18 \div (-9)$ has a positive quotient; the others have negative quotients **43.** -20, -10, -5, -4, -2, -1, 1, 2, 4, 5, 10, 20 **45.** A **47. 49.** 60 **51.** 81 **53.** -12 **55.** 30

Pages 119–122 Chapter 2 Study Guide and Review

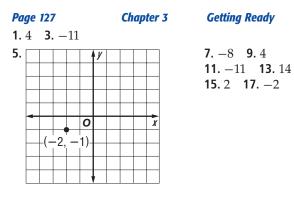
1. false, negative **3**. false, opposite

5. false, *y*-coordinate **7.** true **9.** false, positive **11.** 350 ft **13.** -12° **15.** 32 **17.** -48 mL **19.** > **21.** < **23.** < **25.** {-32, -23, -21, 14, 19, 25} **27.** 3, 1, 0, -1, -2



33. 2 **35.** -5 **37.** -5 **39.** -3 **41.** 4 **43.** -12 **45**. 35 **47**. 28 **49.** -35 **51.** 17,280 **53.** 576 ft **55.** -3 **57.** 9

Chapter 3 Algebra: Linear Equations and Functions



Pages 131–133 Lesson 3-1

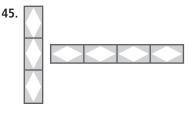
1. n + 8 **3.** n - 9 = 24 **5.** 2m = 18 **7.** x - 1 = 34.3**9.** 15 + t **11.** n - 10 **13.** 8r **15.** $\frac{a}{3}$ **17.** n + 4 = -8**19.** 5d = -20 **21.** h - 10 = 26 **23.** c + 3.5 = 5.5**25.** the length is 4 times the width **27.** the width is 5 less than the length **29**. 2b + 2 **31**. 3(a - 43)**33**. $13k^2$ **35**. \$20 bill **37**. Sample answer: 5 dollars more than my allowance is 8 dollars **39**. x + 2; x - 2 **41**. C **43**. -7 **45**. 15 **47**. 25 **49**. 49 **51**. Plan A **53**. -11 **55**. -8

Pages 139–141 Lesson 3-2

1. 2 **3.** -2 **5.** d + 120 = 364; 244 ft **7.** 5 **9.** 7 **11.** 7 **13.** -3 **15.** -9 **17.** 17 **19.** 7 **21.** 7 = w + 2; 5 **23.** 15 = t - 3; 18 years old **25.** 61 **27.** -5 **29.** -12 **31.** 18.4 **33.** 6.4 **35.** -0.68 **37.** d - 5 = 18; \$23 **39.** 35 + 45 + x = 180; 100° **41.** 2 + 4 + s = 0; -6 **43.** h + 105 = 415; 310 ft **45.** s - 93 = 7; 100 mph **47.** The value of *y* decreases by 3. **49.** C **51.** p + 180 **53.** 46 pages **55.** 2.6 **57.** 1.52

Pages 144–146 Lesson 3-3

1. 3 **3.** -3 **5.** 15 h **7.** 7 **9.** -3 **11.** 7 **13.** -9**15.** 4 **17.** -8 **19.** 15w = 300; 20 weeks **21.** 1,500 = 600*h*; 2.5 h **23.** 23 **25.** 18 **27.** 4.7 **29.** Sample answer: The *Magnum* has the greater speed. The track is almost twice as long, and yet the ride only takes 15 more seconds than the *Blue Streak.* **31.** 6k = 600; k = 100 seconds **33.** Jesse; the variable is multiplied by -5. To solve for *x*, you need to divide each side of the equation by the entire coefficient, -5. **35.** Sample answer: Billie has twice as many cards as Tyree. If Billie has 16 cards, how many does Tyree have? **37.** Sample answer: If it takes a scuba diver 4 seconds to swim 8 meters below the surface of the water, what is the rate of descent? **39.** J **41.** 5 **43.** -3y



Pages 148–149 Lesson 3-4

1. When you are given the final result and asked to find an earlier amount. 3. Sample answer: In the first four games, Hannah scored a total of 83 points. In the fourth game she scored 19 points. In game three, she scored 27 points and in the second game she scored 22 points. How many points did she score in the first game? To solve, first subtract 19 from 83, which is 64. Then subtract 27 from 64 to get 37. Finally, subtract 22 from 37. So, Hannah scored 15 points in her first game. 5. 4 7. Greg rented 9 videos, Paloma rented 5, Grace rented 1, and Jack rented 10. 9. Maya is 15 years old.

4.4	 _	_	 	_
11.				

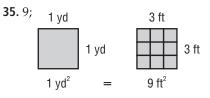
13. Multiplication followed by subtraction; Mikhail's car gets 17,74,074 more inches per gallon than an aircraft carrier.

Pages 153–155 Lesson 3-5

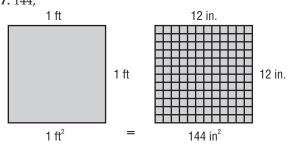
1. 2 **3.** 3 **5.** 3 **7.** 14c + 23 = 65; 3 CDs **9.** 3 **11.** -4 **13.** 4 **15.** 9 **17.** 8 **19.** 11 **21.** 74 + 15w = 149; 5 wk **23.** 2.25 **25.** 2.1 **27.** 28 **29.** 8 + 47.6*d* = 960; 20 days **31.** Less than; -3° F is about -19.4° C. **33.** $\frac{1}{2}(20x) - 18 = 200$; x = 21.8; They must sell at least 22 subscriptions. **35.** Sample answer: A flower shop charges \$2 for each flower in a vase and \$5 for the vase. How many flowers can you place in a vase if you have \$15 to spend? **37.** G **39.** 7 **41.** 41 **43.** 14 ft **45.** 14 **47.** 16

Pages 158–161 Lesson 3-6

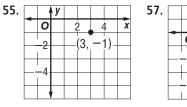
1. 18 yd **3.** 7 in. **5.** 26.25 ft² **7.** 36 ft **9.** 14.8 mm **11.** 11 ft **13.** 18 in. **15.** 78 ft² **17.** 183.6 m² **19.** 6.5 in² **21.** 5 squares **23.** ℓ = 33 ft **25.** 17,010 ft² **27.** perimeter; 4 mi **29.** area; 13 ft **31.** 270 m²

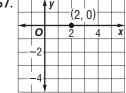


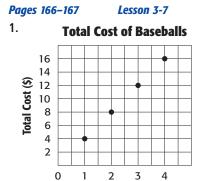


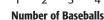


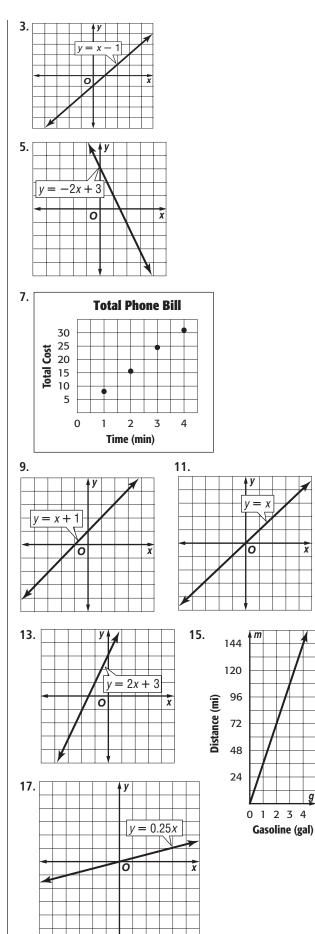
39. When the width of a rectangle is doubled, the perimeter becomes $2\ell + 4w$ and the area becomes $2\ell w$, or in other words, the area is doubled. **41.** P = 2(3w + 1) + 2w or P = 8w + 2 **43.** A **45.** -2 **47.** 3.5 **49.** 5x = 11.25; \$2.25 **51.** -27 **53.** 11 years old

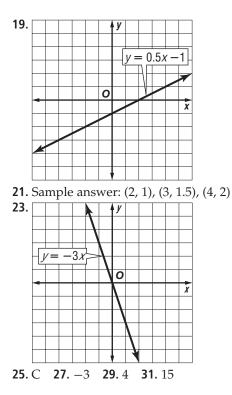








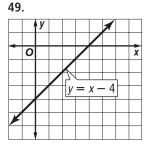


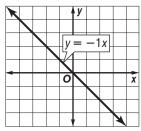


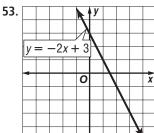
Pages 169–172 Chapter 3 Study Guide and Review

1. true **3.** true **5.** true **7.** false; subtract 3 from each side **9.** true **11.** false; perimeter **13.** x + 5 **15.** 2a **17.** n - 4 = 19 **19.** t = f + \$8.75 **21.** -6 **23.** 23 **25.** 37 **27.** 4 **29.** -9 **31.** 14w = 98; 7 weeks **33.** \$146.70 **35.** 4 **37.** -2 **39.** 5 **41.** 53.4 in.; 142.82 in² **43.** 7 mi **45.** 16 yd **47.** 12 ft

51.







55. y = 6x

Chapter 4 Fractions, Decimals, and Percents

 Page 179
 Chapter 4
 Getting Ready

 1. 0.61
 3. 0.33
 5. Kirsten
 7. 2, 3, 6
 9. Yes; the sum of the digits, 6, is divisible by 3.

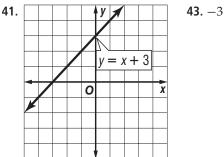
 11. 6
 13. 0.75
 15. 5 × 5 × 5 × 5 × 5
 17. 9 × 9 × 9 × 9
 9

Pages 183–184 Lesson 4-1

1. prime **3.** prime **5.** 2×17 **7.** $2^2 \times 3$ **9.** $2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x$ **11.** composite **13.** prime **15.** composite **17.** prime **19.** $2^5 \times 3$ **21.** $3^2 \times 11$ **23.** $2 \times 3 \times 5 \times 7$ **25.** $2 \times 3^2 \times 7$ **27.** $2 \cdot 5^2$ **29.** $3 \cdot 5 \cdot m \cdot n$ **31.** $2 \cdot 17 \cdot j \cdot k \cdot m$ **33.** $2 \cdot 2 \cdot 13 \cdot g \cdot h \cdot h$ **35.** 7 **37.** 5^2 **39.** $5^2 \times 13$ **41.** prime **43.** $2^3 \times 3 \times 5$ **45.** Sample answer: twenty 2 ft-by-3 ft tiles, or twelve 2 ft-by-5 ft tiles **47.** 36 **49.** If n = 1, 2n is a prime number. If n > 1, 2n is a composite number with at least three factors. **51.** H **53.** 36 ft; 65 ft² **55.** -4**57.** 0 **59.** 2, 5, 10 **61.** 3, 9

Pages 188–189 Lesson 4-2

1. 6 **3.** 10 **5.** 4 **7.** 9 **9.** 10 **11.** 16 **13.** 15 **15.** 5 **17.** 12 **19.** 2 **21.** 4 in. **23.** 3 ft **25.** 10mn **27.** Sample answer: 18 and 81 **29.** Sample answer: 15 and 45 **31.** \$14 **33.** never **35.** sometimes **37.** A **39.** 3 × 5 × 5



Pages 190–191 Lesson 4-3

1. Sample answer: By making an organized list, you can show all the possible ways to make a woodwind trio. Count the number of trios to determine the answer. **3.** 12 **5.** 6 **7.** 27, 29 **9.** 40 cookies **11.** 7 in. **13.** addition followed by division; $$1,200 + $288 + $360 = $1,848; $1,848 \div 24 = 77

Pages 194–195 Lesson 4-4

1. $\frac{1}{3}$ **3.** $\frac{2}{5}$ **5.** $\frac{2}{3}$ **7.** $\frac{5}{7}$ **9.** $\frac{7}{10}$ **11.** $\frac{4}{7}$ **13.** $\frac{6}{7}$ **15.** 1 **17.** $\frac{5}{6}$ **19.** $\frac{5}{7}$ **21.** $\frac{2}{5}$ **23.** $\frac{1}{5}$ **25.** $\frac{3}{4}$ **27.** $\frac{1}{3}$ **31.** No, because both the numerator and denominator can be divided by 2. **33.** Sample answer: A fraction is in simplest form if the GCF of the numerator and denominator is 1. **35.** F **37.** 9 **39.** 5 **41.** 0.5 **43.** 0.7

Pages 199–200 Lesson 4-5

1. 0.4 **3.** 7.5 **5.** 0.125 **7.**0.5 **9.** $\frac{11}{50}$ **11.** $4\frac{3}{5}$ **13.** 0.8 **15.** 4.16 **17.** 0.3125 **19.** 0.66 **21.** 5.875 **23.** 0.4 **25.** 0.16 **27.** 5.13 **29.** $\frac{1}{5}$ **31.** $\frac{11}{20}$ **33.** $5\frac{24}{25}$ **35.** $30\frac{1}{2}$ cm **39.** $\frac{22}{3}$ **41.** $\frac{-16}{5}$ **43.** Felisa; Sample answer: Felisa's batting average is about 0.286. Harmony's batting average is about 0.263. 0.286 > 0.263, so Felisa's average is better than Harmony's. **45.** Sample answer: $3\frac{1}{7} \approx 3.14286...$ and $3\frac{10}{71} \approx 3.14085$; Since 3.1415927... is between $3\frac{1}{7}$ and $3\frac{10}{71}$, Archimedes was

Selected Answers

correct. **47.** B **49.** $\frac{5}{12}$ **51.** $\frac{2}{7}$ **53.** 9 pizzas **55.** $\frac{3}{9}$ or $\frac{1}{3}$ **57.** $\frac{4}{12}$ or $\frac{1}{3}$

