Start Smart

Let's Review!

The Desert Tortoise
California State Reptile

START 1 SMART

Problem Solving

Into the Depths
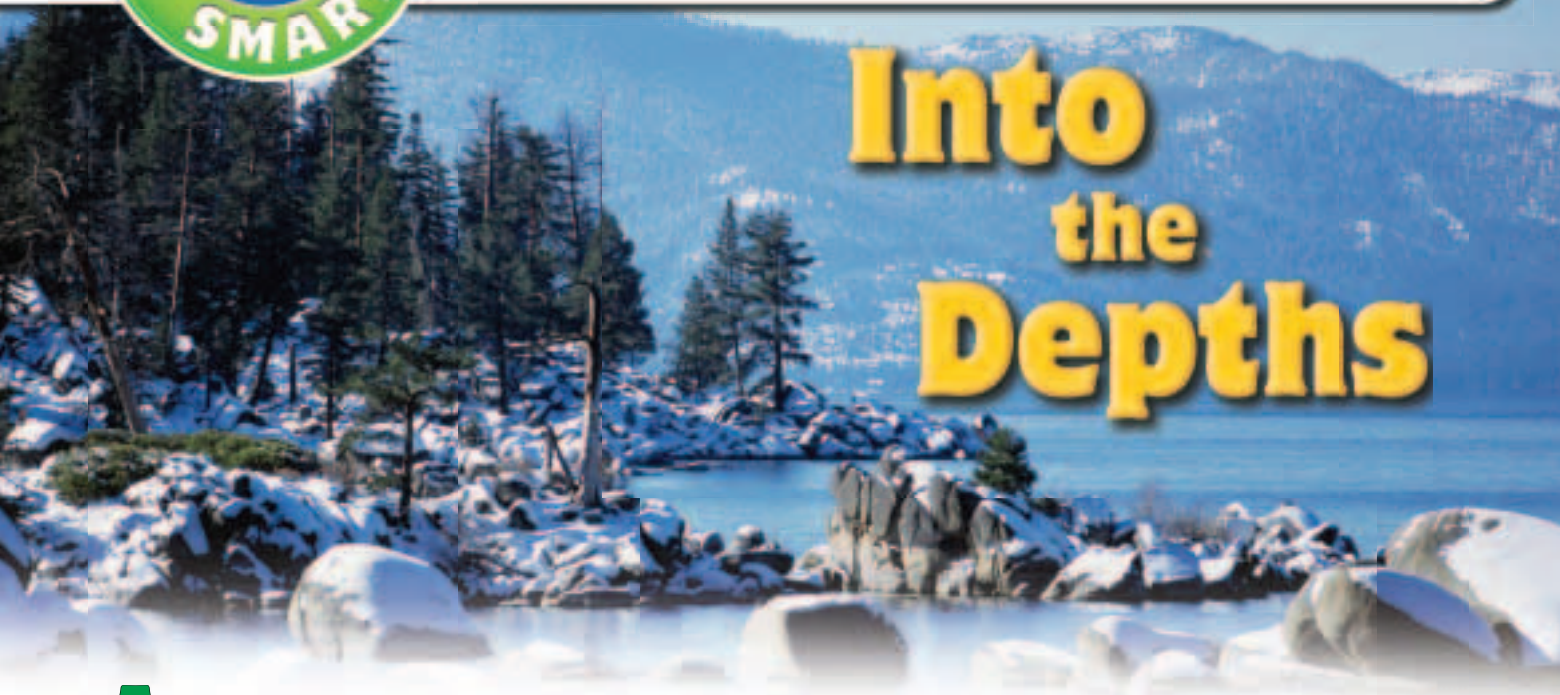
Lake Tahoe

Two of the most popular tourist spots in California are Big Bear Lake and Lake Tahoe. Lake Tahoe is the second deepest lake in the United States, at a maximum depth of 1,645 feet, while Big Bear Lake has a maximum depth of 72 feet.

About how much deeper is Lake Tahoe than Big Bear Lake?

You can use the four-step problem-solving plan to solve many kinds of problems. The four steps are Understand, Plan, Solve, and Check.

Understand

- **Read the problem carefully.**
- **What facts do you know?**
- **What do you need to find?**

The maximum depth of Lake Tahoe is 1,645 feet, and the maximum depth of Big Bear Lake is 72 feet. You need to find *about* how much deeper Lake Tahoe is than Big Bear Lake.

Plan

- **How do the facts relate to each other?**
- **Plan a strategy to solve the problem.**

Lake Tahoe has a maximum depth of 1,645 feet, and Big Bear Lake has a maximum depth of 72 feet. To estimate the difference between the two depths, round each number to the nearest hundred.

Solve

- **Use your plan to solve the problem.**

$$
\begin{array}{r}
1,645 \\
-\ 72
\end{array}
\rightarrow
\begin{array}{r}
1,600 \\
-\ 100 \\
\hline
1,500
\end{array}
$$
Depth of Lake Tahoe
Depth of Big Bear Lake

So, Lake Tahoe is about 1,500 feet deeper than Big Bear Lake.

Did you Know?

The sun shines 75% of the year at Lake Tahoe. That's about 274 days.

Check

- **Look back at the problem.**
- **Does your answer make sense?**

Check by adding. Since $1,500 + 100 = 1,600$, the answer makes sense.

CHECK What You Know

1. List the steps of the four-step problem-solving plan.

2. **WRITING IN MATH** The table shows the lengths of different bridges in California. Explain how to use the four-step plan to find about how many times greater the length of the Golden Gate Bridge is than the length of the San Francisco-Oakland Bay Bridge.

Bridges in California	
Bridge	**Length (feet)**
Antioch	9,504
Colorado Street	1,486
Golden Gate	4,200
San Francisco-Oakland Bay	2,310

START 2 SMART

Number Sense

High Flying Fun

Disney's California Adventure

California is home to many of the world's top theme parks. The table shows the approximate attendance of California's top four theme parks in a recent year.

Theme Park	Attendance
Disneyland	14,500,000
Disney's California Adventure	5,800,000
Knott's Berry Farm	3,600,000
Universal Studios Hollywood	4,700,000

Source: coastergrotto.com

CHECK What You Know

Adding and Subtracting Whole Numbers

Did you Know?

Disneyland in Anaheim opened in 1955 and is credited with being the very first theme park in the United States.

When adding and subtracting whole numbers, always remember to add the digits in the same place-value position.

Use the table on page 4 to answer each question. First list the operation needed to solve the problem, then solve.

1. How many total people visited Knott's Berry Farm and Disney's California Adventure?

2. How many more people visited Disneyland than Universal Studios Hollywood?

3. Find the difference in the attendance between the park with the greatest attendance and the one with the least attendance.

4. Disneyland had the greatest attendance of all the theme parks listed. If the attendance for the other parks is combined, will their total attendance be greater than Disneyland's? Explain.

5. **WRITING IN MATH** California is the leading producer of dairy products in the United States. The table shows the amount of certain dairy products produced, in tons, in California in a recent year. Use the information to write a real-world addition or subtraction problem about California dairy production.

California Dairy Production	
Product	**Tons Produced**
Butter	203,933
Cheddar Cheese	261,312
Cottage Cheese	49,936
Monterey Jack Cheese	166,040
Yogurt	255,993

Source: cdfa.ca.gov

START 3 SMART

Algebra and Functions

In a Nutshell

Pistachios have been grown in Europe, Asia, and the Middle East for centuries. However, they have only been a commercial crop in California since 1976. Approximately 98% of the pistachios grown in the United States are from California.

CHECK What You Know · Functions

A function is a relationship that assigns exactly one output to one input value. You can organize the input-output values in a function table.

The table shows the grams of protein per one ounce serving of pistachios.

1. Use the rule to find the amount of protein in four servings of pistachios.

2. Use the rule to find the amount of protein in five servings of pistachios.

3. Describe the pattern in the output column.

Rule: Multiply by 6.	
Input (Servings)	Output (Grams of Protein)
1	6
2	12
3	18
4	■
5	■

Blaine Harrington III/CORBIS

Did you Know?

California's population increases by 2% every year. This is nearly double the national average.

Fueled by longer life expectancies and strong birthrates, the United States reached a population of 300 million in October of 2006.

4. In the United States, there is 1 birth every 7 seconds. The function table shows the rule for finding the number of births every 7, 14, 21, and 28 seconds. Complete the function table.

Rule: Divide by 7	
Input (Seconds)	Output (Births)
7	1
14	■
21	■
28	■

5. Use the function rule to find how many births occur in 70 seconds.

CHECK What You Know **Algebra** •••••••••••••••••••••••••••••••••

Algebra is a mathematical language that uses symbols. Examples of symbols are letters and boxes. The symbols stand for numbers that are unknown.

6. **WRITING IN MATH** Write a real-world problem in which you would use the function rule $y = 20x$.

Replace each ■ with a number to make a true sentence.

7. $(7 - 3) \times 5 = 4 \times ■$

8. $8 + (10 \times 2) = ■ + 20$

9. $12 \div (9 - 7) = 12 \div ■$

10. $(11 + 6) \times 3 = 17 \times ■$

11. $(16 - 8) \times 14 = ■ \times 14$

12. $(24 \div 6) + 1 = ■ + 1$

Measurement

A Full Basket

The state of California has six professional basketball teams. Four of the teams—the Los Angeles Lakers, Sacramento Kings, Golden State Warriors, and Los Angeles Clippers—are men's teams. Two teams—the Los Angeles Sparks and the Sacramento Monarchs—are women's teams.

CHECK What You Know Area

The area of a figure refers to the number of square units needed to cover the figure. The area of a rectangle or square is found by multiplying its length by its width.

1. Find the area of the rectangle shown. Then draw two other rectangles that have the same area.

2. A regulation professional basketball court is rectangular in shape and measures 94 feet long and 50 feet wide. What is the area of a regulation professional basketball court?

3. The backboard, the board behind the net, usually measures 6 feet long by 4 feet wide. What is the area of the backboard?

Noah Graham/NBAE via Getty Images
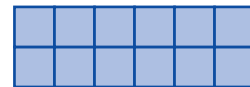
CHECK What You Know — Perimeter

Did you Know?

The Golden State Warriors and the Los Angeles Lakers (formerly the Minneapolis Lakers) were two of the original eight teams in the NBA.

Perimeter is the distance around a figure. To find the perimeter of a rectangle or square, find the sum of the measures of the sides.

10 in.

4 in.   4 in.

10 in.
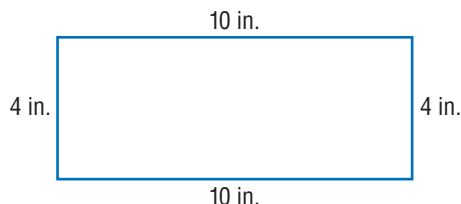
Perimeter $= 10 + 4 + 10 + 4$
$= 28$ inches

4. Refer to the rectangle above. Draw two other rectangles or squares that have the same perimeter.

5. Using the information from Exercise 2, what is the perimeter of a regulation professional basketball court?

6. Using the information from Exercise 3, what is the perimeter of a backboard?

7. Mr. Thorne's garden is shown. The width is 5 yards less than the length. Mr. Thorne extends the length of the garden by 2 yards. What is the total distance around the new garden?

12 yd
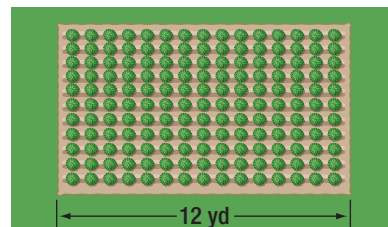
8. WRITING IN MATH Do all rectangles with the same area have the same perimeter? Explain your reasoning.

START 5 SMART

Geometry

A Capitol Idea

The California State Capitol Building in Sacramento is where the state government does its work. It was designed in 1856 by Reuben Clark, and construction was completed on the building in 1874.

CHECK What You Know   Triangles and Quadrilaterals · · · · · · ·

Triangles or quadrilaterals such as squares and rectangles are commonly used in buildings.
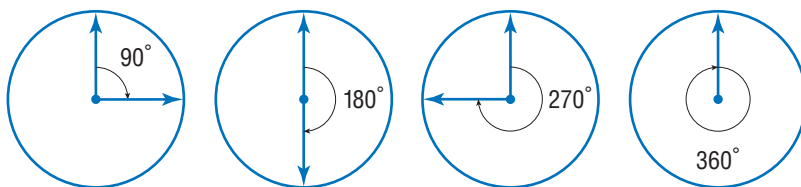
Use the photo of the Capitol Building to solve each problem.

1. Can you see any shapes that appear to be triangles? Describe the triangles that you see.

2. Can you see any shapes that appear to be quadrilaterals? What type of quadrilaterals do they appear to be?

Bruce Burkhardt/CORBIS

✓ CHECK What You Know   **Angles** ·

Different angles can also be found in buildings. Remember that 90°, 180°, 270°, and 360° are associated, respectively, with $\frac{1}{4}$ turn, $\frac{1}{2}$ turn, $\frac{3}{4}$ turn, and 1 full turn on a circle.

90°   180°   270°   360°

Use the photo of the Capitol Building to solve each problem.

3. Describe any angles that appear to be less than 90°.

4. Describe any angles that appear to be exactly 90°.

5. Describe any angles that appear to be greater than 90°.

Did you Know?

The capital of California has not always been Sacramento. The first state capital was in San Jose, followed by Vallejo, Benicia, and finally Sacramento in 1854.

✓ CHECK What You Know   **Parallel and Perpendicular Lines** · · ·

Parallel and perpendicular lines can also be found in buildings. Remember that parallel lines are lines that are the same distance apart and never intersect, and perpendicular lines are lines that intersect to form right angles.

Use the photo of the Capitol Building to solve each problem.

6. Describe any lines that appear to be parallel.

7. Describe any lines that appear to be perpendicular.

8. **WRITING IN ▸MATH** Use the photo of the Transamerica Building in San Francisco to describe any shapes, angles, and types of lines that appear to be in the building.

Start Smart 11

START SMART 6

Statistics, Data Analysis, and Probability

A Real Hot Spot

Death Valley National Park is located on the eastern border of south-central California and includes a small area of Nevada. The winters in Death Valley are mild, but summers are extremely hot and dry. It is one of the hottest places on Earth.