Pages 204–205 Lesson 4-6

1. 57% **3.** 25% **5.** 85% **7.** $\frac{9}{10}$ **9.** $\frac{11}{50}$ **11.** 42% **13.** 99.9% **15.** $66\frac{2}{3}$ % **17.** 80% **19.** 26% **21.** 60% **23.** 100% **25.** 30% **27.** $\frac{3}{10}$ **29.** $\frac{22}{25}$ **31.** $\frac{13}{100}$ **33.** 3 **35.** < **37.** = **39.** > **41.** 64% **43.** 1%; the other ratios equal 10% **45.** C **47.** $\frac{3}{5}$ **49.** $2\frac{4}{5}$ **51.** 3 **53.** 4 **55.** 71 **57.** 0.791

Pages 208–210 Lesson 4-7

1. 0.68 **3.** 0.276 **5.** 9% **7.** 73% **9.** 0.27 **11.** 0.06 **13.** 0.185 **15.** 0.022 **17.** 0.277 **19.** 0.3025 **21.** 0.686 **23.** 70% **25.** 580% **27.** 95% **29.** 17% **31.** 67.5% **33.** 1.2% **35.** 62.5% **37.** Davis Club **39.** < **41.** > **43.** < **45.** 0.044; 0.02083; 0.0115; 0.00625; 0.0045 **7.** 5.625 in. **49.** Sample answer: 0.25, $\frac{1}{4}$, 25% **51.** 37.5% **53.** 3.125% **55.** D **57.** 72% **59.** 3.1% **61.** -83 **63.** 2 × 5 × 5 **65.** 2 × 2 × 19

Pages 213–214 Lesson 4-8

1. 28 **3.** 60 **5.** 60 **7.** 2016 **9.** 72 **11.** 72 **13.** 315 **15.** 72 **17.** 420 **19.** 144 **21.** 6:00 P.M. **23.** 50c **25.** Sample answer: 5, 7 **27.** Sample answer: 10, 35 **29.** 4 packages of juice boxes and 5 packages of oatmeal snack bars **31.** $2^2 \cdot 5^2$, or 100 **33.** Sample answer: 3, 10, 15 **35.** C **37.** 0.55 **39.** 0.0025

41. $\frac{17}{25}$ **43.** 2s + 7 **45.** <

Pages 218–220 Lesson 4-9

1. > **3**. < **5**. Eliot; 3 out of 4 has an average of 0.75; 7 out of 11 has an average of 0.64 **7**. C **9**. < **11**. = **13**. < **15**. > **17**. > **19**. < **21**. > **23**. = **25**. Cecil; $\frac{11}{15} > \frac{5}{18}$ **27**. $\frac{8}{10}$, 0.805, 81% **29**. -1.4, -1.25, $-1\frac{1}{25}$ **31**. 3.47, $3\frac{4}{7}$, $3\frac{3}{5}$ **33**. > **35**. < **37**. 6c, $6\frac{1}{3}$ c, 6.5c **39**. $\frac{1}{5}$ g, 1.5g, 5g **41**. Eastern Chipmunk **43**. Bustos: 0.346; Kretschman: 0.333; Nuveman: 0.313;

43. Dustos: 0.346, Retschman: 0.353, Rutverhan: 0.313, Watley: 0.400; Watley **45.** 0.06; 0.06 equals 6% and the other ratios equal 60%. **47.** Sample answer: Gwen needs $\frac{2}{5}$ yard of fabric and $\frac{3}{8}$ yard of ribbon to make a pillow. Which item does she need more, fabric or ribbon? Answer: fabric **49.** H **51.** 42 **53.** 48 **55.** 0.13 **57.** 18 **59.** 12

Pages 221–224 Chapter 4 Study Guide and Review

1. false; division **3.** true **5.** false; least common multiple **7.** true **9.** 2^7 **11.** 5×19 **13.** $65 = 5 \cdot 13$ **15.** 6 **17.** 21 **19.** \$12 **21.** 15 different plans **23.** $\frac{7}{12}$ **25.** $\frac{2}{9}$ **27.** $\frac{1}{2}$ **29.** 0.75 **31.** 0.5 **33.** 6.4 **35.** $\frac{7}{10}$ **37.** $\frac{1}{20}$ **39.** $\frac{27}{50}$ **41.** 5.13 min **43.** 44% **45.** 40% **47.** $\frac{19}{20}$ **49.** $\frac{4}{25}$ **51.** 0.48 **53.** 0.125 **55.** 61% **57.** 19% **59.** 0.23 **61.** 8 **63.** 24 **65.** 120 **67.** < **69.** > **71.** English

Chapter 5 Applying Fractions

 Page 229
 Chapter 5
 Getting Ready

 1. 35
 3. 30
 5. 21.6
 7. 0.83
 9. 4
 11. $2\frac{6}{5}$

 13. $5\frac{5}{4}$ 15. $\frac{5}{3}$ or $1\frac{2}{3}$ c
 2
 1
 1
 2

Pages 233–235 Lesson 5-1

1–41. Sample answers are given. **1**. 8 + 2 = 10 **3**. $6 \times$ 3 = 18 **5.** $0 + \frac{1}{2} = \frac{1}{2}$ **7.** $\frac{1}{2} \times 1 = \frac{1}{2}$ **9.** $\frac{1}{4} \cdot 16 = 4$ **11.** $12 \div 4$ or about 3 shelves **13.** 1 + 6 = 7**15.** 4 - 2 = 2 **17.** $2 \cdot 3 = 6$ **19.** $9 \div 3 = 3$ **21.** $\frac{1}{2} + \frac{1}{2} = 1$ **23.** $1 - \frac{1}{2} = \frac{1}{2}$ **25.** $\frac{1}{2} \cdot 1 = \frac{1}{2}$ **27.** $0 \div$ 1 = 0 **29.** 16 + 1 or 17 in. **31.** $\frac{1}{6} \times 36 = 6$ **33.** 25 ÷ 5 = 5 **35.** $24 \div 2 = 12$ **37.** 39 **39.** 24 **41.** $\frac{1}{2} \times 200$ or 100 **43.** Sample answer: $\frac{1}{4} \times 60$ inches or 15 inches **45.** Sample answer: $\frac{11}{12}$ and $\frac{7}{15}$; $\frac{11}{12} - \frac{7}{15} \approx 1$ $-\frac{1}{2}$ or $\frac{1}{2}$ and $\frac{11}{12} \cdot \frac{7}{15} \approx 1 \cdot \frac{1}{2}$ or $\frac{1}{2}$ 47. Estimation; Dion doesn't need an exact answer. Sample answer: $3\frac{1}{4} + 1\frac{2}{3} + 1\frac{2}{3}$ is about halfway between 6 and 7 cups. Since this is more than 6 cups, Dion cannot use this bowl to mix the ingredients. 49. C 51. > 53. <55. 5 pkg. of necklaces and 3 pkg. of bracelets **57.** 37.5% **59.** 1.9% **61.** 10 **63.** 15

Pages 238-241 Lesson 5-2 **1.** $\frac{2}{3}$ **3.** $\frac{1}{4}$ **5.** $\frac{13}{24}$ **7.** $\frac{1}{4}$ **9.** addition; Sample answer: To find how much smaller the total height of the photo is now, add $\frac{5}{16}$ and $\frac{3}{8}$; $\frac{11}{16}$ in. **11**. $\frac{4}{7}$ **13**. $\frac{2}{3}$ **15**. $\frac{2}{3}$ **17.** $1\frac{13}{24}$ **19.** $\frac{4}{9}$ **21.** $\frac{14}{45}$ **23.** addition; Sample answer: To find the smallest width to make the shelf, add $\frac{4}{5}$ and $\frac{3}{4}$; $1\frac{11}{20}$ ft **25.** subtraction; Sample answer: To find how much more turkey Makayla bought, subtract $\frac{1}{4}$ from $\frac{5}{8}$; $\frac{3}{8}$ **27**. $\frac{23}{28}$ **29**. $\frac{7}{12}$ **31**. $1\frac{1}{4}$ **33**. $2\frac{2}{3}$ **35**. Jon; $\frac{1}{18}$ of the race **37.** $1\frac{1}{4}$ **39.** $\frac{1}{12}$ **41.** $\frac{2}{3} - \left(\frac{1}{6} + \frac{1}{4}\right) = \frac{1}{4}$ **43.** $\frac{3}{4}$ **45.** Sample answer: The sum of two unit fractions $\frac{1}{a}$ and $\frac{1}{b}$, where *a* and *b* are not 0, is $\frac{a+b}{ab}$. $\frac{1}{a} + \frac{1}{b} = \frac{1 \cdot b}{a \cdot b} + \frac{1 \cdot a}{b \cdot a}$ Rename each fraction using the LCD, ab. $= \frac{b}{ab} + \frac{a}{ab}$ $= \frac{b+a}{ab}$ $= \frac{a+b}{ab}$ Simplify. Add the numerators. **Commutative Property**

So, $\frac{1}{99} + \frac{1}{100} = \frac{99 + 100}{99 \cdot 100}$ or $\frac{199}{9,900}$ **47.** Lourdes; Meagan did not rename the fractions using the LCD. **49.** A **51.** D **53.** Sample answer: 4 + 4 = 8**55.** Sample answer: $6 \cdot 3 = 18$ **57.** 24.8% **59.** -5 **61.** $\frac{2}{3}$ **63.** 5

 Pages 244-246
 Lesson 5-3

 1. $9\frac{6}{7}$ 3. $4\frac{2}{3}$ 5. $1\frac{1}{2}$ 7. $4\frac{5}{8}$ 9. $8\frac{1}{6}$ gal
 11. $7\frac{5}{7}$ 13. $2\frac{1}{7}$

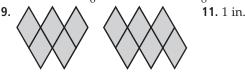
 15. $7\frac{5}{12}$ 17. $18\frac{17}{24}$ 19. $3\frac{1}{2}$ 21. $2\frac{11}{20}$ 23. $5\frac{7}{8}$ 25. $7\frac{1}{6}$

 27. addition; Sample answer: To find the height of the San Jacinto Monument, add 555 ft $5\frac{1}{8}$ in. and 14 ft $6\frac{7}{8}$ in; 570 ft.
 29. subtraction; Sample answer: To find how many inches Alameda had cut, subtract $6\frac{1}{2}$ from $9\frac{3}{4}$; $3\frac{1}{4}$ in.
 31. $15\frac{1}{4}$ 33. $1\frac{3}{4}$ 35. $7\frac{1}{8}$ yd
 37. Sample answer: $4\frac{2}{3} - 1\frac{5}{6}$ 39. Sample answer: Since the garden is a rectangle, the length of one side added to the length of the other side would equal half the length of the perimeter. If one side of the garden is $2\frac{5}{12}$ ft long, find 6 ft $-2\frac{5}{12}$ ft, or $3\frac{7}{12}$ ft.
 41. H
 43. Sample answer: $9 \times 7 = 63$

 47. Sample answer: 4 - 1 = 3 49. 15 ft

Pages 247–248 Lesson 5-4

1. Sample answer: Use estimation, look for a pattern, work backward. **3.** Sample answer: A fishbowl holds $1\frac{1}{2}$ gallons of water. If there is $\frac{1}{3}$ gallon of water in the bowl, how many more gallons are needed to fill the bowl; $\frac{2}{3}$ gallons, $1\frac{1}{6}$ gallons, or $2\frac{1}{6}$ gallons. Answer: $\frac{2}{3}$ gallon is not enough because that would make exactly 1 gallon of water in the tank. $2\frac{1}{6}$ gallons is too much, since the tank only holds $1\frac{1}{2}$ gallons. The answer is $1\frac{1}{6}$ gallons. **5.** J **7.** $\frac{5}{8}$ in.



13. Addition followed by subtraction;

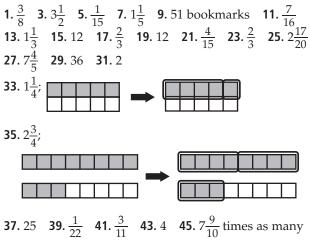
$$\frac{2}{5} + \frac{1}{3} = \frac{11}{15}; 1 - \frac{11}{15} = \frac{4}{5}$$

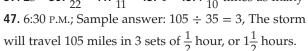
Pages 255–257 Lesson 5-5

1. $\frac{2}{9}$ **3.** $\frac{2}{3}$ **5.** $1\frac{1}{2}$ **7.** $2\frac{1}{2}$ in. **9.** $\frac{4}{15}$ **11.** $4\frac{4}{5}$ **13.** $\frac{1}{9}$ **15.** $\frac{1}{20}$ **17.** $\frac{3}{8}$ **19.** $\frac{3}{4}$ **21.** $\frac{3}{16}$ **23.** 14 c **25.** $1\frac{9}{16}$ **27.** 30 **29.** $31\frac{1}{3}$ **31.** 20 **33.** $7\frac{1}{20}$ mi **35.** $\frac{8}{21}$ **37.** $\frac{11}{48}$ **39.** $16\frac{1}{3}$ yd; $10\frac{5}{6}$ yd² **41.** one pint **43.** one centimeter **45.** $15\frac{3}{4}$ **47.** $28\frac{3}{4}$ **49.** broccoli: $1\frac{7}{8}$ c, pasta: $5\frac{5}{8}$ c, salad dressing: 1 c, cheese: 2 c; Multiply each amount by $1\frac{1}{2}$. **51.** $\frac{2}{3} \times \frac{3}{5}$; $\frac{6}{25}$ **53.** Always; Sample answer: A model showing the product of two fractions will always be partially shaded, representing a part of a whole or less than 1. **55.** Sample answer: $3\frac{2}{5} \times 4\frac{5}{12} = \left(3 + \frac{2}{5}\right) \times \left(4 + \frac{5}{12}\right) \neq (3 \times 4) + \left(\frac{2}{5} \times \frac{5}{12}\right)$. We cannot perform multiple operations in any order. If the only operation was addition or if the only operation was multiplication, we could add in any order or multiply in any order, respectively. But when there is both addition and multiplication, we must follow the order of operations, which tells us that we need to perform the operations inside the parentheses, in this case addition of each whole number and fraction, before multiplying.

57. H **59.** $2\frac{1}{10}$ in. **61.** > **63.** 4.95 + 0.6x = 22.95; 300 min **65.** 3

Pages 261-263 Lesson 5-6 **1.** $\frac{5}{8}$ **3.** $\frac{5}{29}$ **5.** 32 **7.** 20.5 **9.** 32 **11.** 32 **13.** $\frac{6}{5}$ or $1\frac{1}{5} \quad \mathbf{15}. \ \overline{\frac{6}{1}} \text{ or } 6 \quad \mathbf{17}. \ \frac{1}{3} \quad \mathbf{19}. \ \frac{8}{41} \quad \mathbf{21}. \ 36 \quad \mathbf{23}. \ \mathbf{14}.4 \\ \mathbf{25}. \ 2.88 \quad \mathbf{27}. \ 30 \quad \mathbf{29}. \ \frac{20}{21} \quad \mathbf{31}. \ 6\frac{2}{3} \quad \mathbf{33}. \ \mathbf{137}.5 \ \mathrm{mi} \\ \end{array}$ **35.** -75 **37.** 41.4 **39.** $1\frac{1}{2}$ **41.** x = number of tons of avocados; $\frac{3}{5}x = 114,000$; 190,000 tons **43.** x = number of servings; $\frac{3}{4}x = 16\frac{1}{2}$; 22 servings **45.** x = the person's age; $\frac{1}{3}x = 26$; 78 years old **47.** Sample answer: By solving $8 = \frac{m}{4}$, you find that m = 32. So, replace *m* with 32 to find 32 - 12 = 20. **49.** Sample answer: Use the Multiplicative Property to multiply each side by 2. Then use the Division Property to divide each side by *h*. So, $b = \frac{2A}{h}$. **51.** A **53.** $\frac{1}{6}$ **55.** $\frac{2}{5}$ **57.** $3\frac{5}{12}$ c **59.** 0.08 **61.** 1.23 **63.** -1 **65.** -8 **67.** Sample answer: $18 \div 3 = 6$ **69.** $0 \div 1 = 0$ Pages 267-270 Lesson 5-7





Adding $1\frac{1}{2}$ hours to 5:00 P.M. will make it 6:30 P.M. 49. Sample answer; You could use paper and pencil; $\frac{3}{4}$ of what number is $1\frac{1}{2}$? $1\frac{1}{2}$ feet $\div \frac{3}{4} = \frac{3}{2}$ feet • $\frac{4}{2} = 2$ feet. **51.** Yes. If the first proper fraction is larger than the second proper fraction then the resulting quotient will be a whole number or mixed number. **53.** H **55.** $\frac{13}{4}$ or $3\frac{1}{4}$ **57.** $\frac{4}{21}$ **59.** 4.5 ft

Pages 271–274 Chapter 5 Study Guide and Review

1. numerators **3.** reciprocal **5.** unlike **7.** $1\frac{11}{7}$ **9.** 3 **11.** reciprocal **13.** Sample answer: $3 \div 1 = 3$ **15.** Sample answer: $1 \times 0 = 0$ **17.** Sample answer: $\frac{1}{2} \times 26 = 13$ **19.** Sample answer: 19 × 10 or about 190 ft² **21.** $\frac{1}{6}$ **23.** $\frac{2}{3}$ **25.** $\frac{5}{24}$ **27.** $\frac{5}{8}$ in. **29.** $9\frac{11}{15}$ **31.** $10\frac{1}{7}$ **33.** $2\frac{4}{15}$ **35.** $15\frac{1}{8}$ **37.** $7\frac{11}{12}h$ **39.** G **41.** $\frac{5}{27}$ **43.** $2\frac{3}{5}$ **45.** $9\frac{3}{8}$ **47.** $\frac{12}{7}$ or $1\frac{5}{7}$ **49.** $\frac{3}{10}$ **51.** 15 **53.** 0.75 **55.** $\frac{7}{10}$ **57.** $3\frac{3}{10}$ **59.** $1\frac{21}{22}$ **61.** 54

Chapter 6 Ratios and Proportions

 Page 281
 Chapter 6
 Getting Ready

 1. 48.1
 3. 7.4
 5. $\frac{1}{5}$ 7. $\frac{19}{23}$ 9. $\frac{39}{50}$ 11. $\frac{3}{50}$ 13. 450
 15. 2,200

Pages 284–285 Lesson 6-1 1. $\frac{2}{15}$ 3. $\frac{1}{51}$ 5. yes. $\frac{12}{20} = \frac{3}{5}$ and $\frac{6}{10} = \frac{3}{5}$ 7. no; Sample answer: $\frac{2 \text{ boxes}}{\$5} \neq \frac{6 \text{ boxes}}{\$20}$, since $2 \cdot 3 = 6$, but $5 \cdot 3 \neq 20$ 9. $\frac{3}{2}$ 11. $\frac{1}{3}$ 13. $\frac{2}{5}$ 15. $\frac{21}{1.600}$ 17. $\frac{21}{32}$ **19.** yes; $\frac{4}{16} = \frac{1}{4}$ and $\frac{10}{40} = \frac{1}{4}$, so $\frac{4}{16} = \frac{10}{40}$ **21.** no; $\frac{8}{6} = \frac{4}{3}$ and $\frac{12}{10} = \frac{6}{5}$, so $\frac{8}{6} \neq \frac{12}{10}$ **23.** no; Sample answer: $\frac{12 \text{ in.}}{3 \text{ in.}}$ $=\frac{4}{1}$ and $\frac{6 \text{ in.}}{1 \text{ in}} = \frac{6}{1}$, so $\frac{12 \text{ in.}}{3 \text{ in}} \neq \frac{6 \text{ in.}}{1 \text{ in}}$ **25.** yes; $1:1.5=\frac{2}{3}$ $5: 7.5 = \frac{2}{2}$. The picture will fit the frame. **27.** 9 lb **29.** $\frac{80}{20} = \frac{4}{1}$; 4 times **31.** Areas A and C; both ratios simplify to a growth-to-removal ratio of $\frac{11}{30}$. **33.** 80; Sample answer: $440 + 80 = 520; \frac{520}{1.200} = \frac{13}{30}$ which is the same ratio as area B **35.** 4; The ratios of successive terms increase by 1; $\frac{480}{240} = 2$, $\frac{240}{80} = 3$, $\frac{80}{20} = 4$ **37**. B **39.** $\frac{6}{7}$ **41.** $1\frac{2}{3}$ **43.** $5\frac{2}{3}$ **45.** 4.9 **47.** \$0.31

Pages 289-292 Lesson 6-2

1. 6 mi per gal **3.** \$0.50 per lb **5.** C **7.** 60 mi/h

9. 30.4 people per class **11.** 3.5 m/s **13.** \$0.14/oz **15.** about \$0.50 per pair **17.** Susanna; 1.78 m/s > 1.66 m/s > 1.23 m/s **19.** Soft drinks A and B have about 3 grams of sodium per ounce and Soft drink C has about 6 grams per ounce. 21. 510 words **23.** Sample answer: about 60 **25.** 168.3 **27.** 38¢ per lb; $$1.89 \div 5 \approx $1.90 \div 5 \text{ or } 0.38 **29.** 3 c **31.** about 1 h 36 min 24 s **33.** The bear's heart beats 120 times in 2 minutes when it is active. **35.** the bear's heart rate in beats per minute 37. when it is active; Sample answer: The active line increases faster than the hibernating line when read from left to right. **41**. Always; every rate is a ratio, because it is a comparison of two quantities by division. 43. Sample answer: a; $\frac{30 \text{ ft}}{2 \text{ min}} = 15 \text{ ft/min}, \frac{40 \text{ ft}}{2 \text{ min}} = 20 \text{ ft/min}$ **45.** C **47.** $\frac{2}{9}$ **49.** $\frac{9}{14}$ **51.** 8 subs **53.** 14 **55.** 2.1

Pages 297-299 Lesson 6-3

1. 48 **3.** 52 **5.** 3 **7.** $7\frac{1}{2}$ **9.** 1,280 times greater; $4 \text{ lb} = 4 \text{ lb} \cdot \frac{16 \text{ oz}}{\text{ lb}} \text{ or } 64 \text{ lb}; 64 \text{ oz} \div 0.05 \text{ oz } \text{ or } 1,280$ **11.** $4\frac{1}{2}$ **13.** 16 **15.** 24 **17.** 6,600 **19.** $6\frac{1}{2}$ **21.** 6,750 **23.** 3,520 ft **25.** $17\frac{1}{2}$ qt **27.** 50 bushels; 1 ton = 2,000 lb and 2,000 lb $\div \frac{40 \text{ lb}}{1 \text{ bushel}} = 50 \text{ bushels}$ **29.** No; 15 in. $+4\frac{1}{2}$ in. $+6\frac{3}{4}$ in. $=26\frac{1}{4}$ in. and $26\frac{1}{4} \div 12 = 2\frac{3}{16}$. So, it snowed a total of $2\frac{3}{16}$ ft or about 2 ft, not $2\frac{1}{2}$ ft. **31**. $\frac{1}{2}$ **33.** about $8\frac{1}{2}$ mi **35.** Sample answer: The graph is a straight line. For each x-value increase of 1, the y value increases by 4. **37.** 3 gal; Sample answer: the graph increases by 1 gallon for every 4 quarts. 39. < 41. =**43.** 720 in²; Square feet mean a unit of feet \times feet. To divide out each unit, you must multiply by two conversion factors that have feet in the denominator

and inches in the numerator. 5 ft² $\cdot \frac{12 \text{ in.}}{1 \text{ ft}} \cdot \frac{12 \text{ in.}}{1 \text{ ft}}$ 720 in² **45.** G **47.** \$11.90 **49.** $\frac{1}{4}$ **51.** 8 ft **53.** 2v = 22.50; \$11.25/h 55. 118.9 57. 142.127

Pages 303-305 Lesson 6-4

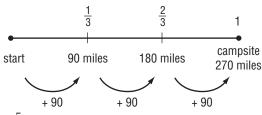
1. 370 **3.** 1.46 **5.** 8.52 **7.** 128.17 **9.** about 5,333.33 ft 11.0.983 13.30 15.0.0821 17.130,500 **19.** 106.17 **21.** 36.01 **23.** 15.75 **25.** 0.61 kg **27**. about 345 lb **29**. 16,582.42 **31**. 403,704 **33.** 0.06 L, 660 mL, 6.6 kL **35.** 130 cm, 2650 mm, 5 m 37. 50 cm 39. Hunter; Arturo multiplied 45.7 by 1,000; he should have divided by 1,000. **41.** about 621,118.01 mi 43. There are a greater number of smaller units. 45. H 47. 26 mi per gal 49. 122 Calories per serving **51.** $4\frac{5}{7}$ **53.** $13\frac{13}{24}$ **55.** 0.37 **57.** 8 **59.** 22

Pages 309-311Lesson 6-51. No; sample answer: $\frac{10 \text{ children}}{2 \text{ adults}} = \frac{5 \text{ children}}{1 \text{ adult}}$ and

 $\frac{12 \text{ children}}{3 \text{ adults}} = \frac{4 \text{ children}}{1 \text{ adult}}.$ The unit rates are not equal. 3. Yes; sample answer: The cross products of the ratios $\frac{8}{21}$ and $\frac{12}{31.5}$, 8 × 31.5 and 21 × 12, are both equal to 252. **5.** 15 **7.** 29.4 **9.** 20 **11.** \$8.33 **13.** No; sample answer: The cross products of the ratios $\frac{20}{6}$ and $\frac{16}{5}$ 20×5 or 100 and 6×16 or 96, are not equal. **15.** Yes; sample answer: The cross products of the ratios $\frac{16}{200}$ and $\frac{28}{350}$, 16 × 350 and 200 × 28, are both equal to 5,600. 17. No; sample answer: The cross products of the ratios $\frac{1.4 \text{ T}}{18 \text{ days}}$ and $\frac{10.5 \text{ T}}{60 \text{ days}}$, $1.4 \times 60 \text{ or } 84 \text{ and } 18 \times 10.5 \text{ or } 189$, are not equal. **19.** No; $\frac{45 \text{ min}}{25 \text{ pages}} = \frac{1.8 \text{ min}}{1 \text{ page}}$ and $\frac{60 \text{ min}}{30 \text{ pages}} = \frac{2 \text{ min}}{1 \text{ page}}$. These rates are not equivalent. **21.** 15 **23.** 3 **25.** 1.5 **27.** 63 **29.** 2.4 **31.** 13.5 **33.** 4.2 lb **35.** 7 stalks **37.** $10\frac{2}{3}$ oz **39.** 1.6 oz **41.** \$19.50 **43.** $\frac{325}{13} = \frac{100}{r}$; 4 **45.** \$5.70 for 6 lb; Sample answer: This ratio has a unit rate of 0.95/lb, while all of the other ratios have a unit rate of \$0.90/lb. **47.** Sample answer: Mental math; \$10 is 4 times more than \$2.50, so the number of ears is 4 times more than a dozen, which is 4 dozen or 48 ears of corn. **49**. B **51.** about 2.27 kg **53.** 56 **55.** $20\frac{9}{16}$ **57.** $17\frac{5}{32}$