CHECK What You Know Line Graphs

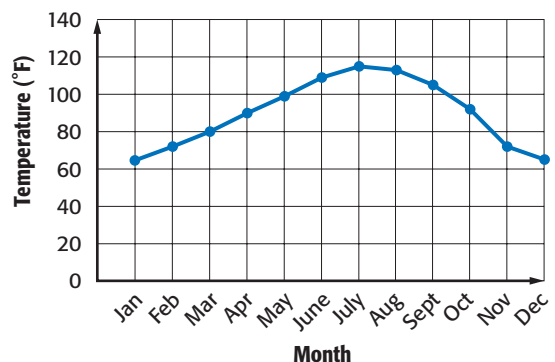A line graph shows how a set of data changes over a period of time. The line graph at the right shows the average high temperatures in Death Valley, California.

1. What month has the highest average high temperature?

2. During which months are the average high temperatures less than 80°F?

Average High Temperatures in Death Valley

Source: desertusa.com

✔ CHECK **What You Know**　**Interpret Line Graphs** ·············

Did you Know?

Death Valley set the record for the highest temperature ever recorded in the U.S., at 134°F on July 10, 1913.

Line graphs are often used to predict future events because they show trends over time. The line graph below shows the average rainfall for Death Valley.

Average Rainfall in Death Valley

Rainfall (inches) vs Month

0.33, 0.24, 0.24, 0.12, 0.07, 0.03, 0.11, 0.12, 0.11, 0.09, 0.19
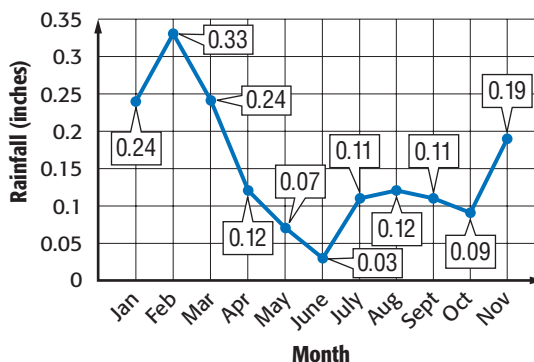
Source: desertusa.com

3. Which month has the least amount of average rainfall?

4. Is a prediction of 0.2 inch of rainfall for next March reasonable? Explain.

5. Describe the trend in average rainfall from February to June.

6. Collect the low temperatures for one week in another California national park. Then make a line graph to show the results.

7. WRITING IN ►MATH Based on your graph in Exercise 6, make a prediction of what you think the low temperature might be at a future date. Explain your reasoning.

Yosemite National Park
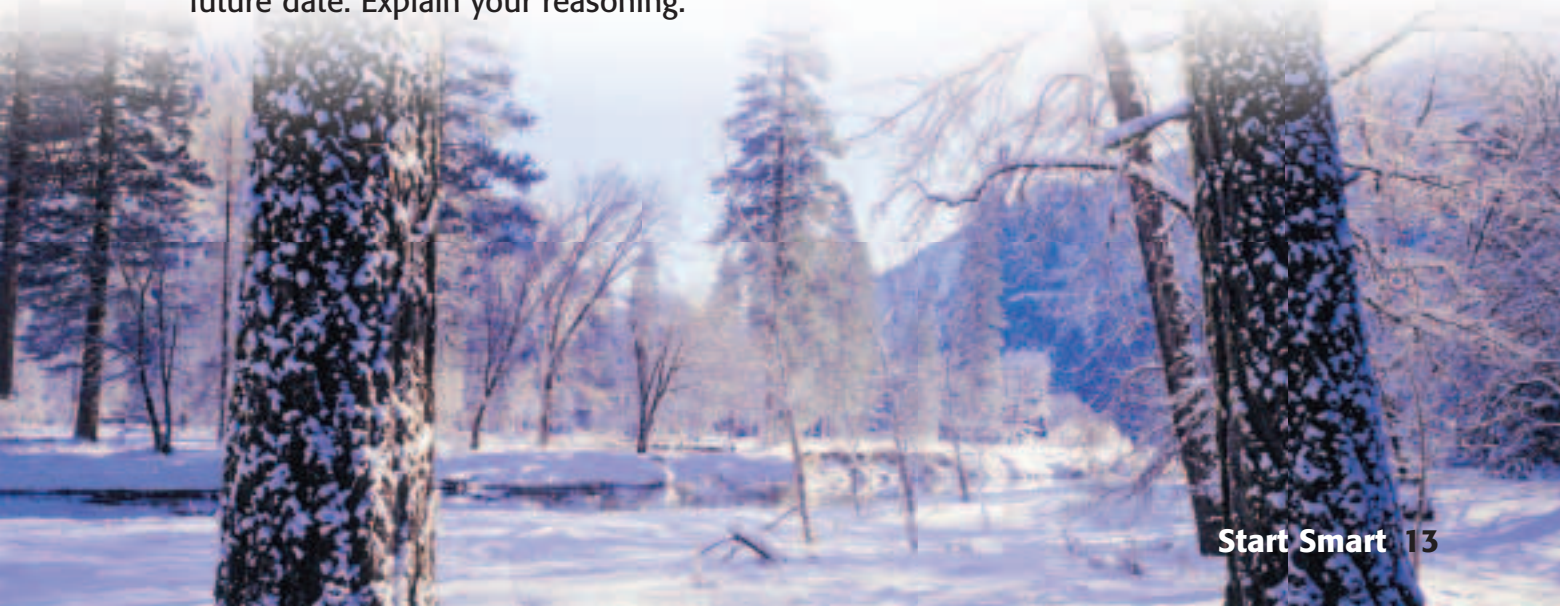
CHAPTER 1

Number Sense, Algebra, and Functions

BIG Idea — What are equations?

An **equation** is a sentence that contains an equals sign.

Example The Los Angeles Memorial Coliseum, home of the University of Southern California Trojans, has a seating capacity of 92,000. Often, there is a cover on many of the seats. You can use the equation $x + 24{,}000 = 92{,}000$ to find x, the number of seats available when the cover is used.

What will I learn in this chapter?

- Find the prime factorization of a composite number.
- Use powers and exponents in expressions.
- Complete function tables and find function rules.
- Use the Distributive Property in equations and expressions.
- Solve problems using the *guess and check* strategy.

Key Vocabulary

variable

evaluate

function

equation

area

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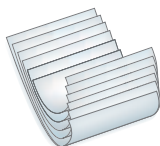
Make this Foldable to help you organize information about this chapter. Begin with six sheets of notebook paper.

1 Stack the pages, placing the sheets of paper $\frac{3}{4}$ inch apart.

2 Roll up bottom edges. All tabs should be the same size.

3 Crease and staple along the fold.

4 Label the tabs with the topics from the chapter.
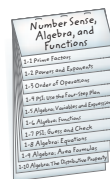
ARE YOU READY for Chapter 1?

You have two ways to check prerequisite skills for this chapter.

Option 1

Complete the Quick Check below.

QUICK Check

Add. (Prior Grade)

1. $83 + 129$ **2.** $99 + 56$ **3.** $67 + 42$

4. $79 + 88$ **5.** $78 + 97$ **6.** $86 + 66$

Subtract. (Prior Grade)

7. $43 - 7$ **8.** $75 - 27$ **9.** $128 - 34$

10. $150 - 68$ **11.** $102 - 76$ **12.** $235 - 126$

13. Ariana bought three shirts for a total of $89. If one shirt costs $24 and another costs $31, how much did the third shirt cost? **(Prior Grade)**

Multiply. (Prior Grade)

14. 25×12 **15.** 18×30 **16.** 42×15

17. 27×34 **18.** 50×16 **19.** 47×22

Divide. (Prior Grade)

20. $72 \div 9$ **21.** $84 \div 6$ **22.** $126 \div 3$

23. $146 \div 2$ **24.** $208 \div 4$ **25.** $504 \div 8$

26. Thirty-two students were placed into groups of four. How many groups were there? **(Prior Grade)**

Prime Factors

MAIN IDEA

I will find the prime factorization of a composite number.

Standard

5NS1.4 Determine the prime factors of all numbers through 50 and write the numbers as the product of their prime factors by using exponents to show multiples of a factor (e.g., $24 = 2 \times 2 \times 2 \times 3 = 2^3 \times 3$).

New Vocabulary

factor
prime number
composite number
prime factorization

GET READY to Learn

Hands-On Mini Lab

The table shows the different rectangles that can be made using 2, 3, 4, 5, or 6 squares.

Step 1 Copy the table.

Number of Squares	Sketch of Rectangle Formed	Dimensions of Each Rectangle
2		1×2
3		1×3
4		$1 \times 4, 2 \times 2$
5		1×5
6		$1 \times 6, 2 \times 3$
⋮		
20		

Step 2 Use square tiles to help you complete the table.

1. For what numbers can more than one rectangle be formed?

2. For what numbers can only one rectangle be formed?

3. For the numbers in which only one rectangle is formed, what do you notice about the dimensions of the rectangle?

When two or more numbers are multiplied, each number is called a **factor** of the product.

$$1 \times 7 = 7 \qquad 1 \times 6 = 6 \text{ and } 2 \times 3 = 6$$

The factors of 7 are 1 and 7.

The factors of 6 are 1 and 6, and 2 and 3.

A whole number that has exactly two unique factors, 1 and the number itself, is a **prime number**. A number greater than 1 with more than two factors is a **composite number**.

Tell whether each number is *prime*, *composite*, or *neither*.

1 28

Factors of 28: 1, 2, 4, 7, 14, 28
Since 28 has more than two factors, it is a composite number.

2 11

Factors of 11: 1, 11
Since there are exactly two factors, 11 is a prime number.

Every composite number can be expressed as a product of prime numbers. This is called a **prime factorization** of the number. A *factor tree* can be used to find the prime factorization of a number.

EXAMPLE **Find Prime Factorization**

3 Find the prime factorization of 54.

54 ← Write the number that is being factored at the top. → 54

2 × 27 ← Choose any pair of whole number factors of 54. → 3 × 18

2 × 3 × 9 ← Continue to factor any number that is not prime. → 3 × 2 × 9

2 × 3 × 3 × 3 ← Except for the order, the prime factors are the same. → 3 × 2 × 3 × 3
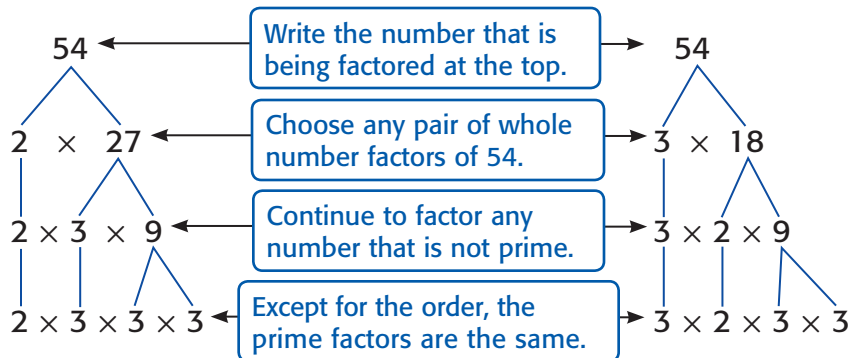
Remember

When writing the prime factorization, it is customary to write the prime factors in ascending order, that is, from least to greatest.

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KEY CONCEPT   Prime and Composite

Number	Definition	Examples
prime	A whole number that has exactly two factors, 1 and the number itself.	11, 13, 23
composite	A number greater than 1 with more than two factors.	6, 10, 18
neither prime nor composite	1 has only one factor. 0 has an infinite number of factors.	0, 1

Reading Math

Infinite *Infinite* means *endless*.

Math Online Extra Examples at ca.gr5math.com

Tell whether each number is *prime*, *composite*, or *neither*.
See Examples 1, 2 (p. 18)

1. 10 **2.** 3 **3.** 1 **4.** 61

Find the prime factorization of each number. See Example 3 (p. 18)

5. 36 **6.** 81 **7.** 65 **8.** 19

9. The state of South Carolina has 46 counties. Write 46 as a product of primes.

SOUTH CAROLINA

10. Talk About It What are the factors of 12?

Practice and Problem Solving

Tell whether each number is *prime*, *composite*, or *neither*.
See Examples 1, 2 (p. 18)

11. 17 **12.** 0 **13.** 15 **14.** 44

15. 23 **16.** 57 **17.** 45 **18.** 29

19. 56 **20.** 93 **21.** 53 **22.** 31

Find the prime factorization of each number. See Example 3 (p. 18)

23. 24 **24.** 18 **25.** 40 **26.** 75

27. 27 **28.** 32 **29.** 49 **30.** 25

31. 42 **32.** 104 **33.** 55 **34.** 77

Real-World PROBLEM SOLVING

Science The cheetah is the fastest land animal.

35. Which speed(s) have a prime factorization of exactly three factors?

36. Which speed(s) have a prime factorization whose factors are all equal?

37. Of the cheetah, antelope, lion, coyote, and hyena, which have speeds that are prime numbers?

Animal	Speed (mph)	Animal	Speed (mph)
cheetah	70	rabbit	35
antelope	60	giraffe	32
lion	50	grizzly bear	30
coyote	43	elephant	25
hyena	40	squirrel	12

Source: *The World Almanac for Kids*
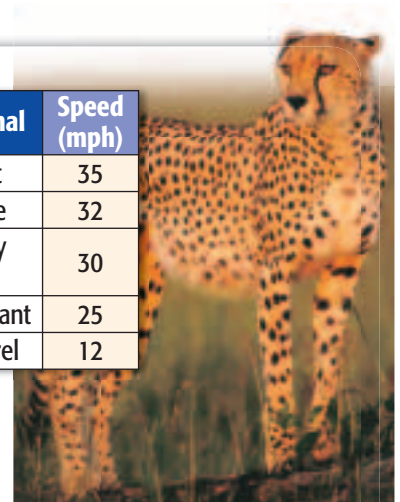
38. All odd numbers greater than or equal to 7 can be expressed as the sum of three prime numbers. Which three prime numbers have a sum of 59? Justify your answer.