Pages 314–315 Lesson 6-6

1. 270 mi; Sample answer:



3. $\frac{5}{8}$ ft **5.** 125 minutes **7.** 15 games **9.** Subtraction; $$2 \times 10^9$

Pages 320–322 Lesson 6-7

1. 50 km **3.** 130 km **5.** 21 ft **7.** $16\frac{2}{3}$ in. **9.** $\frac{1}{48}$ **11.** $\frac{1}{63}\frac{1}{860}$ **13.** 81 mi **15.** 40 mi **17.** 12 ft by 9 ft **19.** $11\frac{1}{5}$ in.; $\frac{1}{90}$ **21.** 6 in.; $\frac{1}{720}$ **23.** 26 mi **25.** $\frac{1}{12}$; 60 ft **29.** $\frac{5,000}{1}$ **31a.** A; 0.5 cm is larger than 1 mm. If 0.5 cm on the model is equal to 1 mm on the actual figure, then model A must be larger than the actual figure. **31b.** B; 1.5 mm is smaller than 4 cm. If 1.5 mm on the model is equal to 4 cm on the actual figure, then model B must be smaller than the actual figure. **31c.** C; 0.25 cm is equal to 2.5 mm. If 0.25 cm is equal to 2.5 mm on the actual figure, then model C must be the same size as the actual figure. **33.** Sample answer: Using the scale given on the map, look at the distance between the two cities on the map and then estimate the actual distance based on the distance given in the scale. **35.** F **37.** 10.5 ft **39.** 3.3¢ per oz **41.** Sample answer: 7 + 9 + 10 + 12 + 7 or 45 mi **43.** 24 **45.** 30 **47.** 60 **49.** $\frac{13}{30}$ **51.** $\frac{7}{9}$

Pages 327–328 Lesson 6-8

1. $\frac{27}{100}$ **3.** $\frac{3}{40}$ **5.** $\frac{5}{8}$ **7.** 16% **9.** 11.11% **11.** $\frac{5}{8}$ **13.** $\frac{23}{80}$ **15.** $\frac{1}{3}$ **17.** $\frac{15}{16}$ **19.** $\frac{33}{500}$ **21.** 55% **23.** 37.5% **25.** 96.67% **27.** 71.43% **29.** 1.25% **31.** 41.67% **33.** 2.5% **35.** < **37.** > **39.** $\frac{1}{2}$ %, $\frac{2}{5}$, 0.48, 0.5 **43.** Less than; $\frac{26}{125} = 20.8$ % **45.** Sample answer: Since a percent is a ratio that compares a number to 100, 80% is the ratio $\frac{80}{100}$. The ratio $\frac{80}{100}$ can be read as eighty-hundredths or written as a decimal, 0.80 or 0.8. The ratio $\frac{80}{100}$ also simplifies to $\frac{4}{5}$ if you divide the numerator and denominator by the same number, 20.

47. G **49.** 6 **51.** 2 **53.** $\frac{4}{5}$ **55.** $4\frac{1}{2}$ **57.** $1\frac{2}{3}$

Pages 330–332 Lesson 6-9

1. 3.25; $3\frac{1}{4}$ **3.** 4.8; $4\frac{4}{5}$ **5.** 0.0015; $\frac{3}{2,000}$ **7.** 0.009; $\frac{9}{1,000}$ **9.** 0.15% **11.** 275% **13.** 325% **15.** 3.5; $3\frac{1}{2}$ **17.** 6 **19.** 0.006; $\frac{3}{500}$ **21.** 0.0055; $\frac{11}{2,000}$ **23.** 0.001; $\frac{1}{1,000}$ **25.** 850% **27.** 264% **29.** 0.9% **31.** 0.34% **33.** 140% **35.** 350% **37.** 0.4% **39.** 0.00125 **41.** 0.0012 **43.** 0.003; $\frac{3}{1,000}$; So, 0.003 of the population of the United States was Japanese. **45.** 0.0005 **47.** about 0.595% **49.** Julie; the first step is to divide 3 by 2,000. The next step is to convert to a percent by multiplying by 100. Mikasi multiplied by 10,000.

53. G **55.** $\frac{3}{250}$ **57.** $\frac{37}{40}$ **59.** 0.85 **61.** 0.369

Pages 333–336 Chapter 6 Study Guide and Review

1. ratio **3.** rate **5.** scale drawing **7.** scale factor **9.** unit rate **11.** $\frac{4}{3}$ **13.** $\frac{2}{3}$ **15.** no; $\frac{18}{24} = \frac{3}{4}, \frac{5}{20} = \frac{1}{4},$ and $\frac{3}{4} \neq \frac{1}{4}$ **17.** \$4.75 per lb **19.** $3\frac{1}{2}$ laps per min **21.** 8 **23.** 3 **25.** 4 ft **27.** 51,528.96 **29.** 18.43 **31.** 6 **33.** 12.5 **35.** 9 **37.** 721.8 lb **39.** 45 **41.** 94 cm **43.** $\frac{27}{500}$ **45.** 12.5% **47.** 17.5% **49.** 1.25; $1\frac{1}{4}$ **51.** 0.005; $\frac{1}{200}$ **53.** 475% **55.** 1.35; $1\frac{7}{20}$

Chapter 7 Applying Percents

Page 3	41	Chapter	7	Getting Ready		
1. 48	3. 1 <i>,</i> 512	5. \$54.75	7. 0.34	9. 0.75	11. 75	
13. 38	.9 15. 0.1	7 17. 1.57	7 19. 0.	075		

Pages 346–348 Lesson 7-1

1. 4 **3.** 110.5 **5.** 23 **7.** \$3.25 **9.** \$194.40 **11.** 45.9 **13.** 14.7 **15.** 17.5 **17.** 62.5 **19.** \$290 **21.** 3.5 **23.** 97.8 **25.** 92.5 **27.** \$19.95 **29.** 3.3 **31.** 990 **33.** 520 **35.** 0.24 **37.** \$9.75 **39.** \$297 **41.** about 1,432 **43.** Sample answer: 53% of $60 \rightarrow 50\% \times 60$ or $\frac{1}{2} \times 60 = 30$ **45.** Sample answer: 75% of $19 \rightarrow 75\%$ $\times 20$ or $\frac{3}{4} \times 20 = 15$ **47.** 80 **49.** Sample answer: 24% $\times 250$ or 60 people prefer cherries. So, 250 – 60 or 190 people did not prefer cherries. **51.** 15 **53.** Sample answer: Determine the number of questions answered correctly on a test and find how much to tip a restaurant server. **55.** Less than the original number; you are subtracting 10% of a greater number. **57.** B **59.** 7.5 **61.** 0.0004 **63.** 71% **65.** $\frac{11}{21}$ **67.** 31, 38, 45 **69.** 70

Pages 353–354 Lesson 7-2

36% 3. 0.7 5. 75 7. 3 c 9. 7.5% 11. 8.6
 375 15. \$12.50 17. 40% 19. 4.1 21. 192
 0.2% 25. \$8 27. about 3.4% 29. about 6,378 km
 20% of 500, 20% of 100, 5% of 100; If the percent is the same but the base is greater, then the part is greater. If the base is the same but the percent is greater, then the part is 3. B 35. 30
 2.75 39. 3 41. 30 43. 18

Pages 357–360 Lesson 7-3

1. 5; $\frac{1}{2} \cdot 10 = 5$; $0.1 \cdot 10 = 1$ and $5 \cdot 1 = 5$ **3.** 24; $\frac{2}{5} \cdot 60 = 24$; $0.1 \cdot 60 = 6$ and $4 \cdot 6 = 24$ **5.** $(1 \cdot 70) + (\frac{1}{2} \cdot 70)$ = 105 7. about \$50; $\frac{1}{4} \cdot $200 = $50; 0.1 \cdot 200 = 20$ and 2.5 • 20 = \$50 **9**. about 160,000 acres; 0.1 • 20,000,000 = 200,000 and $\frac{4}{5}$ of 200,000 = 160,000 **11**. 18; $\frac{1}{5}$ • 90 = 18; 0.1 • 90 = 9 and 2 • 9 = 18 **13**. 135; $\frac{3}{4} \cdot 180 = 135$; 0.1 • 180 = 18 and 7.5 • 18 = 135 **15**. 90; $\frac{9}{100} \cdot 100 =$ 90; 0.1 • 100 = 10 and 9 • 10 = 90 **17**. 36; $\frac{3}{10}$ • 120 = 36; $0.1 \cdot 120 = 12$ and $3 \cdot 12 = 36$ **19.** 90; $\frac{3}{5} \cdot 150 = 90$; $0.1 \cdot 150 = 15$ and $6 \cdot 15 = 90$ **21.** 168; $\frac{7}{10} \cdot 240 = 168$; $0.1 \cdot 240 = 24$ and $7 \cdot 24 = 168$ **23**. about 12 muscles; $\frac{3}{10} \cdot 40 = 12$ **25.** $(2 \cdot 300) + (\frac{1}{4} \cdot 300) = 675$ **27.** 0.01 • $200 = 2 \text{ and } \frac{3}{4} \cdot 2 = 1.5$ **29.** $0.01 \cdot 70 = 7$ **31.** about 2,700 birds; 0.01 • 450,000 = 4,500 and $\frac{3}{5}$ • 4,500 = 2,700 **33.** $\frac{1}{2} \cdot 80 = 40$ **35.** $\frac{1}{10} \cdot 240 = 24$ **37.** $1 \cdot 45 = 45$ **39**. about 3 hours; Method 1: $\frac{1}{3} \cdot 24 = 8$ and $\frac{1}{5} \cdot 24 \approx 5$; 8 - 5 = 3 **41.** Sample answer: about 150; $\frac{1}{4} \cdot 1,000 = 250; \frac{1}{10} \cdot 1,000 = 100; 250 - 100 = 150$ **43.** Sample answer: about 400,000 people; .08 • 5,000,000 = 400,000 **45**. Sample answer: about 0.15 lb; 0.01 • 15 = 0.15 **47.** Sample answer: Find 1% of \$800, then multiply by $\frac{3}{8}$. **49.** Sometimes; sample answer: one estimate for 37% of 60 is $\frac{2}{5} \times 60 = 24$. This is greater than the actual answer because $\frac{2}{5}$ is greater than 37%.

Another estimate is $\frac{1}{3} \times 60 = 20$. This is less than the actual answer because $\frac{1}{3}$ is less than 37%. **51**. B . D **55**. 64.8 **57**. 157.1 **59**. Sample answer: 1 + 0 = 1. Sample answer: $1 - \frac{1}{2} = \frac{1}{2}$ **63**. 50 **65**. 357.1 . 0.7 **69**. 0.75

Pages 363–365 Lesson 7-4

1. $p = 88 \cdot 300; 264$ **3.** $75 = n \cdot 150; 50\%$ **5.** $3 = 0.12 \cdot w; 25$ **7.** 39 loaves **9.** $p = 0.39 \cdot 65; 25.4$ **11.** $p = 0.53 \cdot 470; 249.1$ **13.** $26 = n \cdot 96; 27.1\%$ **15.** $30 = n \cdot 64; 46.9\%$ **17.** $84 = 0.75 \cdot w; 112$ **19.** $64 = 0.8 \cdot w; 80$ **21.** 4,400 games **23.** 1 **25.** $p = 0.4 \cdot 82.1; 0.3$ **27.** $230 = n \cdot 200; 115\%$ **29.** about 43% **31.** about 27% **33.** Sample answer: 30 is 125% of what number?; 24 **35.** Sample answer: It may be easier if the percent and the base are known because after writing the percent as a decimal or fraction, the only step is to multiply. When using the percent proportion, you must first find the cross products and then divide. **37.** H **39.** Sample answer: about 3,000 ÷ 100 or 30 ft/s **41.** 15; $\frac{3}{10} \cdot 50 = 15$ **43.** 37 yr

Pages 366–367 Lesson 7-5

1. Sample answer: Look for a rule or pattern in the data or number facts, estimation, guess and check, make an organized list, or work backward. **3.** \$4 **5.** $0.7 \cdot 400$ or 280 teens **7.** 2 quarters, 1 dime, 4 nickels, and 3 pennies **9.** 10 times **11.** \$3.50 **13.** multiplication followed by addition and finally division; $15 \cdot 18 + 18 \cdot 20 = 630$ ft³. Then convert 630 ft³ to square yards; $630 \div (3 \cdot 3) = 70$ yd²

Pages 372–374 Lesson 7-6

1. 20% decrease **3.** 19% increase **5.** C **7.** 40% increase **9.** 71% decrease **11.** 25% decrease **13.** 5% decrease **15.** 13% increase **17.** 38% decrease **19.** 2% increase **21.** 75% decrease **23.** 150% increase **25.** 300% **29.** \$51 billion **31.** 41% **33.** 16 to 17; 72% **35.** The \$60 sound system since 10 is a greater part of 60 than of 90. **37.** No; after a 10% increase, the quantity is greater then the original quantity. Decreasing a larger number by the same percent results in a greater change. **39.** D **41.** 0.3w = 17; 56.7 **43.** about \$3.19/lb **45.** 0.065 **47.** 0.0825