39. Amanda bought bags of snacks that each cost exactly the same price. She spent a total of $30. Find three possible costs per bag and the number of bags that she could have purchased.

H.O.T. Problems

**40. OPEN ENDED** Select two prime numbers that are greater than 50 but less than 100.

41. NUMBER SENSE *Twin primes* are two prime numbers that are consecutive odd integers such as 3 and 5, 5 and 7, and 11 and 13. Find all of the twin primes that are less than 100.

42. CHALLENGE A *counterexample* is an example that shows a statement is not true. Find a counterexample for the statement below. Explain your reasoning.

All even numbers are composite numbers.

43. WRITING IN ►MATH How would you decide if a number is prime or composite? Explain by using an example.

Standards Practice

44 Which number is *not* prime?

A 7

B 31

C 39

D 47

45 Find the prime factorization of 140.

F 2 × 2 × 2 × 5 × 7

G 2 × 3 × 5 × 7

H 2 × 2 × 5 × 7

J 3 × 5 × 7

46 The volume of a rectangular prism can be found by multiplying the length, width, and height of the prism. Which of the following could be the possible dimensions of the rectangular prism below?
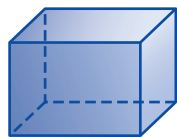
Volume = 75 ft³

A 2 ft × 6 ft × 6 ft

B 3 ft × 5 ft × 7 ft

C 5 ft × 5 ft × 7 ft

D 3 ft × 5 ft × 5 ft

Powers and Exponents

GET READY to Learn

Hands-On Mini Lab

Any number can be written as a product of prime factors.

Step 1 Fold a piece of paper in half and make one hole punch. Count the number of holes and record the results.

Number of Folds	Number of Holes	Prime Factorization
1 ⋮ 5		

Step 2 Find the prime factorization of the number of holes and record the results in the table.

Step 3 Fold another piece of paper in half twice. Then make one hole punch. Complete the table for two folds.

Step 4 Complete the table for three, four, and five folds.

1. What prime factors did you record?

2. How does the number of folds relate to the number of factors in the prime factorization of the number of holes?

3. Write the prime factorization of the number of holes made if you folded it eight times.

MAIN IDEA

I will use powers and exponents in expressions.

Standard 5NS1.3 Understand and compute positive integer powers of nonnegative integers; compute examples as repeated multiplication.
Standard 5NS1.4 Determine the prime factors of all numbers through 50 and write the numbers as the product of their prime factors by using exponents to show multiples of a factor.

New Vocabulary

base
exponent
power
squared
cubed

Repeated multiplication of identical factors can be written using an exponent and a base. The **base** is the number used as a factor. The **exponent** indicates how many times the base is used as a factor.

$$32 = \underbrace{2 \times 2 \times 2 \times 2 \times 2}_{5 \text{ factors}} = 2^5 \leftarrow \text{exponent}$$

base

When no exponent is given, it is understood to be 1. For example, $5 = 5^1$.

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

Powers	Words
2^5	2 to the fifth power
3^2	3 to the second power or 3 **squared**
10^3	10 to the third power or 10 **cubed**

EXAMPLES — Write Powers and Products

1 **Write $3 \times 3 \times 3 \times 3$ using an exponent.**

The base is 3. Since 3 is used as a factor four times, the exponent is 4.

$3 \times 3 \times 3 \times 3 = 3^4$ — Write as a power.

2 **Write 4^5 as a product of the same factor. Then find the value.**

The base is 4. The exponent is 5. So, 4 is used as a factor five times.

$4^5 = 4 \times 4 \times 4 \times 4 \times 4$ — Write 4^5 using repeated multiplication.

$= 1{,}024$ — Multiply.

Remember

4^5 does not mean 4×5.

Real-World EXAMPLES

3 **The approximate daytime surface temperature on the Moon can be written as 2^8 degrees Fahrenheit. What is this temperature?**

$2^8 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$ — Write 2^8 as a product.

$= 256$ — Multiply.

So, the temperature is about 256 degrees Fahrenheit.

4 **A multiple choice test has 7 questions. If each question has 4 choices, the are 4^7 ways the test can be answered. What is the value of 4^7?**

$4^7 = 4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4$ — Write 4^7 as a product.

$= 16{,}384$ — Multiply.

So, the test can be answered in 16,384 ways.
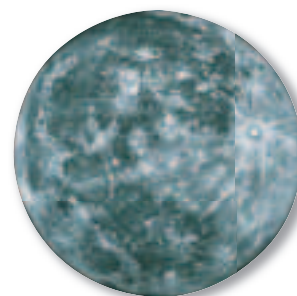
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Exponents can be used to write the prime factorization of a number.

EXAMPLES **Prime Factorization Using Exponents**

Write the prime factorization of each number using exponents.

5 **72**

$72 = \underbrace{2 \times 2 \times 2} \times \underbrace{3 \times 3}$ Write the prime factorization.

$= \quad 2^3 \quad \times \quad 3^2$ Write products of identical factors using exponents.

6 **135**

$135 = \underbrace{3 \times 3 \times 3} \times 5$ Write the prime factorization.

$= \quad 3^3 \quad \times 5$ Write products of identical factors using exponents.

7 **300**

$300 = \underbrace{2 \times 2} \times 3 \times \underbrace{5 \times 5}$ Write the prime factorization.

$= \quad 2^2 \quad \times 3 \times \quad 5^2$ Write products of identical factors using exponents.

CHECK What You Know

Write each product using an exponent. See Example 1 (p. 22)

1. $2 \times 2 \times 2 \times 2$ **2.** $6 \times 6 \times 6$

Write each power as a product of the same factor. Then find the value. See Example 2 (p. 22)

3. 2^6 **4.** 3^7

5. There are nearly 3^5 species of monkeys on Earth. What is the value of 3^5? See Examples 3, 4 (p. 22)

6. An estimated 10^5 people live in Antioch, California. About how many people live in Antioch? See Examples 3, 4 (p. 22)

Write the prime factorization of each number using exponents. See Examples 5–7 (p. 23)

7. 20   **8.** 48   **9.** 90

10. **Talk About It** Compare 4^2 and 4×2.

Write each product using an exponent. See Example 1 (p. 22)

11. 9×9

12. $8 \times 8 \times 8 \times 8$

13. $3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$

14. $5 \times 5 \times 5 \times 5 \times 5$

15. $11 \times 11 \times 11$

16. $7 \times 7 \times 7 \times 7 \times 7 \times 7$

Write each power as a product of the same factor. Then find the value. See Example 2 (p. 22)

17. 2^4

18. 3^2

19. 5^3

20. 10^5

21. 9^3

22. 6^5

23. 8^1

24. 1^7

25. The number of Calories in two pancakes can be written as 7^3. What whole number does 7^3 represent?

26. An estimated 10^9 people in the world speak Mandarin Chinese. About how many people speak this language?

Write the prime factorization of each number using exponents.
See Examples 5–7 (p. 23)

27. 25

28. 56

29. 50

30. 68

31. 88

32. 98

33. 560

34. 378

Write each power as a product of the same factor. Then find the value.

35. seven squared

36. eight cubed

37. four to the fifth power

38. Mrs. Locaputo's garden is organized into 6 rows. Each row contains 6 vegetable plants. How many total vegetable plants does Mrs. Locaputo have in her garden? Write using exponents, and then find the value.

Real-World PROBLEM SOLVING

Fish To find the amount of water a cube-shaped aquarium holds, find the *cube* of the measure of one side of the aquarium.

39. Express the amount of water the aquarium shown holds as a power.

40. Find the amount in cubic units.

18 units

18 units

18 units
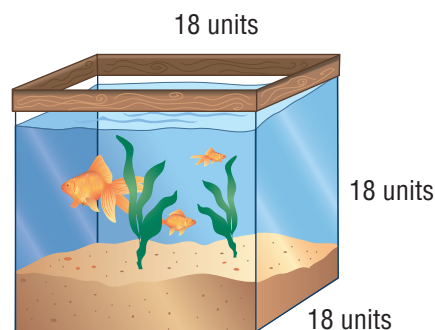
H.O.T. Problems

41. REASONING What is the largest square of a whole number that divides 32? What is the largest cube of a whole number that divides 32?

42. NUMBER SENSE Which is greater: 3^5 or 5^3? Explain your reasoning.

43. FIND THE ERROR Anita and Tyree are finding the value of 6^4. Who is correct? Explain your reasoning.

Anita
$6^4 = 6 \times 6 \times 6 \times 6$
$= 1,296$

Tyree
$6^4 = 6 \times 4$
$= 24$

44. CHALLENGE Find all numbers 50 or less whose only prime factors are 2 and 5.

45. WRITING IN MATH Explain how you find the value of a power.

Standards Practice

46 $4^3 =$

A $4 + 4 + 4$

B $4 \times 4 \times 4$

C 4×3

D $3 \times 3 \times 3 \times 3$

47 Which is the prime factorization of 36?

F $2^2 \times 3$

G $2^2 \times 3^2$

H $2^2 \times 3^3$

J 2×3^2

Spiral Review

Tell whether each number is *prime*, *composite*, or *neither*. **(Lesson 1-1)**

48. 63   **49.** 0   **50.** 29   **51.** 71

52. Measurement The area of a rectangle can be found by multiplying its length and width. If the area of a rectangle is 30 square units, find all of its possible dimensions using only whole numbers. **(Lesson 1-1)**

Facto Bingo
Finding Prime Factorizations

Get Ready!

Players: three or four

You will need: a copy of the Facto Bingo card

Get Set!

- Each player copies the Facto Bingo card shown.

Facto Bingo				
		Free Space		

- Each player selects 24 different numbers from the list below and writes them in the upper right hand corner boxes.

Facto Bingo Numbers									
6	9	10	13	15	18	20	21	24	25
28	32	37	40	43	45	48	50	52	55
59	60	62	64	66	67	69	70	72	74
75	76	79	80	85	88	89	90	96	98

Go!

- The caller reads one number at a time at random from the list above.

- If a player has the number on the card, he or she marks the space by writing the prime factorization in the larger box.

- The first player with bingo wins.

Ed-imaging

Order of Operations

GET READY to Learn

The table shows the number of Calories burned in one minute for two different activities. If you walk for 5 minutes, you will burn 5 × 8 Calories. If you run for 15 minutes, you will burn 15 × 10 Calories. So, if you walk for 5 minutes and then run for 15 minutes, you will burn 5 × 8 + 15 × 10 Calories.

Activity	Calories Burned per Minute
Walking (13 min/mi)	8
Running (12 min/mi)	10

Source: The Fitness Jumpsite

MAIN IDEA

I will find the value of expressions using the order of operations.

Reinforcement of Standard 4AF1.2 Interpret and evaluate mathematical expressions that now use parentheses.

New Vocabulary

numerical expression

order of operations

A **numerical expression** like 5 × 8 + 15 × 10 is a combination of numbers and operations. The **order of operations** tells you which operation to perform first so that everyone finds the same value for an expression.

KEY CONCEPT   Order of Operations

1. Simplify the expressions inside grouping symbols, like parentheses.
2. Find the value of 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

1 **Find the value of 4 + 3 × 5.**

$$4 + 3 \times 5 = 4 + 15 \quad \text{Multiply 3 and 5 first.}$$
$$= 19 \quad \text{Add 4 and 15.}$$

2 **Find the value of 10 − 2 + 8.**

$$10 - 2 + 8 = 8 + 8 \quad \text{Subtract 2 from 10 first.}$$
$$= 16 \quad \text{Add 8 and 8.}$$

EXAMPLES **Parentheses and Exponents**

Find the value of each expression.

3 $20 \div 4 + 17 \times (9 - 6)$

$$
\begin{aligned}
20 \div 4 + 17 \times \textbf{(9 - 6)} &= 20 \div 4 + 17 \times \textbf{3} && \text{Subtract 6 from 9.} \\
&= 5 + 17 \times 3 && \text{Divide 20 by 4.} \\
&= 5 + 51 && \text{Multiply 17 by 3.} \\
&= 56 && \text{Add 5 and 51.}
\end{aligned}
$$

4 $3 \times 6^2 + 4$

$$
\begin{aligned}
3 \times \textbf{6}^2 + 4 &= 3 \times \textbf{36} + 4 && \text{Find } 6^2. \\
&= 108 + 4 && \text{Multiply 3 and 36.} \\
&= 112 && \text{Add 108 and 4.}
\end{aligned}
$$

> **Remember**
>
> To check your answer in Example 5, find the total cost of going to the movies for one person. Then multiply by 5.
>
> $\$7 + \$3 + \$2 = \$12$
> $5 \times \$12 = \$60$ ✔

Real-World EXAMPLE

5 Javier and four friends go to the movies. Each person buys a movie ticket, a snack, and a soda. Write an expression for the total cost of the trip to the movies. Then find the total cost.

Cost of Going to the Movies			
Item	ticket	snack	soda
Cost ($)	7	3	2

To find the total cost, write an expression and then find its value.

Words	cost of 5 tickets plus cost of 5 snacks plus cost of 5 sodas
Expression	$5 \times \$7$ + $5 \times \$3$ + $5 \times \$2$

$$
\begin{aligned}
5 \times \$7 + 5 \times \$3 + 5 \times \$2 & \\
= \$35 + 5 \times \$3 + 5 \times \$2 && \text{Multiply 5 and 7.} \\
= \$35 + \$15 + 5 \times \$2 && \text{Multiply 5 and 3.} \\
= \$35 + \$15 + \$10 && \text{Multiply 5 and 2.} \\
= \$60 && \text{Add 35, 15, and 10.}
\end{aligned}
$$

The total cost of the trip to the movies is $60.

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Find the value of each expression. See Examples 1–4 (pp. 27–28)

1. $9 + 3 - 5$

2. $10 - 3 + 9$

3. $(26 + 5) \times 2 - 15$

4. $18 \div (2 + 7) \times 2 + 1$

5. $5^2 + 8 \div 2$

6. $19 - (3^2 + 4) + 6$

7. Tickets to a play cost $10 for members of the theater and $24 for nonmembers. Write an expression to find the total cost of 4 nonmember tickets and 2 member tickets. Then find the total cost.

8. **Talk About It** Tell how to solve $15 - 9 \div 3$.

Practice and Problem Solving

Find the value of each expression. See Examples 1–4 (pp. 27–28)

9. $8 + 4 - 3$

10. $9 + 12 - 15$

11. $38 - 19 + 12$

12. $22 - 17 + 8$

13. $7 + 9 \times (3 + 8)$

14. $(9 + 2) \times 6 - 5$

15. $63 \div (10 - 3) \times 3$

16. $66 \times (6 \div 2) + 1$

17. $27 \div (3 + 6) \times 5 - 12$

18. $55 \div 11 + 7 \times (2 + 14)$

19. $5^3 - 12 \div 3$

20. $26 + 6^2 \div 4$

21. $15 - 2^3 \div 4$

22. $22 \div 2 \times 3^2$

23. Admission to a museum is $6 for adults and $3 for children. Write an expression to find the total cost of 3 adult tickets and 4 children's tickets. Then find the total cost.

24. Alexis is making chocolate covered pretzels for 15 friends. She has covered 3 dozen pretzels. If she wants each friend to receive exactly 3 pretzels and have no pretzels left over, write an expression to find how many more pretzels she should cover. Then find this number.

Write a numerical expression for each verbal expression. Then find its value.

25. the product of 7 and 6, minus 2

26. the cube of the quotient of 24 and 6

H.O.T. Problems

27. CHALLENGE Create an expression whose value is 10. It should contain four numbers and two different operations.

28. FIND THE ERROR Haley and Ryan are finding $7 - 3 + 2$. Who is correct? Explain your reasoning.

Haley
$$7 - 3 + 2 = 7 - 5$$
$$= 2$$

Ryan
$$7 - 3 + 2 = 4 + 2$$
$$= 6$$

29. WRITING IN ►MATH Write a real-world problem that can be solved using order of operations. Then solve the problem.

Standards Practice

30 Arleta is 2 years younger than Josh, and Josh is 5 years older than Marissa who is 9 years old. Which table could be used to find Arleta's age?

A

Name	Age (years)
Arleta	$9 + 5$
Josh	$9 + 5 - 2$
Marissa	9

C

Name	Age (years)
Arleta	5
Josh	4
Marissa	9

B

Name	Age (years)
Arleta	2
Josh	5
Marissa	9

D

Name	Age (years)
Arleta	$9 + 5 - 2$
Josh	$9 + 5$
Marissa	9

Spiral Review

31. Four members of a certain phone tree are each given 4 people to contact. If the phone tree is activated, the total number of calls made is 4^4. How many calls is this? **(Lesson 1-2)**

Find the prime factorization of each number. (Lesson 1-1)

32. 42   **33.** 75   **34.** 110   **35.** 130

(l)David Young-Wolff/PhotoEdit, (r)Tony Freeman/PhotoEdit

1. **STANDARDS PRACTICE** A principal has 144 computers for 24 classrooms. Which of the following is a factor of 24? **(Lesson 1-1)**

   A 6

   B 48

   C 120

   D 144

Tell whether each number is *prime*, *composite*, or *neither*. (Lesson 1-1)

2. 57

3. 97

4. 0

5. Can a group of 41 books be placed onto more than one shelf so that each shelf has the same number of books and has more than one book per shelf? Explain your reasoning. **(Lesson 1-1)**

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

6. 3^4 7. 6^3

Write the prime factorization of each number using exponents. (Lesson 1-2)

8. 22   9. 40   10. 75

11. The average annual cost of food for a dog is about 3^5 dollars. What is this cost? **(Lesson 1-2)**

Find the value of each expression. (Lesson 1-3)

12. $10 - 6 + 20$

13. $25 \div (15 - 10) \times 2$

14. $3^2 + 32 \div 2$

15. $12 - (4^3 \div 8) + 1$

16. **STANDARDS PRACTICE** Mr. and Mrs. Murphy and their 4 children went to the county fair. Admission to the fair was $7.75 for an adult and $5.50 for a child. Arrange the problem-solving steps below in the correct order to find the total cost of the tickets.

   Step K: Multiply the cost of a child's ticket by the number of children.

   Step L: Add the two products together.

   Step M: Multiply the cost of an adult ticket by the number of adults.

   Step N: Write down the number of adults and the number of children that are going to the county fair.

   Which list shows the steps in the correct order? **(Lesson 1-3)**

   F N, L, M, K   **H** K, M, N, L

   G N, M, K, L   **J** M, K, N, L

17. **WRITING IN MATH** Describe how to use the order of operations to solve numerical expressions that contain more than one operation. **(Lesson 1-3)**

Problem-Solving Investigation

MAIN IDEA I will use the four-step plan to solve a problem.

Standard 5MR1.1 **Analyze problems by identifying relationships,** distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns. **Reinforcement of Stamdard 4NS3.4 Solve problems** involving division of multidigit numbers by one-digit numbers.

P.S.I. TEAM +

DAVID: Today, I learned that there are 5,280 feet in one mile. I wonder how many pennies would be in one mile if I lined the pennies up side by side?

YOUR MISSION: Find how many pennies are in a row that is one mile long.

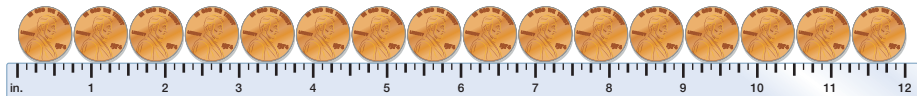| **Understand**	**What facts do you know?**
	There are 5,280 feet in one mile.
	What do you need to find?
	You need to find how many pennies are in a row that is one mile long.
Plan	**Plan a strategy for solving the problem.**
	Find how many pennies are in one foot. Then multiply by 5,280 to find how many pennies are in one mile.
Solve	**Use your plan to solve the problem.**
	Line up pennies along a ruler. There are 16 pennies in one foot, and $16 \times 5,280 = 84,480$.
	What is the solution?
	So, a row of pennies one mile long will contain 84,480 pennies.
Check	**Does the answer make sense?**
	Look back at the problem. Use estimation to check. $15 \times 5,000 = 75,000$ ✔

Use the four-step plan to solve each problem.

> PROBLEM-SOLVING SKILLS
> • Use the four-step plan.

1. Julian is on the swim team. The table shows the number of laps he swims in the first four days of practice. If the pattern continues, how many laps will he swim on Friday?

Day	Laps
Monday	5
Tuesday	6
Wednesday	8
Thursday	11
Friday	■

2. A bus departed at 11:45 A.M. It traveled 715 miles in 11 hours. How many miles did it travel in each hour?

3. Jupiter orbits the Sun at a rate of 8 miles per second. How far does Jupiter travel in one day?

4. An adult male walrus weighs about 2,670 pounds. An adult female walrus weighs about 1,835 pounds. How much less does an adult female walrus weigh than an adult male walrus?

5. In which corner will the circle be in the next figure in the pattern?

6. Brandon can run one mile in 7 minutes. At this rate, how long will it take him to run 8 miles?

7. After shopping at the mall, you come home with $3. You spent $4 on a snack, $8 on a movie, and $5 on arcade games. How much money did you start with?

8. The Corbetts are buying a 36-inch television for $788. They plan to pay in four equal payments. Find the amount of each payment.

9. The table shows how the number of a certain bacteria increases. At this rate, how many bacteria will there be after 2 hours? (*Hint:* There are 60 minutes in one hour.)

Time (min)	Number of Bacteria
0	5
20	10
40	20
60	40
80	80
100	■
120	■

10. English is spoken in 107 countries, and Vietnamese is spoken in 20 countries. About how many times more countries speak English than Vietnamese?

11. **WRITING IN MATH** Write a problem that you can solve using the four-step plan. Explain why it is important to compare your answer to your estimate.

Algebra: Variables and Expressions

GET READY to Learn

A box contains some crayons. There are also two crayons outside of the box. The total number of crayons is *the sum of two and some number*. The two crayons represent the known value 2, and the crayons in the box represent the unknown value.

MAIN IDEA

I willl evaluate algebraic expressions.

Standard 5AF1.2 Use a letter to represent an unknown number; write and **evaluate simple algebraic expressions in one variable by substitution.**
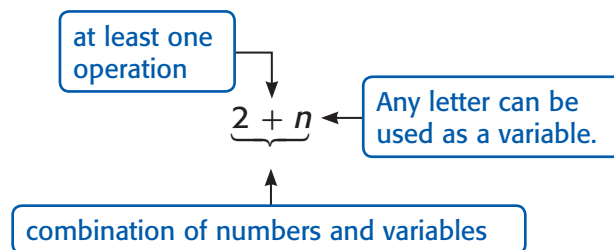
New Vocabulary

algebra
variable
algebraic expression
evaluate

Vocabulary Link

Variable

Everyday Use able to change or vary, as in variable winds

Math Use a symbol used to represent a number

Algebra is a language of symbols. One symbol that is often used is a variable. A **variable** is a symbol, usually a letter, used to represent a number or some other unknown quantity. The expression $2 + n$ represents *the sum of two and some number*.

Algebraic expressions are combinations of variables, numbers, and at least one operation.

at least one operation

$$2 + n$$

Any letter can be used as a variable.

combination of numbers and variables

The letter x is often used as a variable. It is also common to use the first letter of the word describing the value you are representing.

The variables in an expression can be replaced with any number. Once the variables have been replaced, you can **evaluate**, or find the value of, the algebraic expression.

In addition to the symbol $\times$, there are other ways to show multiplication.

$$2 \cdot 3 \qquad 5t \qquad st$$

the product of 2 and 3

the product of 5 and t

the product of s and t
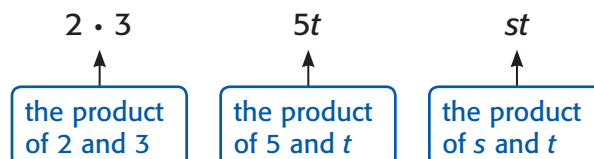
Evaluate Algebraic Expressions

1 **Evaluate** $16 + b$ **if** $b = 25$.

$16 + \boldsymbol{b} = 16 + \boldsymbol{25}$ Replace b with 25.

$\quad\quad = 41$ Add 16 and 25.

2 **Evaluate** $x - y$ **if** $x = 64$ **and** $y = 27$.

$\boldsymbol{x} - \boldsymbol{y} = \boldsymbol{64} - \boldsymbol{27}$ Replace x with 64 and y with 27.

$\quad\quad = 37$ Subtract 27 from 64.

3 **Evaluate** $5t + 4$ **if** $t = 3$.

$5\boldsymbol{t} + 4 = 5 \cdot \boldsymbol{3} + 4$ Replace t with 3.

$\quad\quad = 15 + 4$ Multiply 5 and 3.

$\quad\quad = 19$ Add 15 and 4.

> **Remember**
>
> In algebra, the symbol $\cdot$ is often used to represent multiplication, as the symbol $\times$ may be confused with the variable x.

Real-World EXAMPLES

4 **If admission to a fair is $7 per person and each ride ticket costs $2, the total cost for admission and** t **ride tickets is** $7 + 2t$. **Find the total cost for admission and 5 ride tickets.**

$7 + 2\boldsymbol{t} = 7 + 2 \cdot \boldsymbol{5}$ Replace t with 5.

$\quad\quad = 7 + 10$ Multiply 2 and 5.

$\quad\quad = 17$ Add 7 and 10.

So, the total cost for admission and 5 ride tickets is $17.

5 **Measurement** **An expression for finding the area of a triangle whose height is 3 units longer than its base is** $(b + 3) \cdot b \div 2$, **where** b **is the measure of the base. Find the area of a triangle with a base 8 units long.**

You need to find the value of the expression given $b = 8$.

$(\boldsymbol{b} + 3) \cdot \boldsymbol{b} \div 2 = (\boldsymbol{8} + 3) \cdot \boldsymbol{8} \div 2$ Replace b with 8.

$\quad\quad = 11 \cdot 8 \div 2$ Add 8 and 3.

$\quad\quad = 88 \div 2$ Multiply 11 and 8.

$\quad\quad = 44$ Divide 88 by 2.

The area of the triangle is 44 square units.

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CHECK What You Know

Evaluate each expression if $m = 4$ and $z = 9$. See Examples 1–3 (p. 35)

1. $3 + m$

2. $z + 5$

3. $z - m$

4. $m - 2$

5. $4m - 2$

6. $2z + 3$

7. The amount of money that remains from a $20 dollar bill after Malina buys 4 party favors for p dollars each is $20 - 4p$. Find the amount remaining if each favor costs $3.

8. **Talk About It** Describe three ways to write *the product of 7 and x.*

Practice and Problem Solving

Evaluate each expression if $m = 2$ and $n = 16$. See Examples 1, 2 (p. 35)

9. $m + 10$

10. $n + 8$

11. $9 - m$

12. $22 - n$

13. $n \div 4$

14. $12 \div m$

15. $n \cdot 3$

16. $6 \cdot m$

17. $m + n$

18. $n + m$

19. $n - 6$

20. $m - 1$

Evaluate each expression if $a = 4$, $b = 7$, and $c = 11$. See Example 3 (p. 35)

21. $b - a$

22. $c - b$

23. $5c + 6$

24. $2b + 7$

25. $3a - 4$

26. $4b - 10$

27. Distance traveled can be found using the expression rt, where r represents the speed (rate) and t represents time. How far did a hot air balloon travel at an average rate of 15 miles per hour for 6 hours?

28. To find the average speed (rate) of a racecar, use the expression $d \div t$, where d represents distance and t represents time. Find the speed s of a racecar that travels 508 miles in 4 hours.

29. The expression $500t$ can be used to find the distance in miles traveled by a DC–10 aircraft. The variable t represents time in hours. How far can a DC–10 travel in 4 hours?

30. What is the value of $st \div 6r$ if $r = 5$, $s = 32$, and $t = 45$?

Evaluate each expression if $x = 3$, $y = 12$, and $z = 8$.

31. $4z + 8 - 6$

32. $6x - 9 \div 3$

33. $15 + 9x \div 3$

34. $7z \div 4 + 5x$

35. $y^2 \div (3z)$

36. $z^2 - (5x)$

37. Measurement To find the area of a rectangle, use the expression ℓw, where ℓ represents the length, and w represents the width of the rectangle. What is the area of the rectangle shown?