Pages 377–378 Lesson 7-7

1. \$3.10 **3.** \$1,338.75 **5.** \$98.90 **7.** \$1,605 **9.** \$4.90 **11.** \$7.99 **13.** \$96.26 **15.** \$7.50 **17.** 30% **19.** \$35.79 **21.** \$143.75 **23.** \$25 **25.** \$60, \$35; The percent of discount is about 42%. All of the other pairs have a discount of 25%. **27.** C **29.** C **31.** 9% decrease **33.** about 500 × 0.7 or 350 mi **35.** $\frac{1}{18}$

Pages 381–382 Lesson 7-8

1. \$38.40 **3.** \$5.80 **5.** \$1,417.50 **7.** \$1,219.00 **9.** \$21.38 **11.** \$123.75 **13.** \$45.31 **15.** \$14.06 **17.** \$1,353.13 **19.** \$116.25 **21.** 6 yr **23.** \$627, \$655.22,

\$684.70 **25**. C **27**. \$21.39 **29**. 37% decrease **31**. $1\frac{1}{5}$ **33**. $2\frac{2}{15}$

Pages 384–388 Chapter 7 Study Guide and Review

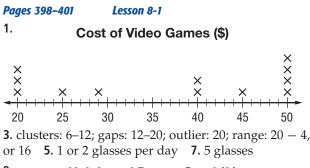
1. true **3.** true **5.** false; 10% **7.** true **9.** false; original **11.** 39 **13.** 135 **15.** 14 games **17.** 0.3 **19.** \$27.49 **21.** Sample answer: $40; \frac{1}{3} \cdot 120 = 40$ **23.** Sample answer: $20; \frac{1}{5} \cdot 100 = 20$ **25.** Sample answer: $360; 0.1 \cdot 400 = 40; 9 \cdot 40 = 360$ **27.** $32 = p \cdot 50; 64\%$ **29.** $n = 42 \cdot 300; 126$ **31.** $108 = 0.12 \cdot w;$ 900 **33.** 333 **35.** Sample answer: \$700 × 0.4 = \$280 **37.** 93% increase **39.** 10% increase **41.** \$26.75 **43.** \$8,440 **45.** 14% **47.** \$3.51 **49.** \$1,500 **51.** \$101.25 **53.** \$311.85

Chapter 8 Statistics: Analyzing Data

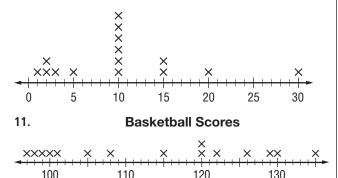
 Page 395
 Chapter 8
 Getting Ready

 1. 95.89, 96.02, 96.2
 3. 22, 22.012, 22.02
 5. 74.7, 74.67, 74.67, 74.65

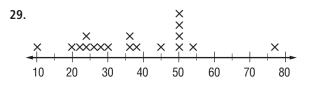
 7. 3.340, 3.304, 3.04
 9. 2.32



9. Heights of Desert Cacti (ft)



13. 34° **15.** Sample answer: cluster $104^{\circ}F-122^{\circ}F$; gaps $100^{\circ}F-104^{\circ}F$, $122^{\circ}F-125^{\circ}F$, $125^{\circ}F-128^{\circ}F$, and $128^{\circ}F-134^{\circ}F$; outliers $100^{\circ}F$ and $134^{\circ}F$ **17.** 36 - 10 or 26**19.** 15 **21.** Sometimes; the range will only change if the new data value lies above or below the greatest and least points, respectively, of the original data set. **23.** 10 **25.** about 72% **27.** Sample answer: range 34 yr; cluster 10-12 yr; outlier 40 yr



Sample answer: The data are more spread out, with a range of 67 compared with the previous range of 34. There is a cluster from 20 to 30 and a gap between 54 and 77. The piece of data that occurs most frequently is 50, which means that the maximum life span of more animals is 50 years than any other number of years. **31**. Sample answer: The range of a data set excluding the outlier(s) is a lesser value than the range of the same data set including the outlier(s). This is because any outliers will lie below and above the least and greatest values, respectively, of the data set and the range will change to include these values. **33**. Sample answer: A frequency table shows the number of times data occur by using tally marks. A line plot shows the number of times data occur by using \times s. A frequency table usually shows intervals of data and is useful when a summary is needed. A line plot shows individual data points and is useful when you need to see how all the data points are spread out. 35. H 37. \$60 39. \$4.46 41. 47 43. 12.6

Pages 405–408 Lesson 8-2

1. 52.3; 57; 59 **3.** 44.6; 44; 44 **5.** Sample answer: Either the mean, median, or mode could be used to represent the data. The mean is slightly greater than most of the data items, and therefore is a less accurate description of the data. 7. 87; 90; 80 and 93 9. \$12; \$9; \$6 **11.** 26.5; 25.5; 23 and 25 **13.** Sample answer: The mean, 15.6, is higher than most of the data. The median, 1, or mode, 1, best represents the data. **15.** \$3.50, \$3.50, \$3.50 **17.** Always; Sample answer: Any value that is added which is greater than the maximum value, 23, will increase the average, or mean, of the values. 19. Sometimes; Sample answer: The mean of the data set is currently 14.5. If a value that is greater than 14.5 is added, the mean will increase. If a value that is less than 14.5 is added, the mean will decrease. If a value that is exactly 14.5 is added, the mean will remain unchanged. **21**. Sample answer: A length of 960 inches is much greater than the other pieces of data. So, if this piece of data is added, the mean will increase. **23.** 10 points; Sample answer: The sum of the points for the first thirteen games is 158. In order for the average number of points to be 12, the total number of points for fourteen games would need to be 12×14 or 168. So, 168 - 158or 10 points need to be scored during the last game. **25**. Sample answer: 4, 5, 2, 2, 3, 3, 1, 0, 1, 2, 4, 68, 5; the mean, 7.7, is not the best representation since it is greater than all the data items except one. **27.** Sometimes; if there is an odd number of items, the median is the middle number. If there is an even number of items, the median is the mean of the two middle numbers. 29. Mean; a mode must be a

member of the data set, and it is impossible to have 2.59 family members. **31.** H

33. Fiber in Cereal (g)	35. \$10.43
×	37. Commutative (×)
×	39. ones
××	41 . tenths
x x	
X X X X	
$\times \times \times \times \times \times$	
0 1 2 3 4 5	

Pages 412–414 Lesson 8-3

1.

Height of Trees(ft) 3.5 5. mean

 Stem
 Leaf

 0
 8
 8

 1
 0
 2
 5
 5
 6
 8

 2
 0
 5

$$2 \mid 0 = 20 \ ft$$

7.		9.	
Low	Temperatures (°F)	Schoo	ol Play Attendance
Stem	Leaf	Stem	Leaf
1	3 3 5	22	579
2	048	23	0
3	0 1 2 2 5 6 8 8 8	24	36
	$1 3 = 13^{\circ}F$	25	
		26	799
		27	888
			26 7 = 267 people

11. 4; 1 **13.** \$45 **15.** mean **17.** 26 **19.** Sample answer: Yes; Thirty-six of the 56 signers were 30–49 years. Since 36 out of 56 is greater than half, you can say that the majority of the signers were 30–49 years old.

21. Average Length (ft) of Crocodiles

 Stem	Leaf	Sample answer:
6	3	A reasonable
7		length for
8	1	an average crocodile is
9	8 8	about 16 feet.
10		
11	4	23. Diana; three
12		out of the six or 50%
13	6	50% of the pieces of ribbon
14		are 20–30 inches
15		in length.
16	0 3 3 3 3	
17		
18		
19	5	
	13 6 = 13.6 ft	

25.	Price (\$)	Tally	Frequency
	20–29		4
	30–39	HI HI	10
	40–49	I III	5
	50-59		1

Price of Jeans (\$)

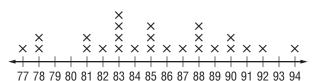
				X			
×		XX	X	×			
×х	ХХ	XXXXX	×	×	×	×	×
<+++	++++	+	++	+++	++++	++++	┼┼┼┼►
24 26	28 30	32 34 36	38	40 42	44 46	48 50 5	52 54 56

Price of Jeans (\$)										
Stem	Le	eaf								
2 3 4 5	4	6	6	8						
3	0	2	3	4	5	5	6	6	8	8
4	0	0	0	5	9					
5	6									
							=			

All three representations show the frequency of data occurring. The frequency table shows intervals of data and is useful in comparing price ranges. The line plot gives a good picture of the spread of the data. The stem-and-leaf plot shows individual prices as in the line plot, as well as intervals, such as \$20s, \$30s, and so on. See students' favorites and reasons. **27.** C **29.** 48.7; 50; 55



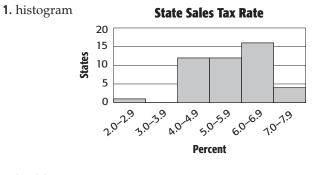
Test Scores



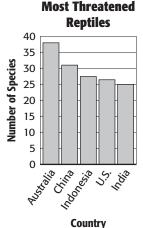
33. $\frac{3}{8}$ **35.** Sample answer: 20; 20–120



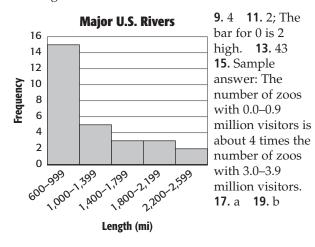
Lesson 8-4



3. health



7. histogram



21. Sample answer: 210,000 thousand, or
210,000,000
23. Sample answer: It is easier to compare two sets of data.
25. tennis
27. Sample answer: The number of boys and girls is the same because kickball is a sport that mostly everyone can play and the only sports equipment needed is a kickball.
29. Sample answer: Each interval represents a portion of the data set. The number of items in each interval is indicated by the frequency, typically shown along the vertical scale. By adding the frequencies for each interval, you can determine the number of values in the data set.

33.

Number of Wins										
Stem										
1	5	7 5 1	9							
2	3	5	6							
3	0	1	2	6						
4	0	0	1	3	4	5	6	7 5	7	
5	0	0	0	1	2	3	3	5	6	6
								5 3	=	53

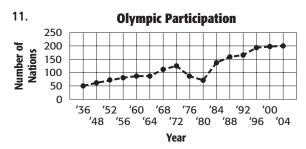
35. Mental math; the numbers are easy to computer mentally. Sample answer: $\frac{1}{5}$ of \$50 is \$10 and \$50 - \$10 = \$40. So, he will need an additional \$40.

Pages 424–425 Lesson 8-5

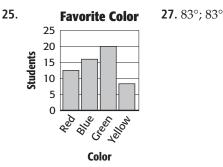
 Sample answer: Graphs provide a visual representation of a situation involving comparisons. A graphical model can sometimes show conclusively what is often difficult to interpret from looking at lists alone.
 Sample answer: 95°F 5. 158, 318
 Tuesday and Thursday 9. division; 2,500 ÷ 150 is about 16 people

Pages 428–431 Lesson 8-6

Sample answer: The graph shows a negative relationship. That is, as the weeks pass, the time decreases.
 about 155–160 people
 about 400
 about 95 min
 Sample answer: As the speed increases, the distance required to come to a complete stop increases.



13. Sample answer: In most years, the number of participants increases. 15. about \$55,000
17. No; if the trend continues for both counties, then the population in Miami-Dade County will still be greater than the population in Broward County. The gap between the populations will actually widen.
19. mode; the other three are ways to display data.
21. Graphs often show trends over time. If you continue the pattern, you can use it to make a prediction. 23. F



Pages 435–437 Lesson 8-7

1. 19,800 **3.** 5.72 million **5.** 1,396 students **7.** 58,800 teens **9.** b. **11.** a. **13.** about 38 people **15.** about 1,040 **17.** Sample answer: Since large numbers are involved, use a calculator; $0.15 \cdot 5,900,962 = 885,144.3$, so about 885,000 people would belong to a fitness center. **19.** C **21.** B **23.** It takes Dale a little bit longer to run each successive mile of the 5-mile run. **25.** -24 **27.** 54 **29.** $\frac{3}{10}$ or 0.3 **31.** $\frac{18}{4}$ or 4.5

Pages 440–443 Lesson 8-8

1. The conclusion is invalid. This is a biased sample, since people in other states might have more umbrellas than those in Arizona. The sample is a convenience sample since all the people are from the same state. **3.** This is a simple random survey, so the sample is valid; about 102 students. 5. The conclusion is invalid. This is a biased, convenience sample. 7. The conclusion is valid. This is an unbiased random sample. 9. The conclusion is invalid. This is a biased, convenience sample. **11.** This is an unbiased random sample, so the results are valid; about 132 boxes. **13.** This sample is a voluntary response sample. Therefore, no valid conclusion can be made. **15.** about 550 **17.** Sample answer: This is an unbiased random sample. The time a student spends on the Internet during this week may not be typical of other weeks. **19**. Sample answer: This is a convenience sample. The softball team may not represent the entire student population. **21**. Not necessarily; Sample answer: Because you may be surveying different people in each sample, you may get different results. **23.** Sample answer: You want to determine the number of students in your school who own at least one pet. 25. Yes; Sample answer: Every 10th person at a basketball game is asked whether they prefer basketball or baseball. This survey is a convenience sample because people attending a basketball game probably prefer basketball. 27. C 29. about 292 students **31.** \$58.44 **33.** $\frac{5}{8}$ **35.** true

Pages 447–449 Lesson 8-9

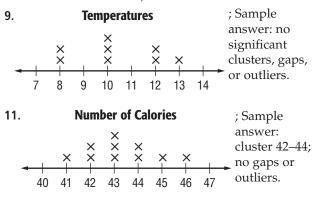
1. Graph A; From the length of the bars, it appears that Hank Aaron hit about 4 times as many home runs as Willie Mayes. However, Willie Mayes hit about 600 home runs and Hank Aaron hit about 750 home runs. So, the conclusion is not valid. **3.** Sample answer: The mean is 8,638 and the median is 8,941. Since the median is greater than the mean, use the median to emphasize the average length. **5.** The sample is a biased convenience sample. Mr. Kessler's first period class may not be representative of all his students. The display is biased because the data used to create the display came from a biased sample. 7. The median or the mode because it is much closer in value to most of the pieces of data. 9. The sample is a biased convenience sample. The first 100 batteries produced may not be representative of all the batteries produced. The display is biased because the data used to create the display came from a biased sample.