7 ft

16 ft

38. As a member of a music club, you can order CDs for $15 each. The music club also charges $5 for each shipment. The expression $15n + 5$ represents the cost of n CDs. Find the total cost for ordering 3 CDs.

39. Temperature To change a temperature given in degrees Celsius to degrees Fahrenheit, first multiply the Celsius temperature by 9. Next, divide the answer by 5. Finally, add 32 to the result. Write an expression that can be used to change a temperature from degrees Celsius to degrees Fahrenheit. Then use the information in the table below to find the difference in average temperatures in degrees Fahrenheit for San Antonio from January to April. (*Hint:* Convert to degrees Fahrenheit first.)

Average Monthly Temperature for San Antonio, Texas	
Month	**Temp. (°C)**
January	10
April	20
July	29

Source: infoplease.com

H.O.T. Problems

40. OPEN ENDED Create two algebraic expressions involving multiplication that have the same meaning.

41. CHALLENGE Elan and Robin each have a calculator. Elan starts at zero and adds 3 each time. Robin starts at 100 and subtracts 7 each time. Suppose Elan and Robin press the keys at the same time. Will their displays ever show the same number? If so, what is the number? Explain your reasoning.

42. SELECT A TECHNIQUE Ichiro is evaluating $x^2 - z$, where $x = 3$ and $z = 8$. Which of the following techniques might Ichiro use to evaluate the expression? Justify your selection(s). Then use the technique(s) to solve the problem.

| mental math | number sense | estimation |

43. Which One Doesn't Belong? Identify the expression that does not belong with the other three. Explain your reasoning.
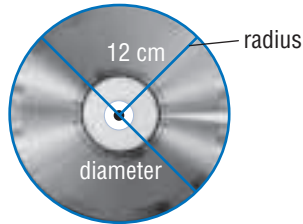
| 5x | 3 + 4 | ab | 7x + 1 |

44. WRITING IN ►MATH Compare and contrast numerical expressions and algebraic expressions. Use examples in your explanation.

Standards Practice

45 The expression $2r$ can be used to find the diameter of a circle, where r is the length of the radius. Find the diameter of the compact disc.

radius — 12 cm

diameter

- **A** 3 cm
- **C** 12 cm
- **B** 6 cm
- **D** 24 cm

46 Which expression represents the product of 36 and s?

- **F** $36 + s$
- **H** $36s$
- **G** $36 - s$
- **J** $36 \div s$

47 If $S = 7$, what is the value of $8 \times S + 6$?

- **A** 8
- **B** 50
- **C** 62
- **D** 104

48 If $m = 11$, what is the value of $5m - 9$?

- **F** 4
- **H** 55
- **G** 46
- **J** 64

Spiral Review

49. On a test with 62 questions, Trey missed 4 questions. How many did he get correct? **(Lesson 1-4)**

Find the value of each expression. (Lesson 1-3)

50. $12 - 8 \div 2 + 1$ **51.** $5^2 + (20 \div 2) - 7$ **52.** $21 \div (3 + 4) \times 3 - 8$

53. Measurement The distance from Earth to the Sun is close to 10^8 miles. How many miles is this? **(Lesson 1-2)**

Algebra: Functions

MAIN IDEA

I will complete function tables and find function rules.

Standard 5AF1.2 Use a letter to represent an unknown number; write and evaluate simple algebraic expressions in one variable by substitution.

Standard 5AF1.5 Solve problems involving linear functions with integer values; write the equation; and graph the resulting ordered pairs of integers on a grid.

New Vocabulary

function
function table
function rule
defining the variable

GET READY to Learn

A brown bat can eat 600 mosquitoes an hour. At this rate, how many mosquitoes can a brown bat eat in 2 hours? 3 hours?

A **function** is a relationship that assigns exactly one output value to one input value. The number of mosquitoes eaten (output) depends on the number of hours (input). You can organize the input-output values in a **function table**.

Input	Function Rule	Output
Number of Hours (t)	$600t$	Mosquitoes Eaten
1	600(1)	600
2	600(2)	1,200
3	600(3)	1,800

The **function rule** describes the relationship between each input and output.

EXAMPLE Complete a Function Table

1 Complete the function table below.

Input (x)	$x + 4$	Output
10	■	■
12	■	■
14	■	■

The function rule is $x + 4$. Add 4 to each input.

Input (x)	$x + 4$	Output
10	10 + 4	14
12	12 + 4	16
14	14 + 4	18

Joe McDonald/CORBIS

EXAMPLES   **Find the Rule for a Function Table**

2 **Find the rule for the function table.**

Input (x)	Output (■)
2	6
5	15
7	21

Study the relationship between each input and output. Each output is three times the input.

So, the function rule is $3 \cdot x$, or $3x$.

3 **Find the rule for the function table.**

Input (x)	Output (■)
0	0
4	1
16	4

Study the relationship between each input and output. Each output is one-fourth the input.

So, the function rule is $x \div 4$.

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When you write a function rule that represents a real-world situation, you first choose a variable to represent the input. This is called **defining the variable**.

Real-World EXAMPLE

4 **A local band charges $70 for each hour it performs. Define a variable. Then write a function rule that relates the total charge to the number of hours it performs.**

Determine the function rule. The cost of the performance depends on the number of hours. Let h represent the number of hours the band performs.

Words	$70 for each hour
Variable	Let h represent the number of hours the band performs.
Expression	$70 \cdot h$

The function rule is $70h$.

Copy and complete each function table. See Example 1 (p. 39)

1.

Input (x)	$x + 3$	Output
0	■	■
2	■	■
4	■	■

2.

Input (x)	$4x$	Output
1	■	■
3	■	■
6	■	■

Find the rule for each function table. See Examples 2, 3 (p. 40)

3.

Input (x)	Output (■)
1	0
3	2
5	4

4.

Input (x)	Output (■)
0	0
3	6
6	12

5. Lamar is buying jelly beans for a party. He can buy them in bulk for $3 a pound. Define a variable. Write a function rule that relates the total cost of the jelly beans to the number of pounds he buys.
See Example 4 (p. 40)

6. **Talk About It** A function rule is $6x$. What are the input values if the output values are 24, 30, and 36?

Practice and Problem Solving

EXTRA **PRACTICE**
See page 655.

Copy and complete each function table. See Example 1 (p. 39)

7.

Input (x)	$x - 4$	Output
4	■	■
8	■	■
11	■	■

8.

Input (x)	$x \div 3$	Output
0	■	■
3	■	■
9	■	■

Find the rule for each function table. See Examples 2, 3 (p. 40)

9.

Input (x)	Output (■)
0	2
1	3
6	8

10.

Input (x)	Output (■)
7	2
9	4
15	10

11.

Input (x)	Output (■)
2	4
5	10
8	16

12.

Input (x)	Output (■)
0	0
4	20
7	35

13.

Input (x)	Output (■)
5	1
15	3
25	5

14.

Input (x)	Output (■)
6	3
22	11
34	17

15. Ricardo is 8 years older than his sister. Define a variable. Write a function rule that relates Ricardo's age to his sister's age.

16. Whitney has a total of 30 sandwiches for her guests. Define a variable. Write a function rule that relates the number of sandwiches per guest to the number of guests.

For Exercises 17 and 18, define a variable and write a function rule. Then solve each problem.

17. Moose can swim up to 6 miles per hour. At this rate, find the total number of miles a moose can swim in two hours.

18. An Internet company charges $10 a year to be a member of its music program. It also charges $1 for each song you download. How much will it cost if you download 46 songs in a year?

Real-World PROBLEM SOLVING

Data File The California State Railroad Museum is located in Sacramento.

19. Write a function rule that relates the total cost of admission to the number of adult and youth (ages 6–17) tickets purchased.

20. Use the function rule to find the total cost of admission for 2 adults and 3 youth (ages 6–17).

Source: csrmf.org

Admission

Adults:
$8

Ages 6–17:
$3

Ages 5 and under:
Free

H.O.T. Problems

21. OPEN ENDED Create a function table. Then write a function rule. Choose three input values and find the output values.

22. FIND THE ERROR Olivia and Nicole are finding the function rule when each output is 5 less than the input. Who is correct? Explain.

Olivia
Function rule:
$x - 5$

Nicole
Function rule:
$5 - x$

23. CHALLENGE Suppose the estimated 223 million Americans who have jugs or bottles of coins around their homes put coins back into circulation at a rate of $10 a year per person. Create a function table showing the amount that would be recirculated in 1, 2, and 3 years.

24. SELECT A TOOL Courtney is evaluating the function rule $43x - 6$ for an input of 4. Which of the following tools might Courtney use to determine the output? Justify your selection(s). Then use the tool(s) to solve the problem.

> real objects   graphing calculator   paper/pencil

25. WRITING IN ▸MATH Explain how to find a function rule given a function table.

Standards Practice

26 Which expression represents the y values in terms of the x values?

x	1	2	3	4	5	6
y	5	7	9	11	13	15

A $2x + 3$ **C** $3x - 2$

B $x + 3$ **D** $6 - x$

27 The school store makes a profit of $5 for each sweatshirt sold. Which expression represents the profit on n sweatshirts?

F $5 \times n$ **H** $n \div 5$

G $5 + n$ **J** $n - 5$

Spiral Review

Algebra Evaluate each expression if $a = 3$, $b = 6$, and $c = 10$.
(Lesson 1-5)

28. $b - a$ **29.** $3c + a$ **30.** $bc + 12$

31. The table represents the average amounts consumers spent on back-to-school merchandise in a recent year. How much more did consumers spend on clothing, accessories, and shoes than on school supplies? Use the four-step plan. **(Lesson 1-4)**

Back-to-School Spending	
Merchandise	**Amount ($)**
Clothing/Accessories	219
Electronic Equipment	101
Shoes	90
School Supplies	73

Source: *USA Today*

32. A deli sells wraps for $5 and soup for $3 a bowl. Write and solve an expression for the cost of 3 wraps and 2 bowls of soup. **(Lesson 1-3)**

33. California has 5^2 area codes. What is the value of 5^2? **(Lesson 1-2)**

Problem-Solving Strategy

MAIN IDEA I will solve problems by using the *guess and check* strategy.

Standard 5MR2.6 Make precise calculations and check the validity of the results from the context of the problem. **Reinforcement of Standard 4NS2.1** Estimate and **compute the sum or difference of whole numbers** and positive decimals to two places.

A comic book store sells used comic books in packages of 5 and new comic books in packages of 3. Keisha buys a total of 16 comic books for her brother Trent for his birthday. How many packages of new and used comic books did Keisha buy for Trent?

Understand	**What facts do you know?**
	• The comic book store sells 3-book packages and 5-book packages.
	• The used comic books come in packages of 5. The new comic books come in packages of 3.
	• 16 books were bought.
	What do you need to find?
	How many packages of new and used comic books did Keisha buy for Trent?
Plan	**Plan a strategy for solving the problem.**
	Make a guess until you find an answer that makes sense for the problem.
Solve	**Use your plan to solve the problem.**

Number of 3-book packages	Number of 5-book packages	Total Number of Comic Books
1	1	$1(3) + 1(5) = 8$
1	2	$1(3) + 2(5) = 13$
2	1	$2(3) + 1(5) = 11$
2	2	$2(3) + 2(5) = 16$ ✔

So, Keisha bought two 3-book packages and two 5-book packages.

Check	**Does the answer make sense?**
	Look back at the problem. Two 3-book packages result in 6 books. Two 5-book packages result in 10 books. Since $6 + 10$ is 16, the answer is correct. ✔

Refer to the problem on the previous page.

1. Are there any other combinations of new and used packages that Keisha could have bought? Explain.

2. Suppose Keisha bought Trent 18 comic books. How many new and used packages did she buy?

3. Explain when to use the *guess and check* strategy to solve a problem.

4. Is the *guess and check* strategy always the best strategy for solving a word problem?

PRACTICE the Strategy

Solve. Use the *guess and check* strategy.

5. Antonio is thinking of four numbers from 1 through 9 whose sum is 23. Find the numbers.

6. Each hand in the human body has 27 bones. There are 6 more bones in your fingers than in your wrist. There are 3 fewer bones in your palm than in your wrist. How many bones are in each part of your hand?

7. Mrs. Collins is buying sandwiches for the 10 students in the chess club. If she bought at least one of each type of sandwich and spent a total of $34.00, how many of each sandwich did she buy?

Sandwiches	
Type	**Price**
Italian	$4.00
Roast Beef	$3.50
Veggie	$3.00

8. Mateo has seven coins in his pocket that total $1.50. What are the coins?

9. The admission prices for a health fair are shown below. Twelve people paid a total of $50 for admission. If 8 children attended the health fair, how many adults and senior citizens attended?

Children	$4.00
Adults	$6.00
Senior Citizens	$3.00

10. Lavinia sold some wrapping paper for $7 a roll and some gift bags for $8 a set. If she sold a total of 17 items for a total of $124, how many rolls of wrapping paper and sets of gift bags did she sell?

11. A wallet contains 14 bills worth $150. If all of the money was in $5 bills, $10 bills, and $20 bills, how many of each bill was in the wallet?

12. The sum of two prime numbers is 20. Find the numbers.

13. **WRITING IN ►MATH** Write a problem that you can solve by the *guess and check* strategy. Then describe the steps you would take to find the solution of the problem.

1-8 Algebra: Equations

MAIN IDEA

I will solve equations by using mental math and the guess and check strategy.

Standard 5AF1.1 Use information taken from a graph or equation to answer questions about a problem situation.

Standard 5AF1.2 Use a letter to represent an unknown number; write and evaluate simple algebraic expressions in one variable by substitution.
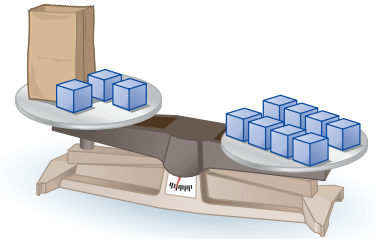
New Vocabulary

equation
equals sign
solve
solution

GET READY to Learn

Hands-On Mini Lab

When the amounts on each side of a scale are equal, the scale is balanced.

Step 1 Place three centimeter cubes and a paper bag on one side of a scale.

Step 2 Place eight centimeter cubes on the other side of the scale.

1. Suppose the variable x represents the number of cubes in the bag. What equation represents this situation?

2. Replace the bag with centimeter cubes until the scale balances. How many centimeter cubes did you need to balance the scale?

Let x represent the bag. Model each sentence on a scale. Find the number of centimeter cubes needed to balance the scale.

3. $x + 1 = 4$ 4. $x + 3 = 5$

5. $x + 7 = 8$ 6. $x + 2 = 2$

An **equation** is a sentence that contains an **equals sign**, =. A few examples are shown below.

$$2 + 7 = 9 \qquad 10 - 6 = 4 \qquad 14 = 2 \cdot 7$$

Some equations contain variables.

$$2 + x = 9 \qquad 4 = k - 6 \qquad 15 \div m = 3$$

When you replace a variable with a value that results in a true sentence, you **solve** the equation. That value for the variable is the **solution** of the equation.

The value for the variable that results in a true sentence is 7. So, 7 is the solution.

$2 + x = 9$ ← The equation is $2 + x = 9$.

$2 + 7 = 9$

$9 = 9$ ← This sentence is true.

EXAMPLE   Find the Solution of an Equation

1 Is 3, 4, or 5 the solution of the equation $a + 7 = 11$?

Value of a	$a + 7 \stackrel{?}{=} 11$	Are Both Sides Equal?
3	$3 + 7 = 11$ $10 \neq 11$	no
4	$4 + 7 = 11$ $11 = 11$	yes ✔
5	$5 + 7 = 11$ $12 \neq 11$	no

The solution is 4 since replacing a with 4 results in a true sentence.

EXAMPLE   Solve an Equation Mentally

2 Solve $12 = 3h$ mentally.

$12 = 3h$ THINK   12 equals 3 times what number?
$12 = 3 \cdot 4$ You know that $12 = 3 \cdot 4$.

So, $h = 4$. The solution is 4.

Real-World EXAMPLE

3 An antelope can run 49 miles per hour faster than a squirrel. Let s represent the speed of a squirrel. Solve the equation $s + 49 = 61$ mentally to find the speed of a squirrel.

Use the *guess and check* strategy.

Try 10.	Try 11.	Try 12.
$s + 49 = 61$	$s + 49 = 61$	$s + 49 = 61$
$10 + 49 \stackrel{?}{=} 61$	$11 + 49 \stackrel{?}{=} 61$	$12 + 49 \stackrel{?}{=} 61$
$59 \neq 61$	$60 \neq 61$	$61 = 61$ ✔

So, $s = 12$. The speed of the squirrel is 12 miles per hour.

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CHECK What You Know

Identify the solution of each equation from the list given.

1. $9 + w = 17$; 7, 8, 9

2. $d - 11 = 5$; 14, 15, 16

3. $4 = 2y$; 2, 3, 4

4. $8 \div c = 8$; 0, 1, 2

Solve each equation mentally.

5. $x + 6 = 18$

6. $n - 10 = 30$

7. $15k = 30$

8. The equation $b + 7 = 12$ describes the number of boxes of cereal and the number of breakfast bars in a kitchen cabinet. If b is the number of breakfast bars, how many breakfast bars are there?

9. **Talk About It** What is the meaning of the term *solution*?

Practice and Problem Solving

Identify the solution of each equation from the list given.

10. $a + 15 = 23$; 6, 7, 8

11. $29 + d = 54$; 24, 25, 26

12. $35 = 45 - n$; 10, 11, 12

13. $19 = p - 12$; 29, 30, 31

14. $6w = 30$; 5, 6, 7

15. $63 = 9k$; 6, 7, 8

16. $36 \div s = 4$; 9, 10, 11

17. $x \div 7 = 3$; 20, 21, 22

Solve each equation mentally.

18. $j + 7 = 13$

19. $m + 4 = 17$

20. $22 = 30 - m$

21. $12 = 24 - y$

22. $15 - b = 12$

23. $25 - k = 20$

24. $5m = 25$

25. $10t = 90$

26. $22 \div y = 2$

27. $d \div 3 = 6$

28. $54 = 6b$

29. $24 = 12k$

30. The equation $45 + k = 63$ represents the total cost before tax of a pair of in-line skates for $45 and a set of kneepads. If k is the cost of the set of kneepads, find the cost of the set of kneepads.

31. The equation $b \div 12 = 6$ describes the height of a grizzly bear, where b is the height of the grizzly bear in inches. What is the height of the grizzly bear in inches?

H.O.T. Problems

32. OPEN ENDED Give an example of an equation that has a solution of 5.

33. REASONING If x is a number that satisfies $4x + 3 = 18$, can x be equal to 3? Explain.

CHALLENGE For Exercises 34 and 35, tell whether each statement is *true* or *false*. Then explain your reasoning.

34. In the expression $m + 8$, the variable m can have any value.

35. In the equation $m + 8 = 12$, any value of the variable is a solution.

36. **WRITING IN ►MATH** Create a real-world problem in which you would solve the equation $a + 12 = 30$.

Standards Practice

37 The graph shows the life expectancy of certain mammals. Which situation could be described by $d + 35 = 80$?

   A the difference between the life expectancy of a blue whale and a gorilla

   B the life expectancy of a blue whale

   C the total life expectancy of a blue whale and a gorilla

   D the difference between the life expectancy of a gorilla and a killer whale

Life Expectancy of Mammals

	Killer Whale	Blue Whale	Human	African Elephant	Gorilla
Years	90	80	76	70	35
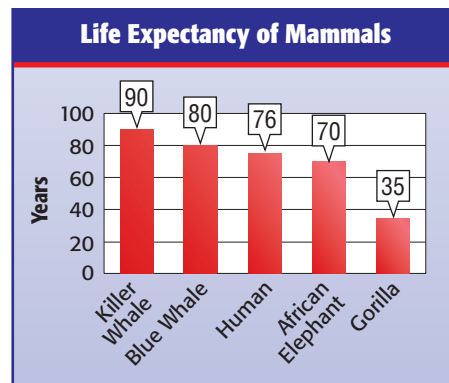
Source: *Scholastic Book of World Records*

Spiral Review

38. On a science quiz, Ivan earned 18 points. If there are 6 problems worth 2 points each and 2 problems worth 4 points each, find the number of problems of each type Ivan answered correctly. **(Lesson 1-7)**

39. Sophia earns a weekly allowance of $4. Define a variable. Write a function rule that relates the total allowance to the number of weeks. Find the total allowance she earns in 8 weeks. **(Lesson 1-6)**

Algebra Evaluate each expression if $r = 2$, $s = 4$, and $t = 6$. **(Lesson 1-5)**

40. $3rst + 14$ **41.** $9 \div 3 \cdot s + t$ **42.** $4 + t \div r \cdot 4s$

Algebra Lab for 1-9
Writing Formulas

The number of square units needed to cover the surface of a figure is called its *area*. In this activity, you will explore how the area and side lengths of rectangles and squares are related. You will then express this relationship as an equation called a *formula*.

MAIN IDEA

I will use tables of data to generate formulas.

Standard 5MR3.3 Develop generalizations of the results obtained and apply them in other circumstances. **Preparation for Standard 5MG1.4** Differentiate between, and use appropriate units of measures for, two- and three-dimensional objects (i.e., find the perimeter, area, volume).

ACTIVITY

1 Step 1 On centimeter grid paper, draw, label, and shade a rectangle with a length of 2 centimeters and a width of 3 centimeters.

2 cm
3 cm
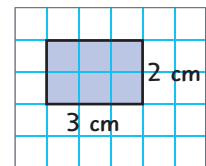
Step 2 Count the number of squares shaded to find the area of the rectangle. Then record this information in a table like the one shown.

Rectangle	Length (cm)	Width (cm)	Area (sq cm)
A	2	3	
B	2	4	
C	2	5	
D	3	4	
E	4	4	
F	5	4	

Reading Math

Units Area is measured in square units. Read *cm²* as *square centimeters.*

Step 3 Repeat Steps 1 and 2 for rectangles B, C, D, E, and F, whose dimensions are shown in the table.

Analyze the Results

1. Describe the relationship between the area of a rectangle and its length and width in words.

2. What would be the area of a rectangle with length 2 centimeters and width 8 centimeters? Test your conjecture by modeling the rectangle and counting the number of shaded squares.

3. **Algebra** If A represents the area of a rectangle, write an equation that describes the relationship between the rectangle's area A, length ℓ, and width w.

ACTIVITY

2 **For each step below, draw new rectangles on grid paper and find the areas. Organize the information in a table.**

Step 1 Using the original rectangles in Activity 1, double each length, but keep the same width.

Step 2 Using the original rectangles in Activity 1, double each width, but keep the same length.

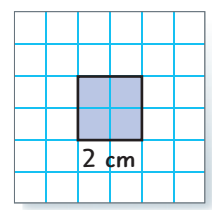**Step 3** Using the original rectangles in Activity 1, double both the length and width.

Analyze the Results

Compare the areas you found in each step to the original areas. Write a sentence describing how the area changed. Explain.

4. Step 1   **5.** Step 2   **6.** Step 3

ACTIVITY

3 **Step 1** On centimeter grid paper, draw, label, and shade a square with a length of 2 centimeters.

Step 2 Count the number of squares shaded to find the area of the square. Record this information in a table like the one shown.

2 cm

Step 3 Repeat Steps 1 and 2 for squares B and C, whose dimensions are shown in the table.

Square	Side Length (cm)	Area (sq cm)
A	2	
B	3	
C	4	

Analyze the Results

7. What would be the area of a square with side lengths of 8 centimeters? Test your conjecture.

8. **Algebra** If A represents the area of a square, write an equation that describes the relationship between the square's area A and side length s.

Algebra: Area Formulas

MAIN IDEA

I will find the areas of rectangles and squares.

Standard 5AF1.2 Use a letter to represent an unknown number; write and evaluate simple algebraic expressions in one variable by substitution. **Standard 5MG1.4** Differentiate between, and **use appropriate units of measures for, two- and three-dimensional objects**.

New Vocabulary

area
formula

GET READY to Learn

Checkered patterns can often be found on game boards and flags. What relationship exists between the length and the width, and the number of squares needed to cover the surface?

Object	Squares Along the Length	Squares Along the Width	Squares Needed to Cover the Surface
flag	4	3	12
game board	8	8	64

The **area** of a figure is the number of square units needed to cover a surface. The rectangle shown has an area of 24 square units.

4 units — 24 square units — 6 units
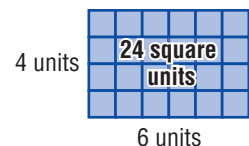
You can also use a formula to find the area of a rectangle. A **formula** is an equation that shows a relationship among certain quantities.

KEY CONCEPT — Area of a Rectangle

Words The area A of a rectangle is the product of the length ℓ and width w.

Model

ℓ — w
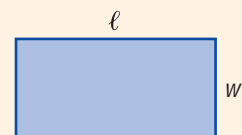
Formula $A = \ell w$

Remember

When finding area, the units are also multiplied. So, area is given in *square units*.

$A = 12 \text{ ft} \times 7 \text{ ft}$
$A = (12 \times 7)(\text{ft} \times \text{ft})$
$A = 84 \text{ ft}^2$

EXAMPLE   Find the Area of a Rectangle

① **Find the area of a rectangle with length 12 feet and width 7 feet.**

7 ft — 12 ft

$A = \ell w$ Area of a rectangle

$A = 12 \cdot 7$ Replace ℓ with 12 and w with 7.

$A = 84$ Multiply.

The area is 84 square feet.

Extra Examples at ca.gr5math.com
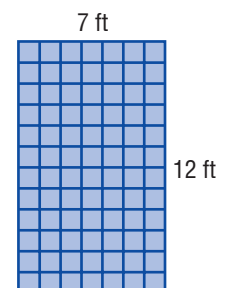
The formula for the area of a square is written with an exponent.

KEY CONCEPT — Area of a Square

Words	The area A of a square is the length of a side s squared.	Model

s

s
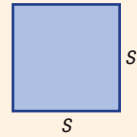
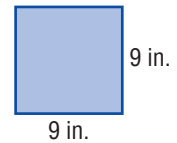**Formula** $A = s^2$

EXAMPLE   Find the Area of a Square

2 **Find the area of a square with side length 9 inches.**

$A = s^2$ Area of a square

$A = 9^2$ Replace s with 9.

$A = 81$ Multiply.

9 in.

9 in.

The area is 81 square inches.

Real-World EXAMPLES

3 **A high school volleyball court is 60 feet long and 30 feet wide. What is the area of a high school volleyball court?**

The length is 60 feet, and the width is 30 feet.

$A = \ell w$ Area of a rectangle

$A = 60 \cdot 30$ Replace ℓ with 60 and w with 30.

$A = 1,800$ Multiply.

The area of a high school volleyball court is 1,800 square feet.

4 **The Junkins are replacing the flooring in their kitchen with ceramic tiles. They are using 6-inch square tiles. What is the area each tile?**

The length of a side is 6 inches.

$A = s^2$ Area of a square

$A = 6^2$ Replace s with 6.

$A = 36$ Multiply.
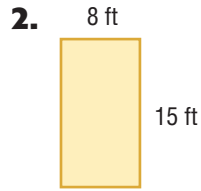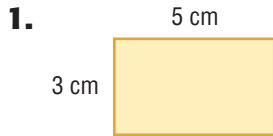
The area of each ceramic tile is 36 square inches.

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Find the area of each rectangle or square. See Examples 1, 2 (pp. 52–53)

1.
5 cm
3 cm

2.
8 ft
15 ft

3.
1 yd
1 yd
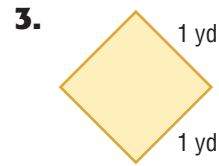
4. Measurement A television screen measures 9 inches by 12 inches. What is the area of the viewing screen?
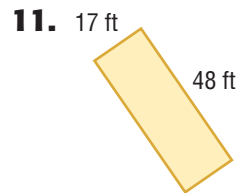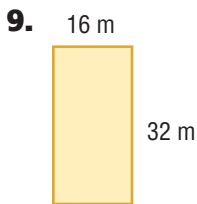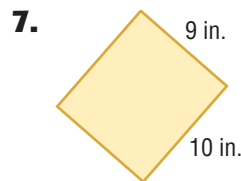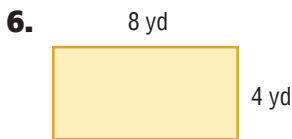
5. Talk About It Describe two ways to find the area of a rectangle. Explain which way is the most useful.