11. **Monthly Cost to Rent** an Apartment 625 600 🕑 575 Cent 550 525 500 0 2 3 4 5 Year

13. Sample answer: Outliers may distort measures of central tendency; data shown in graphs may be exaggerated or minimized by manipulating scales and intervals. **15.** G **17.** about 391 teens

Pages 450–454 Chapter 8 Study Guide and Review

1. true 3. true 5. false; outlier 7. true



13. 84.3°; 86°; none

15. Hours Worked

Stem	
2	1 3 6 9 1 2 7 8 6 4
3	1278
4	6
5	4
	3 2 = 32 hours

17. Birthdates

Stem							
0	3 0	5	7	9			
1	0	1	2	4	6	8	
2	1	4					
			i	12	2 =	= 12	,

19. 10.75 million 21. *Crazy Horse* 23. Sample answer: The graph shows a positive relationship. That is, as the number of people in a family increases, the number of telephone calls per week increases. 25. about 208
27. 162 teens 29. The conclusion is valid. This is an unbiased random sample. 31. There are no labels on the vertical scale.

Chapter 9 Probability

Page 459 Chapter 9 Getting Ready

1. 105 **3.** 52 **5.** 160 **7.** 210 **9.** 360 **11.** 5,040 **13.** \$315 **15.** $\frac{1}{6}$ **17.** $\frac{1}{3}$ **19.** 5 **21.** 4

Pages 462–464 Lesson 9-1

1.
$$\frac{1}{12}$$
 3. $\frac{1}{4}$ **5.** $\frac{3}{5}$ **7.** $\frac{23}{30}$ **9.** 1 **11.** $\frac{1}{20}$ **13.** $\frac{3}{10}$ **15.** $\frac{19}{20}$
17. $\frac{3}{5}$ **19.** 0 **21.** 1 **23.** $\frac{4}{5}$ **25.** 60% **27.** $\frac{1}{11}$;
Sample answer: The bar height for \$111-\$160 is low

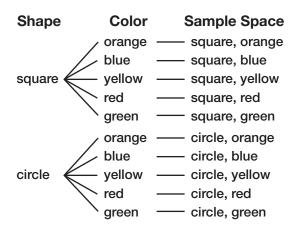
compared to other bar height for \$111-\$100 is low should be relatively low. **29.** Sample answer: The complementary event is the chance of no rain. Its probability is 63% **31a.** 1; Sample answer: Since 2032 is a leap year, there will be 29 days in February, making this event certain to happen; **31b.** 0; Sample answer: Since 2058 is not a leap year, there will only be 28 days in February, making this event impossible to happen. **33.** 0.65, 0.55 are probabilities that are not complementary because $0.65 + 0.55 \neq 1$. The other sets of probability are complementary. **35.** C **37.** There are no labels on the vertical scale. **39.** $\frac{1}{3}$ **41.** $\frac{1}{2}$ **43.** $\frac{9}{16}$

Pages 467–470 Lesson 9-2

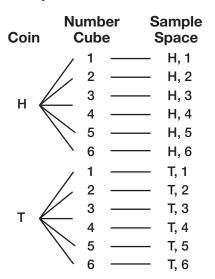
1. Sample answer:

	Outcomes										
	1	2	3	4	5	6					
1	1, 1	1, 2	1, 3	1, 4	1, 5	1, 6					
2	2, 1	2, 2	2,3 2,4	2, 4	2, 5	2, 6					
3	3, 1	3, 2	3, 3 3, 4		3, 5	3, 6					
4	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6					
5	5, 1	5, 2	5, 3	5, 4	5, 5	5, 6					
6	6, 1	6, 2	6, 3	6, 4	6, 5	6, 6					

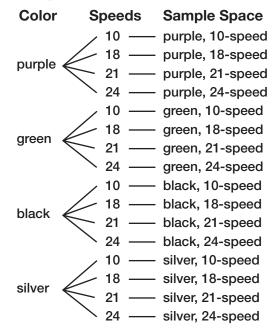
3. C **5.** Sample answer:



7. Sample answer:



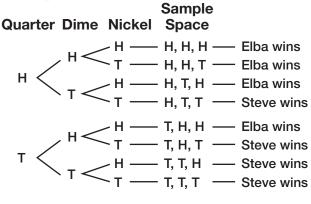
9. Sample answer:



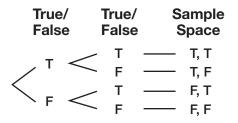
11. Sample answer:

Outcomes							
Short Sleeve	Gray	Small					
Short Sleeve	Gray	Medium					
Short Sleeve	Gray	Large					
Short Sleeve	White	Small					
Short Sleeve	White	Medium					
Short Sleeve	White	Large					
Long Sleeve	Gray	Small					
Long Sleeve	Gray	Medium					
Long Sleeve	Gray	Large					
Long Sleeve	White	Small					
Long Sleeve	White	Medium					
Long Sleeve	White	Large					

13. Sample answer:



There are 8 equally-likely outcomes with 4 favoring Elba. So, the probability that Elba wins is $\frac{1}{2}$. **15**. $\frac{1}{8}$ **17**. $\frac{3}{8}$ **19**. $\frac{1}{8}$ **21**. 8 **25**. Sample answer: Mei can draw a model of the situation using a tree diagram to show the sample space. Then she can determine the probability. The probability of guessing correctly is $\frac{1}{4}$.



27. Sample game: Each player tosses a coin 10 times. If it comes up heads, player 1 receives 1 point. If it comes up tails, player 2 receives 1 point. The player with the most points at the end of 20 tosses wins. **29.** $\frac{2}{5}$ **31.** $\frac{13}{20}$ **33.** $\frac{3}{10}$ **35.** The cost is increasing over time. In about a year's time, the cost has more than tripled. **37.** \$2,598.75 **39.** 15.6 **41.** 154 **43.** 460

Pages 472–474 Lesson 9-3

1. 8 **3.** 60 **5.** 12 **7.** 84 **9.** 24 **11.** 6 possible routes; $\frac{1}{6}$ **13.** 7,776 **15.** No; the number of selections is 25 • 14 or 350, which is less than 365. **17.** 2; 4; 8; 2^{*n*}; Sample answer: I used a pattern to determine the number of outcomes for *n* coins. One coin: 2^1 outcomes, two coins: $2 \cdot 2$ or 2^2 outcomes, three coins: $2 \cdot 2 \cdot 2$ or 2^3 outcomes, *n* coins: 2^n outcomes. 19. Sample answer: When there are multiple events, the Fundamental Counting Principle is a much faster method of obtaining the total number of outcomes than drawing a tree diagram. The Fundamental Counting Principle also saves paper space and can often be done mentally. When you need to see what the specific outcomes are, make a tree diagram since the Fundamental Counting Principle only gives the number of outcomes. **21.** F **23.** $\frac{1}{2}$ **25.** $\frac{1}{5}$, 0.22, 27%, 20.1 **27.**6 **29.**120

Pages 476–478 Lesson 9-4

1. 5,040 **3.** $\frac{1}{20}$ **5.** 24 **7.** 720 **9.** $\frac{1}{90}$ **11.** $\frac{1}{12}$ **13.** Sample answer: Calculator; An exact answer is required. 24 × 23 × 22 × 21 = 255,024 **15.** $\frac{1}{4}$ **17.** Sample answer: The number of ways you can

order 3 books on a shelf is 3 • 2 • 1 or 6. **19.** H

21.	weat		Cheese	Outcomes
	turkey		- cheddar	 turkey, cheddar
	luikey		Swiss	 turkey, Swiss
	ham		- cheddar	 ham, cheddar
	IIdIII	\sim	Swiss	 ham, Swiss
	salami		- cheddar	 salami, cheddar
	Salalill	\sim	Swiss	 salami, Swiss

23.
$$1\frac{13}{15}$$
 25. $4\frac{11}{48}$ **27.** 56 **29.** 3

Pages 482–483 Lesson 9-5

1. 21 ways **3.** 6 **5.** 210 **7.** 924 **9.** $\frac{1}{20}$ **11.** 10; $\frac{1}{10}$ **13.** permutation; 90 **15.** 15 **17.** The number of ways you can choose three CDs from a collection of ten CDs is 120 ways. **19.** H **21.** 72 **23.** Sample answer: $\frac{1}{2} - 0 = \frac{1}{2}$ **25.** $\frac{1}{5}$

Pages 484–485 Lesson 9-6

1. Sample answer: Results would vary slightly. **3.** No; Sample answer: the experiment produces about 1–2 correct answers, so using a spinner with 4 sections is not a good way to answer a 5-question multiple-choice quiz. **5.** 30 **7.** 250 is a reasonable answer since 31% of 800 is 248. **9.** No, the 6th row should have the numbers 1, 5, 10, 10, 5, 1. **11.** No; Sample answer: the experiment produces about 2–3 correct answers, so using a number cube is not a good way to answer a 5-question true-false quiz. **13.** subtraction; 29,000 – $1.38 \times 10^4 = 15,200$ ft

Pages 488–490 Lesson 9-7

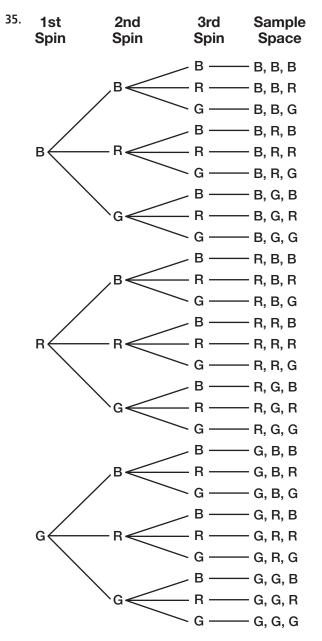
1. $\frac{14}{25}$ **3.** The experimental probability, $\frac{14}{25}$ or 56%, is close to its theoretical probability of $\frac{1}{2}$ or 50%. **5.** 24 **7.** $\frac{9}{10}$; the experimental probability, $\frac{9}{10}$ or 90%, is close to its theoretical probability of $\frac{5}{6}$, or about 83% 9. $\frac{2}{5}$ 11. 51 13. 10 15. $\frac{13}{25}$ 17. No; The experimental probability that a mother will receive jewelry is $\frac{17}{100}$. Out of 750 mothers that receive gifts, only about 128 can expect to receive jewelry not 250. **19.** Yes; Sample answer: If there are 40 unsharpened pencils in the box, then there are twice as many unsharpened pencils as there are sharpened pencils. If there are five sharpened pencils in the sample that was taken out, then there should be ten unsharpened pencils which would give a total of 15 pencils in the sample, which was the size of the sample. It is important to note that this was only one sample. To be sure that the sample represents the population, other samples should be taken and compared to the first sample. 21. B 23. 6 25. 80% 27. 87.5%

Pages 495-497
 Lesson 9-8

 1.
$$\frac{1}{30}$$
 3. $\frac{1}{10}$
 5. $\frac{2}{9}$
 7. $\frac{1}{90}$
 9. $\frac{2}{3}$
 11. $\frac{1}{2}$
 13. $\frac{1}{6}$
 15. $\frac{3}{25}$

 17. 0
 19. $\frac{3}{16}$
 21. $\frac{15}{92}$
 23. $\frac{3}{7}$
 25. $\frac{4}{7}$
 27. $\frac{3}{20}$
 29. $\frac{1}{10}$

 31. $\frac{1}{1,024}$
 33. 22.5%



37. These events are dependent, not independent. Selecting one book and not returning it to the shelf limits your choices for the next pick to 2 books, not 3, as on the first pick. **39.** G **41.** 6 **43.** -48 **45.** 80

Pages 498–502 Chapter 9 Study Guide and Review

1. true 3. false; probability 5. false; independent events7. false; disjoint9. $\frac{1}{4}$ 11. $\frac{3}{4}$ 13. 8%15.Outcomes17. 3619. $\frac{1}{30}$ 21. 40,320

•	Outc	omes			
	White	Turkey			
	White	Ham			
	White	Salami			
	Wheat	Turkey			
	Wheat	Ham			
	Wheat	Salami			
	Rye	Turkey			
	Rye	Ham			
	Rye	Salami			

23.56 25.45 27.No; Sample answer: the experiment produces about 3 correct answers, so tossing a coin is not a good way to answer a 6-question truefalse quiz. 29.8

31. $\frac{3}{25}$ **33.** $\frac{1}{2}$ **35.** $\frac{23}{50}$ **37.** $\frac{3}{64}$; $\frac{1}{20}$ **39.** $\frac{1}{16}$; $\frac{7}{120}$ **41.** $\frac{1}{3}$

Chapter 10 Geometry: Polygons

Page 508 Chapter 10 Getting Ready

1. 306 **3.** 0.15 **5.** 0.11 **7.** 44 **9.** 105 **11.** 14 **13.** 36

Pages 510-513 Lesson 10-1

1. \angle *MNP*, \angle *PNM*, \angle *N*, \angle 1; obtuse **3.** \angle 1 and \angle 3; Sample answer: Since $\angle 1$ and $\angle 3$ are opposite angles formed by the intersection of two lines, they are vertical angles. **5.** $\angle DEF$, $\angle FED$, $\angle E$, $\angle 5$; right **7.** \angle *MNP*, \angle *PNM*, \angle *N*, \angle *7*; straight **9.** \angle *RTS*, \angle *STR*, $\angle T$, $\angle 9$; acute **11**. neither **13**. adjacent **15**. vertical **17.** $\angle 1$ and $\angle 2$; Sample answer: Since $\angle 1$ and $\angle 2$ share a common vertex, a common side, and do not overlap, they are adjacent angles. 19. False; Sample answer: Two straight angles cannot be adjacent since they cannot share a common side or a common vertex.