Practice and Problem Solving

Find the area of each rectangle. See Example 1 (p. 52)

6.
8 yd
4 yd

7.
9 in.
10 in.

8.
14 ft
6 ft

9.
16 m
32 m

10.
25 cm
20 cm

11.
17 ft
48 ft

Find the area of each square. See Example 2 (p. 53)

12.
3 m
3 m

13.
10 in.
10 in.

**14.**
12 cm
12 cm
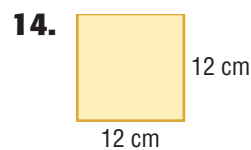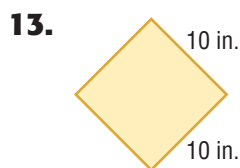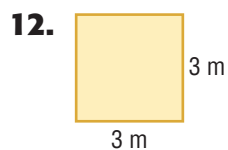
15. What is the area of a square with a side length of 22 feet?

16. Measurement A 3-ring binder measures 11 inches by 10 inches. What is the area of the front cover of the binder?

17. Measurement Meagan and her friends are knitting small squares to join together to form a blanket. The side length of each square must be 7 inches. What is the area of each square?

Find the area of each shaded region.

18.

12 ft

8 ft

4 ft

9 ft

19.

5 m

11 m

5 m

7 m

20.

10 cm

5 cm

15 cm

5 cm
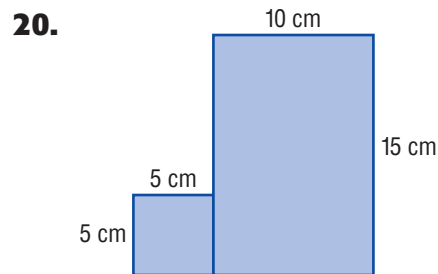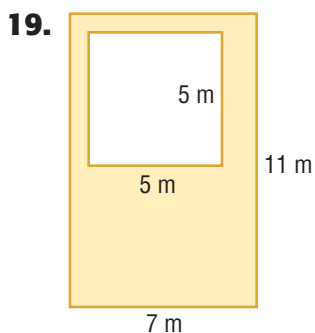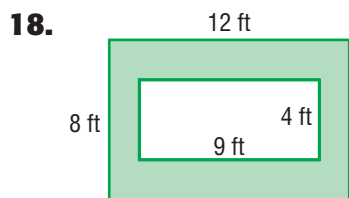
H.O.T. Problems

21. NUMBER SENSE Give the dimensions of two different rectangles that have the same area.

22. CHALLENGE Suppose opposite sides of a rectangle are increased by 3 units. Would the area of the rectangle increase by 6 square units? Use a model in your explanation.

23. WRITING IN MATH Explain how to use the formula for the area of a square. Include the formula for the area of a square in your explanation.

Standards Practice

24 Which rectangle has an area of 54 square units?

A

6 units

8 units

C

8 units

8 units

B

4 units

9 units

D

6 units

9 units
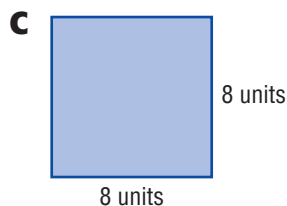
Spiral Review

Algebra Solve each equation mentally. **(Lesson 1-8)**

25. $x + 4 = 12$

26. $9 - m = 5$

27. $k - 8 = 20$

28. James is thinking of three even numbers less than 10 whose sum is 18. Find the numbers. **(Lesson 1-7)**

Lesson 1-9 Algebra: Area Formulas **55**

S W E E T

D R E A M S

Dreamcatchers were first made by the Chippewa people, who hung them over the beds of children to trap bad dreams. The Chippewa are one of the largest Native American groups in North America. In 1990, around 106,000 Chippewa were living throughout their original territories.

Each dreamcatcher is made with many beads and feathers. A simple dreamcatcher has 28 pony beads and is made with 7 yards of string. Today, Native Americans continue to make dreamcatchers on more than 300 reservations.

Did You Know?
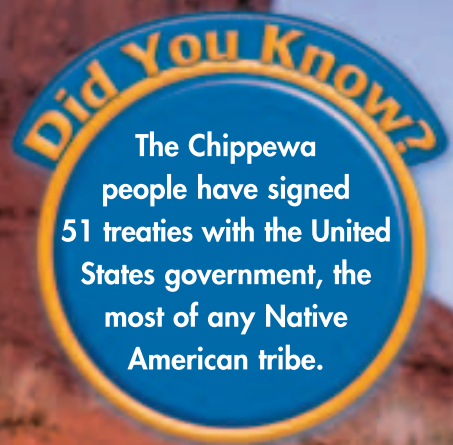
The Chippewa people have signed 51 treaties with the United States government, the most of any Native American tribe.

Real-World Math

Use the information on page 56 to solve each problem.

1. Is the number of yards of string in a simple dreamcatcher a prime or composite number?

2. Write the number of pony beads in a simple dreamcatcher as a product of primes using exponents.

3. Each time you add a feather to a dreamcatcher, you add 3 turquoise beads. Use a function table to find out how many beads you will need if you have 2, 5, 8, or 13 feathers in your dreamcatcher.

4. Find the rule for the function table you created in Exercise 3.

5. You are making dreamcatchers that require 6 beads for every 1 feather. Let f represent the number of feathers. Then write a function rule that relates the total number of beads to the number of feathers.

6. Use the function rule from Exercise 5 to find the number of beads you would use if you made a dreamcatcher with 17 feathers.

7. Suppose you use 12 feathers and a certain amount of beads to make a dreamcatcher. If you had 48 feathers and beads, how many beads did you use?

Algebra: The Distributive Property

GET READY to Learn

Hands-On Mini Lab

To find the area of a rectangle formed by two smaller rectangles, you can use either one of two methods.

Find the area of the blue and yellow rectangles.

One Way: Add the lengths. Then multiply.	**Another Way:** Find each area. Then add.
6 3	6 3
4	4 4
$4 \times (6 + 3) = 4 \times 9$ Add.	$(4 \times 6) + (4 \times 3)$
$= 36$ Simplify.	$= 24 + 12$ Multiply.
	$= 36$ Simplify.

You found that $4 \times (6 + 3) = 36$. You also found that $(4 \times 6) + (4 \times 3) = 36$. So, $4 \times (6 + 3) = (4 \times 6) + (4 \times 3)$.

1. Draw a model showing $2 \times (4 + 6) = (2 \times 4) + (2 \times 6)$.

2. Write an expression that has the same value as $2 \times (5 + 7)$. Explain your reasoning.

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

MAIN IDEA

I will use the Distributive Property in equations and expressions.

Standard 5AF1.3 Know and use the distributive property in equations and expressions with variables.

New Vocabulary

Distributive Property

KEY CONCEPT
Distributive Property

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

Symbols

Numbers	Algebra
$2(7 + 4) = (2 \times 7) + (2 \times 4)$	$a(b + c) = ab + ac$

You can use the Distributive Property to solve some multiplication problems mentally.

Distribute
Everyday Use to divide among several people or things

Distributive
Math Use property that allows you to multiply a sum by a number

EXAMPLE   **Use the Distributive Property**

1 **Find 4×58 mentally using the Distributive Property.**

$$
\begin{aligned}
4 \times 58 &= 4 \times (50 + 8) && \text{Write 58 as } 50 + 8. \\
&= (4 \times 50) + (4 \times 8) && \text{Distributive Property} \\
&= 200 + 32 && \text{Find each product mentally.} \\
&= 232 && \text{Add 200 and 32 mentally.}
\end{aligned}
$$

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Real-World EXAMPLE

2 **More than 10 million people have visited the Wax Museum at Fisherman's Wharf in San Francisco to see wax figures like the ones shown. Suppose admission to a museum costs $5 and bus tickets are $3 per student. What is the cost for 30 students?**

One Way:	Another Way:
Find the cost of 30 admissions and 30 bus tickets. Then add.	Find the cost for 1 person. Then multiply by 30.
$30 \times \$5$ + $30 \times \$3$	$30 \times (\$5 + \$3)$
cost of 30 admissions cost of 30 bus tickets	cost for 1 person

$$
\begin{aligned}
30 \times (5 + 3) &= (30 \times 5) + (30 \times 3) && \text{Distributive Property} \\
&= 150 + 90 && \text{Multiply.} \\
&= 240 && \text{Add.}
\end{aligned}
$$

The total cost is $240 for 30 students.

Find each product mentally. Use the Distributive Property.
See Example 1 (p. 59)

1. 5×84 **2.** 10×23 **3.** 4×42

Rewrite each expression using the Distributive Property. Then evaluate. See Example 1 (p. 59)

4. $3 \times (20 + 4)$ **5.** $5 \times (60 + 5)$ **6.** $(12 \times 10) + (12 \times 8)$

7. Tickets to a college football game cost \$21 per person and seat cushions cost \$4 each. What is the total cost for 3 friends if each gets one ticket and one seat cushion? See Example 2 (p. 59)

8. Talk About It   Explain why $4 \times (6 + 3) = (4 \times 6) + (4 \times 3)$.

▶ **Practice and Problem Solving**

EXTRA PRACTICE
See page 657.

Find each product mentally. Use the Distributive Property.
See Example 1 (p. 59)

9. 7×15 **10.** 3×72 **11.** 25×12

12. 15×11 **13.** 30×8 **14.** 60×2

Rewrite each expression using the Distributive Property. Then evaluate. See Example 1 (p. 59)

15. $7 \times (30 + 6)$ **16.** $12 \times (40 + 7)$ **17.** $2 \times (50 + 4)$

18. $13 \times (30 + 8)$ **19.** $(15 \times 10) + (15 \times 9)$ **20.** $(10 \times 100) + (10 \times 15)$

21. For a walk-a-thon, the 24 students in Mrs. Flores' class walked 12 miles each, and the 24 students in Mr. Gardner's class walked 17 miles each. Find the total number of miles walked. See Example 2 (p. 59)

22. Taylor made 15 party bags for her birthday. Each bag contained 3 chocolate chip cookies and 2 oatmeal cookies. What is the total number of cookies Taylor used? See Example 2 (p. 59)

Find the value of the variable that makes each equation true.

23. $3 \times 16 = (3 \times 10) + (3 \times y)$ **24.** $5 \times 85 = (5 \times z) + (5 \times 5)$

25. $10 \times 54 = (10 \times 50) + (h \times 4)$ **26.** $2 \times 91 = (j \times 90) + (2 \times 1)$

27. $(6 \times 10) + (6 \times k) = 6 \times 16$ **28.** $(4 \times m) + (4 \times 8) = 4 \times 28$

H.O.T. Problems

29. OPEN ENDED Create two equations that illustrate the Distributive Property.

CHALLENGE Rewrite each expression using the Distributive Property.
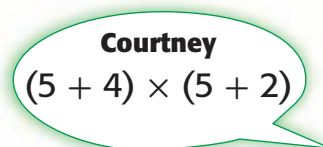
30. $2 \times (y + 2)$ **31.** $m \times (2 + 7)$ **32.** $(j \times 10) + (j \times 3)$

33. FIND THE ERROR Benjamin and Courtney are using the Distributive Property to simplify $5 \times (4 + 2)$. Who is correct? Explain your reasoning.

Benjamin
$(5 \times 4) + (5 \times 2)$

Courtney
$(5 + 4) \times (5 + 2)$

34. **WRITING IN ►MATH** Explain how to use the Distributive Property to find a product mentally.

Standards Practice

35 Which expression is equivalent to $(2 \times 4) + (6 \times 4)$?

A $4 \times (2 \times 6)$

B $6 \times (2 + 4)$

C $4 \times (2 + 6)$

D $2 \times (4 + 6)$

36 What value for y makes the following equation true?

$$2 \times 17 = (2 \times 10) + (2 \times y)$$

F 2   **H** 10

G 7   **J** 17

Spiral Review

37. Measurement James is mowing a rectangular lawn that measures 50 feet by 120 feet. What is the area of the lawn being mowed? **(Lesson 1-9)**

Algebra Solve each equation mentally. **(Lesson 1-8)**

38. $j + 6 = 10$ **39.** $12 = 45 - m$ **40.** $7m = 49$ **41.** $36 \div y = 9$

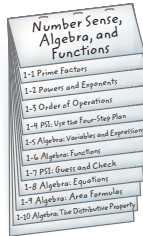**42.** The Milky Way galaxy is about 10^5 light years. What is the value of 10^5? **(Lesson 1-2)**

FOLDABLES Study Organizer — GET READY to Study

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

Number Sense, Algebra, and Functions
- 1-1 Prime Factors
- 1-2 Powers and Exponents
- 1-3 Order of Operations
- 1-4 PSI: Use the Four-Step Plan
- 1-5 Algebra: Variables and Expressions
- 1-6 Algebra: Functions
- 1-7 PSI: Guess and Check
- 1-8 Algebra: Equations
- 1-9 Algebra: Area Formulas
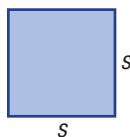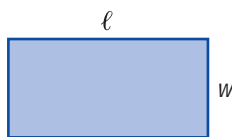- 1-10 Algebra: The Distributive Property

BIG Ideas

Prime and Composite Numbers (Lesson 1-1)

- A prime number has exactly two factors, 1 and the number itself.

- A composite number is a number greater than 1 with more than two factors.

- 1 has only one factor and is neither prime nor composite. 0 has an infinite number of factors and is neither prime nor composite.

Area Formulas (Lesson 1-9)

- The area A of a rectangle is the product of the length ℓ and width w.

- The area A of a square is the length of a side s squared.

The Distributive Property (Lesson 1-10)

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

Numbers: $2 \times (7 + 4) = (2 \times 7) + (2 \times 4)$

Algebra: $a \times (b + c) = ab + ac$

Key Vocabulary

algebra (p. 34)	function (p. 39)
algebraic expression (p. 34)	numerical expression (p. 27)
area (p. 52)	power (p. 22)
base (p. 21)	prime
cubed (p. 22)	factorization (p. 18)
equation (p. 46)	solution (p. 46)
evaluate (p. 34)	solve (p. 46)
exponent (p. 21)	squared (p. 22)
factor (p. 17)	variable (p. 34)

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 <u>formula</u> is used to find the area of a rectangle.

2. When two or more numbers are multiplied, each number is called a <u>factor</u>.

3. The <u>base</u> of a figure is the number of square units needed to cover a surface.

4. A <u>function</u> represents an unknown value.

5. A <u>variable</u> is a relationship that assigns exactly one output value to one input value.
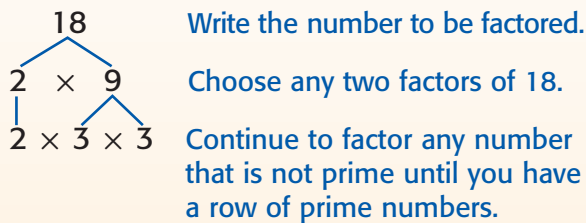
Math Online **Vocabulary Review at** ca.gr5math.com

Lesson-by-Lesson Review

1-1 Prime Factors (pp. 17–20)

Example 1
Find the prime factorization of 18.

Make a factor tree.

18 — Write the number to be factored.

2 × 9 — Choose any two factors of 18.

2 × 3 × 3 — Continue to factor any number that is not prime until you have a row of prime numbers.

The prime factorization of 18 is 2 × 3 × 3.

Tell whether each number is *prime*, *composite*, or *neither*.

6. 44   **7.** 67

Find the prime factorization of each number.

8. 42   **9.** 75   **10.** 96

11. Cryptography uses prime numbers to encode information. Suki's bank account was encoded with the number 273. What are the prime number factors of this code?

1-2 Powers and Exponents (pp. 21–25)

Example 2
Write 4 × 4 × 4 × 4 × 4 × 4 using an exponent. Then find the value of the power.

The base is 4. Since 4 is a factor 6 times, the exponent is 6.

$4 \times 4 \times 4 \times 4 \times 4 \times 4 = 4^6$ or 4,096

Write each product using an exponent. Then find the value of the power.

12. $5 \times 5 \times 5 \times 5$

13. $12 \times 12 \times 12$

14. The average brain weight in grams for a walrus is 2^{10}. Find this value.

1-3 Order of Operations (pp. 27–30)

Example 3
Find the value of 28 ÷ 2 − 1 × 5.

$28 \div 2 - 1 \times 5$

$= 14 - 1 \times 5$ Divide 28 by 2.

$= 14 - 5$ Multiply 1 and 5.

$= 9$ Subtract 5 from 14.

The value of $28 \div 2 - 1 \times 5$ is 9.

Find the value of each expression.

15. $4 \times 6 + 2 \times 3$

16. $11^2 - 6 + 3 \times 15$

17. Maria counted 3 groups of motorcycles, each with 5 motorcycles and an additional 7 motorcycles by themselves. Write and evaluate expression for the number of motorcycles Maria saw.

1-4 **Problem-Solving Investigation:** Use the Four-Step Plan (pp. 32–33)

Example 4

Esteban studied 2 hours each day for 10 days. How many hours has he studied?

Explore You need to find the total number of hours.

Plan Multiply 2 by 10.

Solve $2 \times 10 = 20$
So, Esteban studied 20 hours.

Check Since $20 \div 2 = 10$, the answer makes sense.

Use the four-step plan to solve each problem.

18. Tickets to a school dance cost $4 each. If $352 was collected, how many tickets were sold?

19. In the 1932 presidential election, Franklin Roosevelt won 472 electoral votes while Herbert Hoover won 59. How many electoral votes were cast for these two men?

1-5 **Algebra: Variables and Expressions** (pp. 34–38)

Example 5

Evaluate $9 - k^3$ if $k = 2$.

$9 - k^3 = 9 - 2^3$ Replace k with 2.

$\quad = 9 - 8$ $2^3 = 8$

$\quad = 1$ Subtract 8 from 9.

Example 6

Evaluate $10 + mn$ if $m = 3$ and $n = 5$.

$10 + mn = 10 + (3)(5)$ $m = 3$ and $n = 5$

$\quad = 10 + 15$ Multiply 3 and 5.

$\quad = 25$ Add 10 and 15.

Evaluate each expression if $a = 18$ and $b = 6$.

20. $a \times b$ **21.** $a^2 \div b$

22. $3b^2 + a$ **23.** $2a - 10$

Evaluate each expression if $x = 6$, $y = 8$, and $z = 12$.

24. $2x + 4y$

25. $3z^2 + 4x$

26. $z \div 3 + xy$

27. Joe will tile a square kitchen floor with square ceramic tile. He knows the number of tiles needed is equal to $a^2 \div b^2$, where a is the floor length in inches and b is the length of the tile in inches. If $a = 96$ and $b = 8$, how many tiles are needed?

1-6 **Algebra: Functions** (pp. 39–43)

Example 7
Find a rule for the function table.

Input (x)	Output (■)
6	2
12	4
15	5

Study the relationship between each input and output. Divide each input by 3 to find the output.

So, the function rule is $x \div 3$.

Copy and complete each function table.

28.

Input (x)	x − 1	Output
1	■	■
6	■	■
8	■	■

Find the rule for each function table.

29.

Input (x)	Output (■)
2	8
7	13
12	18

30. Tina drove 60 miles per hour to Tucson. Define a variable. Write a function rule that relates the number of miles traveled to the hours driven.

31. A boy is 5 years older than his sister. Define a variable. Write a function rule that relates the age of the boy to the age of his sister.

1-7 **Problem-Solving Strategy: Guess and Check** (pp. 44–45)

Example 8
Owen is 8 inches taller than his sister, Lisa. If the sum of their heights is 124 inches, how tall is Owen?

Make a guess. Check to see if it is correct. Adjust the guess until it is correct.

Owen's Height		Lisa's Height		Sum of Heights	
60 in.	+	52 in.	=	112 in.	*too low*
68 in.	+	60 in.	=	128 in.	*too high*
66 in.	+	58 in.	=	124 in.	✔

Solve. Use the *guess and check* strategy.

32. A company makes toy cars. It sells red cars for $2 each and black cars for $3 each. If the company sold 44 cars total and made $105, how many red cars were sold?

33. The sum of two numbers is 22 and their product is 117. Find the numbers.

34. Alex caught 3 more catfish than he did trout. If the total number of catfish and trout was 19, how many catfish did he catch?

1-8 Algebra: Equations (pp. 46–49)

Example 9
Solve $x + 9 = 13$ mentally.

$x + 9 = 13$ What number plus 9 is 13?
$4 + 9 = 13$ You know that $4 + 9$ is 13.
$x = 4$

The solution is 4.

Solve each equation mentally.

35. $p + 2 = 9$ **36.** $20 + y = 25$

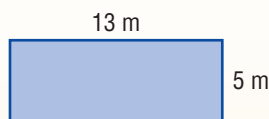**37.** $40 = 15 + m$ **38.** $16 - n = 10$

39. $27 = x - 3$ **40.** $17 = 25 - h$

41. The equation $18 + p = 34$ represents the sum of Pedro's and Eva's ages, where p represents Pedro's age. How old is Pedro?

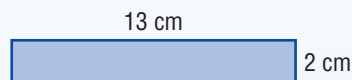## 1-9 Algebra: Area Formulas (pp. 52–55)

Example 10
Find the area of the rectangle.

13 m
5 m

$A = \ell w$ Area of a rectangle
$\quad = 13 \cdot 5$ Replace ℓ with 13 and w with 5.
$\quad = 65$

The area is 65 square meters.

42. Find the area of the rectangle below.

13 cm
2 cm

43. Measurement Find the area of a painting that measures 4 feet by 4 feet.

1-10 Algebra: The Distributive Property (pp. 58–61)

Example 11
Rewrite $4 \times (2 + 9)$ using the Distributive Property. Then evaluate.

$4 \times (2 + 9)$
$= (4 \times 2) + (4 \times 9)$ Distributive Property
$= 8 + 36$ Multiply.
$= 44$ Add.

Rewrite each expression using the Distributive Property. Then evaluate.

44. $4 \times (7 + 2)$

45. $8 \times (14 + 9)$

46. $(3 \times 8) + (3 \times 12)$

47. $(9 \times 6) + (9 \times 13)$

48. Tickets to a movie are $7 for students and $5 for children. What is the total cost of admission for three students and three children?

1. STANDARDS PRACTICE Justin earned $308 by mowing lawns and raking leaves for a total of 43 hours. He raked leaves for 18 hours and earned $108. Arrange the steps below in a correct order to find how much he earned per hour mowing lawns.

Step P: Find the difference between $308 and the amount Justin earned raking leaves.

Step Q: Find the quotient of $200 and the number of hours Justin spent mowing lawns.

Step R: Find the number of hours Justin spent mowing lawns.

Which list shows the steps in the correct order?

A P, Q, R   **C** Q, R, P

B R, Q, P   **D** R, P, Q

Tell whether each number is *prime*, *composite*, or *neither*.

2. 57   **3.** 1   **4.** 31

5. Find the prime factorization of 68.

6. Miranda told 3 friends that it was her birthday. Each of those 3 friends told 3 other students. By noon, 3^5 students knew it was Miranda's birthday. Write this number as a product of the same factor. Then find the value.

Find the value of each expression.

7. $12 - 3 \times 2 + 15$ **8.** $72 \div 2^3 - 4 \times 2$

Evaluate each expression if $a = 4$ and $b = 3$.

9. $a + 12$ **10.** $27 \div b$ **11.** $a^3 - 2b$

12. STANDARDS PRACTICE Latisha and Raquel ordered two beverages for $1.50 each, two dinners for $12.99 each, and a dessert for $3.50. Which of the following expressions can be used to find the amount each should pay, not including tax?

F $1.50 + 2 \times 12.99 + 3.50 \div 2$

G $(2 \times 1.50 + 2 \times 12.99 + 3.50) \div 2$

H $2 \times (1.50 + 12.99 + 3.50)$

J $(2 \times 1.50 + 12.99) + 3.50 \div 2$

Find the rule for each function table.

13.

Input (x)	Output (■)
3	8
7	12
11	16

14.

| Input (x)	Output (■)
0	0
8	1
16	2

15. A potato has 26 grams of carbohydrates. Define a variable. Write a function rule that relates the amount of carbohydrates to the number of potatoes.

16. Diego has $1.30 in quarters, dimes, and nickels. He has the same amount of nickels as quarters, and one more dime than nickels. How many of each coin does he have?

Algebra Solve each equation mentally.

17. $d + 9 = 14$ **18.** $56 = 7k$

19. Measurement Find the area of the rectangle.

17 ft

8 ft
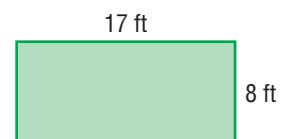
20. WRITING IN MATH Find the value of the variable that makes $7 \times 12 = (7 \times 10) + (7 \times y)$ true. Explain.

Standards Example

The table shows Molly's age and Max's age over 4 consecutive years.

Molly's Age, x (years)	Max's Age, y (years)
2	5
3	6
4	7
5	8

Which expression best represents Max's age in terms of Molly's age?

A $y + 3$ **C** $x + 3$

B $3x$ **D** $3y$

Read the Question

You need to find the expression that best represents Max's age in terms of Molly's age.

Solve the Question

Study the relationship between Molly's age and Max's age. Max's age is 3 more than Molly's age. Molly's age is x years. So, $x + 3$ represents Max's age. The answer is C.

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Choose the best answer.

1 **The cost of renting roller blades is $4 plus an additional $3.50 for each hour that the roller blades are rented. Which equation can be used to find c, the cost in dollars of the rental for h hours?**

A $c = 4h + 3.5$ **C** $c = 3.5(h + 4)$

B $c = 3.5 - 4h$ **D** $c = 3.5h + 4$

2 **Which expression represents the product of m and 30?**

F $30m$

G $30 - m$

H $30 + m$

J $30 \div m$

3 Which situation could be described by the expression $m + 585$?

  A Samantha drove m miles on Friday and 585 miles fewer on Monday

  B Samantha drove 585 miles on Friday and m miles fewer on Monday

  C Samantha drove 585 miles on Friday and m times as many miles on Monday

  D Samantha drove 585 miles on Friday and m miles farther on Monday

4 A sub shop is keeping track of the number of meatball subs sold each day.

Day	Number of Meatball Subs Sold
Monday	40
Tuesday	25
Wednesday	30
Thursday	45
Friday	65

About how many subs were sold during that week?

  F 150 subs   **H** 300 subs

  G 200 subs   **J** 350 subs

5 At a large middle school, there are 18 fifth-grade homerooms and approximately 22 students in each homeroom. About how many fifth-grade students attend the middle school?
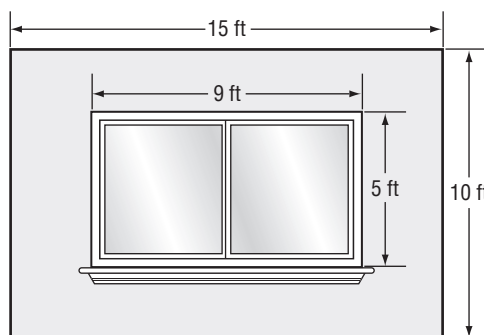
  A 250   **B** 325   **C** 400   **D** 650

6 What value for y makes the following equation true?

$$5 \times 13 = (5 \times 10) + (5 + y)$$

  F 3   **H** 10

  G 5   **J** 13

7 Lynette is painting a 15-foot by 10-foot rectangular wall that has a 9-foot by 5-foot rectangular window at its center. How many square feet of wall space does she need to paint?

  A 45 ft^2 **C** 150 ft^2

  B 105 ft^2 **D** 195 ft^2

8 Which is the prime factorization of 360?

  F 2^7 **H** $3^3 \times 5^2$

  G $2^3 \times 3^2 \times 5$ **J** $3^2 \times 5 \times 7^2$

9 Amanda planted a square garden with sides of 8 feet. Find the area.

  A 16 ft^2 **C** 64 ft^2

  B 32 ft^2 **D** 80 ft^2