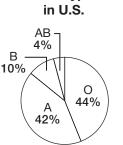
21. A **23.** $\frac{1}{24}$ **25.** $\frac{5}{24}$ **27.** 46 **29.** 54

Pages 514-517

Lesson 10-2

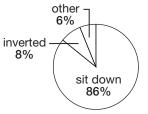
1. supplementary **3**. 135 **5**. supplementary **7.** supplementary **9.** neither **11.** 65° **13.** 84 **15.** Sample answer: $\angle KGJ$, $\angle KGC$ **17.** adjacent; adjacent; vertical **19.** $m \angle 1 = 180^{\circ} - m \angle 2$; $m \angle 3 =$ 180° – $m \angle 2$; Sample answer: $m \angle 1$ and $m \angle 3$ both equal the same expression. **21.** $m \angle E = 39^\circ$, $m \angle F = 51^\circ$ **23.** B **25.** ∠*P*, ∠*I*, ∠*RPQ*, ∠*QPR*; acute **27.** 223.2 **29.** 0.12



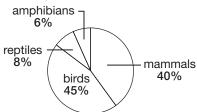


3. blue

U.S. Steel Roller 5. Coasters



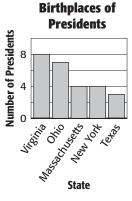


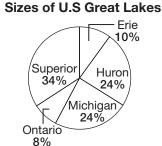


9. grades 1–8 **11.** about 16.5 million **13.** about 12 million **15.** 15

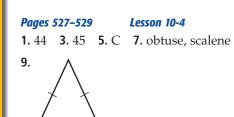
17. bar graph

19.

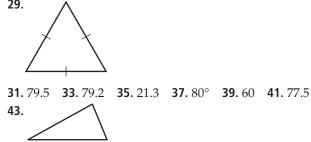




21. Lake Ontario is one-third the size of Lake Michigan. **23.** No; a 50% increase in 126 students is 189, and 189 is not equal to 366. So, it is not reasonable to say that 50% more students said they could make a difference. Since 300% of 126 is 378, it is reasonable to say that 300% more students said they could make a difference than those who said they could make a difference. **25.** 12.5%; English is half of the circle. Since Science is half of English, Science is half of 50% or 25%. Math is half of Science, which is half of 25% or 12.5%. **27.** Sample answer: No; the sum of the percents is greater than 100. The people surveyed must have been able to choose more than one fruit juice. **29.** Sample answer: $\angle 1$ and $\angle 3$ **31.** 68 **33.** 101



11. 118
13. 27
15. 90
17. 53°
19. acute, equilateral
21. right, isosceles
23. acute, scalene
25. right
27.
29. Λ



Sample answer: All of the angles are acute and there are no congruent sides. 45. Never; Sample answer: The sum of the three angles in a triangle is 180°. If a triangle has two obtuse angles, the sum of these two angles, not including the third angle, would already be greater than 180°. 47. B 49. 147.6°
51. supplementary 53. about \$9

Pages 530–531 Lesson 10-5

1. Sample answer: They used inductive reasoning because they made a rule after seeing four examples. **3.** Two angles are congruent. **5.** 25 units; Sample answer: The pattern in the table shows that the length in units is the square of the time in seconds. So, the length of the yo-yo if it takes 5 seconds to swing back and forth is 5² or 25 units. **7.** 265 mi **9.** 196 sq units **11.** Sample answer: addition; $22\frac{1}{2} + 22\frac{1}{2} + 37\frac{1}{4} + 37\frac{1}{4} = 119\frac{1}{2}$ ft **13.** Sample answer: addition and division;

Find the score that when added to the others, the total sum divided by the number of scores, 5, is equal to 82. The answer is 79.

Pages 535–538 Lesson 10-6

1. rectangle **3.** parallelogram **5.** 120° **7.** 64° **9.** square **11.** quadrilateral **13.** trapezoid **15.** 56° **17.** 67° **19.** 90° **21.** 116° **23.** Bricks A, B, and D are rectangles and brick C is a square. 25. 129.1° 27. 131.8° 29. trapezoids, squares, scalene triangles, equilateral triangles **31.** right isosceles triangles, squares, trapezoids **33.** No; a quadrilateral with three right angles will have both pairs of opposite sides parallel. So, it cannot be a trapezoid. **35**. 45 **37**. 80 **39.** Property B states that there are 4 right angles; Sample answer: A rectangle has 4 right angles in addition to property A. So, property B must state that there are 4 right angles. **41.** Never; Sample answer: A trapezoid has only one pair of parallel sides. A parallelogram has 2 pairs of parallel sides. **43.** Sometimes; Sample answer; A rhombus is only a square if all 4 angles are right angles. 45. Since a square has all the properties of a rectangle and a rhombus, the diagonals of a square must be congruent and perpendicular. Nothing can be concluded about

the diagonals of a parallelogram unless more information is provided. If a quadrilateral is a parallelogram, it is not necessarily a rectangle or a rhombus. So, it would not necessarily have the properties of a rectangle or a rhombus. **47**. H **49**. Neva: hamster, Sophie: turtle, Seth: dog **51**. right, scalene **53**. 104° **55**. \$3.45 **57**. 3 **59**. 7

Pages 543–545 Lesson 10-7

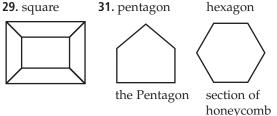
1. rectangle *PQRS* **3.** 45 mm **5.** triangle *CAB* **7.** 25 mi **9.** 7.2 in. **11.** 6 ft **13.** 12 m **15.** about 42 ft **17.** 120 m **19.** 1:16 **21.** B **23.** C **25.** trapezoid **27.** 69° **29.** 90 **31.** 120

Pages 549–551 Lesson 10-8

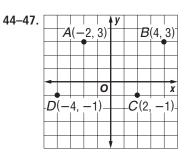
1. decagon; not regular **3.** hexagon; regular **5.** 128.6° **7.** not a polygon; the figure is not simple **9.** isosceles right triangle; not regular **11.** hexagon; not regular **13.** 144° **15.** 90° **17.** No; the figure is a decagon. Each angle of a decagon measures 144° ; since 144° does not divided evenly into 360° , a decagon cannot make a tessellation. **19.** hexagon and triangle **21.** octagon and square **23.** $36\frac{1}{4}$ yd **25.** No; the stop

sign is an octagon in shape. An octagon cannot make a tessellation. So, there will be some steel that is wasted after the nine signs are cut from the sheet.

27. trapezoid



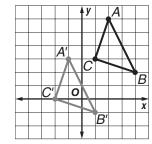
33. Sample answer; A copy of the parallelogram can fit next to it since $45^{\circ} + 135^{\circ} = 180^{\circ}$ and above or below it since $135^{\circ} + 45^{\circ} = 180^{\circ}$. **35.** G **37.** trapezoid **39.** 32 servings **41.** $3\frac{1}{6}$ **43.** $4\frac{37}{40}$



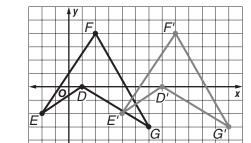


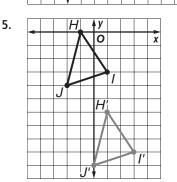
1.



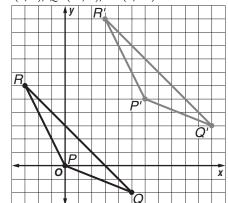


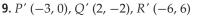
3. *D*′ (7, 0), *E*′ (4, -2), *F*′ (8, 4), *G*′ (12, -3)

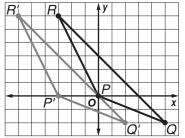




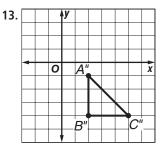
7. *P*′ (6, 5), *Q*′ (11, 3), *R*′ (3, 11)





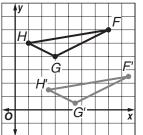


11. right 2, down 3; (2, −3)

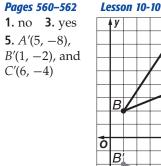


15. Sample answer: There are two main images, the brown horseman and the white horseman. Both main horsemen are translated to different parts of the picture. These translations allow for the tessellation of both horsemen.

17.
$$F'\left(8\frac{1}{2}, 2\frac{1}{2}\right), G'\left(4\frac{1}{2}, \frac{1}{2}\right), H'\left(2\frac{1}{2}, 1\frac{1}{2}\right)$$



19. 5 units left and 3 units down; (-5, -3) **21.** 5 units right and 4 units up; (5, 4) **23**. Transformation A is not a translation; the others are translations. **25**. B **27.** octagon **29.** $2 \times 4 \times 3$ or 24 dinners **31.** The range would be 62 instead of 55. **33.** The range would be 8 instead of 6. **35.** Sample answer: 0.567 **37.** Sample answer: 1.026 **39.** no **41.** yes

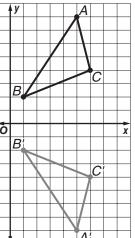


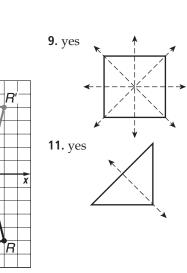
7. Q'(-2, -5),

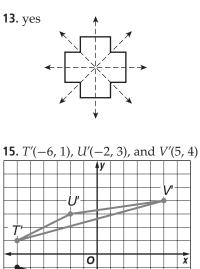
S

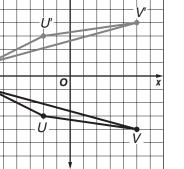
R'(-4, -5),and S'(-2, 3)

Q



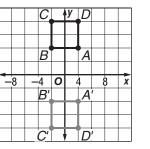


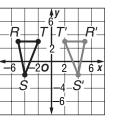




17. A'(2, -4), B'(-2, -4),C'(2, -8), D'(-2, -8)

19. *R*′(5, 3), *S*′(4, -2), T'(2, 3)





21. *H*′(1, 3), *I*′(1, -1), *J*′(-2, -2), and *K*′(-2, 2)

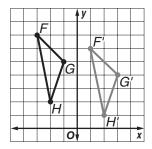
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			\geq	\leq			
	J^{*}					J	
			1				

23. Sample answer: One is vertically down the center of the picture. The other is horizontally with the reflection of the water. **25.** 1 **27.** figures *A* and *C* **29.** Sample answer; A reflection over the *y*-axis followed by a reflection over the *x*-axis.

31.		4	y A	<i></i>			
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				Λ_{-}			
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		0			\mathbf{N}		x
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33. *x*-axis **35.** *y*-axis **37.** *J*"(7, -4), *K*"(-7, -1), and *L*"(-2, 2) **39.** C **41.** *F*'(1, 6), *G*'(3, 4), *H*'(2, 1)

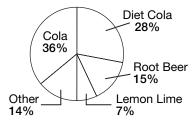


43. Sample answer: $\frac{1}{2} + 8 = 8\frac{1}{2}$ **45.** Sample answer: $12 \div 6 = 2$

Pages 563-566 Chapter 10 Study Guide and Review

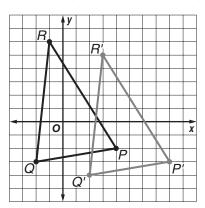
1. false; supplementary angles **3.** false; acute angle **5.** true **7.** \angle *FGH*, \angle *HGF*, \angle *G*, or \angle 1; obtuse **9.** Sample answer: \angle 1 and \angle 2; Since they share a common vertex, a common side, and do not overlap, they are adjacent angles. **11.** supplementary

13. Favorite Soft Drinks

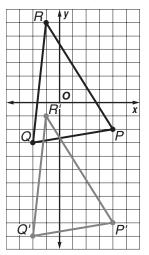


15. 47 17. Donnie, field hockey; Barbara, golf;
Milo, volleyball; Jenna, soccer 19. rhombus
21. trapezoid 23. 10.5 m 25. heptagon; not regular
27. 150°

29. *P*′(8, -3), *Q*′(2, -4), and *R*′(3, 5)



31. P'(4, -9), Q'(-2, -10), and R'(-1, -1)



33. *A*'(-1, 3), *B*'(-2, -1), *C*'(-5, -1), *D*'(-4, 3)

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D'		—	_	A			\mathcal{D}	
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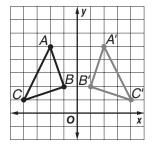
Chapter 11 Measurement: Two- and Three-Dimensional Figures

Page 569 Chapter 11 Getting Ready

1. 136 **3.** 1,248 **5.** 77 **7.** \$41.67 **9.** 121 **11.** 36 **13.** 12.6 **15.** 31.4 **17.** 254.3

Pages 572-574 Lesson 11-1

1. 135 cm² **3.** 17.5 in² **5.** 32 in² **7.** 60 cm² **9.** 0.2 cm² **11.** 49.5 yd² **13.** 190.625 m² **15.** 525 mm² **17.** 216 in² or 1.5 ft² **19.** 972 in² or 0.8 yd² **21.** 42,000 mi² **23.** 15 in. **25.** $16\frac{2}{3}$ ft² **27.** False; if the base and height are each doubled, then the area is $2b \cdot 2h = 4bh$, or 4 times greater. **29.** D **31.** A'(2, 5), B'(1, 2), C'(4, 1)



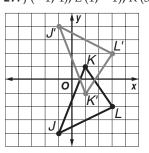
33. Sample answer: The sum of the measures of an octagon is $1,080^\circ$. Each angle measure is $1,080^\circ \div 8$ or 135° . Since 135 does not go into 360 evenly, an octagon does not tessellate the plane. **35.** 84 **37.** 19.5

Pages 578–580 Lesson 11-2

1. 6 in² **3.** 90.4 ft² **5.** 147 in² **7.** 4.5 cm² **9.** 183.7 in² **11.** about 95,000 mi² **13.** 125 ft **15.** Sample answer: 10 cm² **17.** Sample answer: 7 ft²



19. $6,500 \text{ ft}^2$ **21.** A = 2h **23.** The area of a triangle is half the area of a parallelogram with the same base and height, because two of these triangles make up the parallelogram. **25.** G **27.** J'(-1, 4), L'(1, -1), K'(3, 2)



29. 25% **31.** 156.3 **33.** 91.1 **35.** 72.3

Pages 584–586 Lesson 11-3

1. 31.4 ft **3.** 44 m **5.** 67.2 cm **7.** 50.2 ft **9.** 22.6 cm **11.** 66 ft **13.** 33 in. **15.** 33.9 km **17.** $38\frac{1}{2}$ mi **19.** $28\frac{2}{7}$ in. **21.** 94.2 ft **23.** 11.0 in. **29.** 8.0 ft **31.** 4.8 yd **33.** Sample answer: Using the circumference formula, you find that the unicycle travels 3.14 \cdot 10 \cdot 2 or 62.8 inches on one revolution.

So, in 5 revolutions, it will travel 62.8 • 5 or 314 inches. To change into feet, divide 314 by 12. So, the unicycle will travel $26\frac{1}{6}$ feet in 5 revolutions. **37**. Mya; Aidan incorrectly applied the formula that uses the diameter. **39**. Both will be doubled. If the value of *x* is doubled, the diameter will be 2x instead of *x*. The circumference will increase from $2\pi x$ to $2\pi(2x)$ to $4\pi x$. **41**. C **43**. B

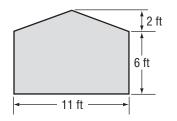
45. 3.7 ft² **47.** $\frac{15}{27}$ or $\frac{5}{9}$ **49.** 153.9 **51.** 63.6

Pages 591–593 Lesson 11-4

1. 78.5 cm² **3.** 201 m² **5.** B **7.** 28.3 in² **9.** 226.9 cm² **11.** 32.2 mm² **13.** 124.6 cm² **15.** 44.2 ft² **17.** 338.0 yd² **19.** 2,826 ft² **21.** Sample answer: $3 \cdot 6^2 = 108$ ft² **23.** 32; 60 **25.** about 50.3 cm² **27.** 29.0 m² **29.** $\pi \cdot 71^2 \approx 15,828.7$ ft² and 15,828.7 $\cdot 0.1$ = 1,582.9 yd² **31.** 62.8 m² **33.** 103.5 cm² **35.** Sample answer: If the radius of a circular garden is 6 feet, how much room is there for gardening? about 113.1 ft² **37.** J **39.** 50.2 yd **41.** 120 in² **43.** 100.1 m² **45.** 113.04 **47.** 150.5

Pages 594–595 Lesson 11-5

Sample answer: Finding the areas of the separate geometric figures and then adding is easier than trying to find the area of the irregular figure as a whole.
 Sample answer: Find the area of the wall below to determine how much paint to buy. To solve, find the area of the triangle and the area of the rectangle, then add. The answer is 77 ft².



5. Sample answer: $0.44 \times 3,000,000$ or 1,320,000 phone lines have 888 area code; $0.24 \times 3,000,000$ or 720,000 phone lines have 777 area code; $0.32 \times 3,000,000$ or 960,000 phones lines have 555 area code. **7.** A **9.** Sample answer: $\frac{1}{3} \times 360,000$ or 120,000 people **11.** multiplication flowed by division; $150 \times 108 = 16,200$; $16,200 \div 10 = 1,620$; 1,620 h

Pages 597–599 Lesson 11-6

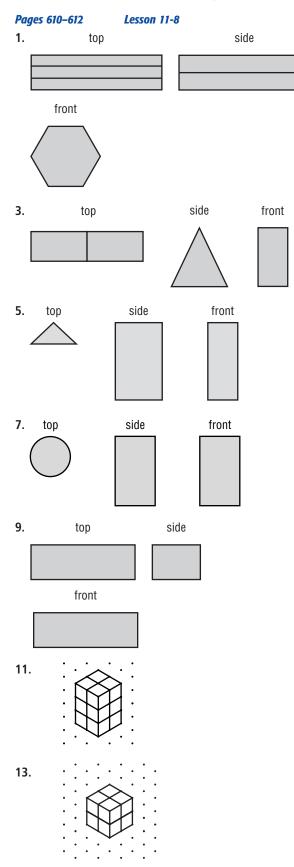
1. 112 m² **3.** 145 m² **5.** 195 ft² **7.** 58.6 in² **9.** 257 mm² **11.** 66.2 yd² **13.** approximately 847.2 ft² **15.** 196.1 in² **17.** $x^2 + \frac{1}{2}(6x)$ or $x^2 + 3x$ **19.** 467.4 ÷ 350 ≈ 1.34; Since only whole gallons of paint can be purchased, you will need 2 gallons of paint. At \$20 each, the cost will be 2 • \$20 or \$40. **21.** Sample answer: Add the areas of a trapezoid and a triangle. Area of a trapezoid: $\left[\frac{1}{2} \times 2.5 (7 + 10)\right] = 21.25$; Area of a triangle: $\frac{1}{2} \times 6 \times 2 = 6$; 21.25 + 6 = 27.25. So, an approximate area is 27.25 × 1,900 or 51,775 mi². **23.** B **25.** Sample answer: about 30% of \$500 or \$150 **27.** 452.4 in²

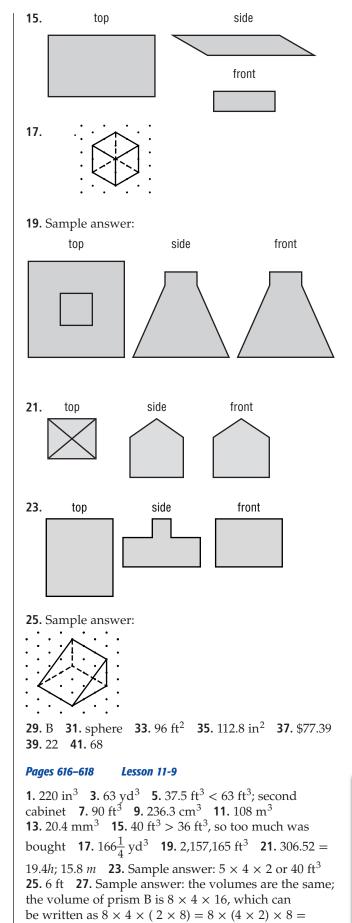


Pages 605–606 Lesson 11-7

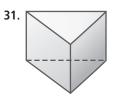
square; square pyramid
 circle; cylinder
 triangle; triangular pyramid
 rectangular pyramid
 cone
 trapezoid;
 trapezoidal prism
 octagon; octagonal prism
 triangular prism and rectangular prism
 rectangular prism
 Sample answer: A cone

has only one base that is a circle. A pyramid also has only one base, but its base is a polygon. They both have only one vertex. A cone does not have any lateral faces and a pyramid has at least three lateral faces. **21.** F **23.** 102.1 m² **25.** 53° **27.** square **29.** circle





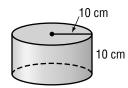
8 × 8 × 8. **29.** 4032



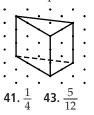
33. rectangle; rectangular prism **35.** 50 mph **37.** Sample answer: $5 \cdot 3^2$ or 45 **39.** Sample answer: $3 \cdot 2^2 \cdot 2$ or 24

Pages 620–623 Lesson 11-10

1. 141.3 in³ **3.** 617.4 ft³ **5.** about 602.9 cm³ **7.** 4,071.5 ft³ **9.** 2,769.5 yd³ **11.** 35.6 m³ **13.** 103.3 m³ **15.** 288.5 in³ **17.** 163.3 m³ **19.** 124,579.5 m³ **21.** d. **23.** a. **25.** 1,413 in³ **27.** 9 cm **29.** about 40.7 ft **31.** Sample answer:

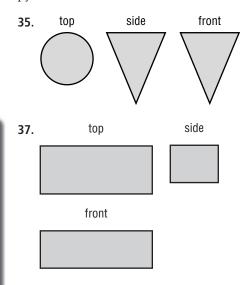


33. 1 to 4 **35.** D **37.** 152.9 m³ **39.** Sample answer:



Pages 626–630 Chapter 11 Study Guide and Review

1. rectangular prism **3.** trapezoid **5.** cylinder **7.** circle **9.** 2,520 in² **11.** 36 ft² **13.** 527.3 yd² **15.** 75.4 in. **17.** $26\frac{2}{5}$ ft **19.** $29\frac{6}{7}$ ft **21.** 1,519.8 cm² **23.** 800 cakes **25.** \$105 **27.** 67.8 yd² **29.** triangle; triangular prism **31.** cylinder **33.** rectangular pyramid

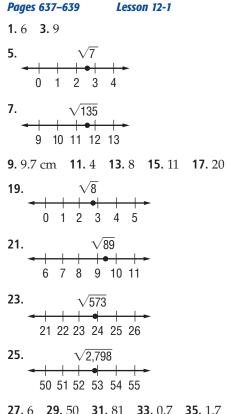


39. 639.6 in³ **41.** 1,330 ft³ **43.** 4,040.3 mm³ **45.** 942 in.³

Chapter 12 Looking Ahead to Grade 7: Geometry and Measurement

Page 635 Chapter 12 Getting Ready

1. 16 **3.** 169 **5.** 89 **7.** 225 **9.** 130 yr **11.** 226 **13.** 42.1 **15.** 527.8



27. 6 **29.** 50 **31.** 81 **33.** 0.7 **35.** 1.7 **37.** 3.8 **39.** 3.17 cm **43.** Sample answer: 17, 18, 19 **45.** 2 **47.** 5 **49.** It cannot be written as a fraction. **51.** G **53.** 28.3 in³ **55.** acute **57.** obtuse **59.** 74 **61.** 16

Pages 643–644 Lesson 12-2

1. 26 mm **3.** 18.5 cm **5.** 4.0 ft **7.** 16.1 m **9.** 14.1 m **11.** 5.4 ft **13.** 2.8 yd **15.** 25 in. **17.** 5.6 mi **19.** 72.1 in. **21.** Sample answer: The mirror will not fit horizontally or vertically. However, the diagonal of the doorway measures about 7.2 feet. So, the mirror will fit through the doorway if you tilt it diagonally. **23.** about 10.4 in. **27.** G **29.** 1,413 in³ **31.** 0.08 **33.** 2.65

Pages 646–647 Lesson 12-3

1. Sample answer: A three-dimensional object allows you to physically change the object. This makes it easier to make the pattern and then solve the problem. **2.** 11 25 in hu 0 in **5.** 47 in **7.** $(1 \text{ min } 0.160^7 \text{ tr}^2)$

3. 11.25 in. by 9 in. **5.** 47 in. **7.** $6\frac{1}{4}$ min **9.** $160\frac{7}{8}$ ft²

Selected Answers

11. Take the square root followed by addition followed by subtraction; 586 ft

Pages 651–653 Lesson 12-4

1. 108 ft² **3.** No; The surface area of the toy box is 48 ft². To paint it twice would require enough paint for 48 × 2 or 96 ft². Since 87 ft² < 96 ft², he does not have enough paint. **5.** 314 cm² **7.** 833.1 mm² **9.** 125.4 in² or $124\frac{3}{8}$ in² **11.** 234 in² **13.** 243.8 ft² **15.** 64.5 in² **17.** $s = 6x^2$ **19.** Sample answer: Not all sides of the rectangular prism will be painted. The top will not be painted. The number of square feet to be painted is (18)(12) + 2(18)(6) + 2(12)(6). **21.** Surface area measures the area of the faces, and area is measured in square units. **23.** G **25.** 12.4 ft **27.** 803.8 ft² **29.** 145.2 yd²

Pages 657–659 Lesson 12-5

1. 87.9 mm² **3.** about 471 m² **5.** $1,215.2 \text{ m}^2$ **7.** 271.8 mm² **9.** $1,119.4 \text{ in}^2 \text{ or } 1,119\frac{2}{5} \text{ in}^2$ **11.** 61.2 cm² **13.** Sample answer: $2 \cdot 3 \cdot 4^2 + 2 \cdot 3 \cdot 4 \cdot 4$ or 192 m² **15.** 204.9 in² **17.** No; the surface area of the side of the cylinder will double, but the area of the bases will not. **19.** A cylinder with radius 6 cm and height 3 cm has a greater surface area than a cylinder with height 6 cm and radius 3 cm; Sample answer: The first cylinder has a surface area of 169.6 cm². **21.** G **23.** 112 cm² **25.** 12.8 in. **27.** 7.2 cm

Pages 660–662 Chapter 12 Study Guide and Review

false; right triangle
 true
 true
 false; right triangle
 false; cylinder
 false; cylind

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