

Int
Alg

1

Expressions, Equations, and Functions

- 1.1 Evaluate Expressions
- 1.2 Apply Order of Operations
- 1.3 Write Expressions
- 1.4 Write Equations and Inequalities
- 1.5 Use a Problem Solving Plan
- 1.6 Represent Functions as Rules and Tables
- 1.7 Represent Functions as Graphs

Before

In previous courses, you learned the following skills, which you'll use in Chapter 1: using fractions and percents, and finding perimeter and area.

Prerequisite Skills

VOCABULARY CHECK

Copy and complete the statement.

1. In the fraction $\frac{2}{3}$, ? is the numerator and ? is the denominator.
2. Two fractions that represent the same number are called ? fractions.
3. The word *percent* (%) means "divided by ?."

SKILLS CHECK

Perform the indicated operation. (Review pp. 914–915 for 1.1, 1.2.)

4. $\frac{2}{3} + \frac{3}{5}$

5. $\frac{5}{6} - \frac{3}{4}$

6. $\frac{3}{5} \times \frac{2}{3}$

7. $\frac{1}{2} \div \frac{5}{8}$

Write the percent as a decimal. (Review p. 916 for 1.5.)

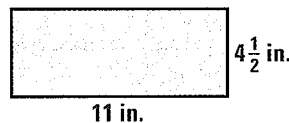
8. 4%

9. 23%

10. 1.5%

11. 2.5%

12. Find the perimeter and area of the rectangle.
(Review p. 924 for 1.5.)



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Now

In Chapter 1, you will apply the big ideas listed below and reviewed in the Chapter Summary on page 52. You will also use the key vocabulary listed below.

Big Ideas

- 1 Writing and evaluating algebraic expressions
- 2 Using expressions to write equations and inequalities
- 3 Representing functions as verbal rules, equations, tables, and graphs

KEY VOCABULARY

- variable, p. 2
- algebraic expression, p. 2
- power, exponent, base, p. 3
- order of operations, p. 8
- verbal model, p. 16
- rate, unit rate, p. 17
- open sentence, p. 21
- equation, inequality, p. 21
- solution of an equation or inequality, p. 22
- formula, p. 30
- function, p. 35
- domain, range, p. 35
- independent variable, p. 36
- dependent variable, p. 36

Why?

You can use multiple representations to describe a real-world situation. For example, you can solve an equation, make a table, or draw a diagram to determine a running route.

Animated Algebra

The animation illustrated below for Example 1 on page 28 helps you answer this question: How does the number of blocks you run affect the total distance?

Your goal is to find a 2 mile running path around the long and short city blocks.

Actual: $0.15 \cdot 2 + 0.1 \cdot 0 = 0.3$ Predicted: $0.15 \cdot 4 + 0.1 \cdot 2 = 0.8$ Submit

Click on a point on the graph to move the runner and see the distance covered.

Animated Algebra at classzone.com

Other animations for Chapter 1: pages 7, 9, 14, 21, 37, 50, and 52

1.1 EXERCISES

HOMEWORK KEY

○ = WORKED-OUT SOLUTIONS
on p. WS1 for Exs. 19, 35, and 51

★ = STANDARDIZED TEST PRACTICE
Exs. 2, 15, 44, 45, 52, and 54

SKILL PRACTICE

- VOCABULARY** Identify the exponent and the base in the expression 6^{12} .
- ★ **WRITING** Describe the steps you would take to evaluate the expression n^5 when $n = 3$. Then evaluate the expression.

EXAMPLE 1

on p. 2
for Exs. 3–15

EVALUATING EXPRESSIONS Evaluate the expression.

- | | | |
|---|--|---|
| 3. $15x$ when $x = 4$ | 4. $0.4r$ when $r = 6$ | 5. $w - 8$ when $w = 20$ |
| 6. $1.6 - g$ when $g = 1.2$ | 7. $5 + m$ when $m = 7$ | 8. $0.8 + h$ when $h = 3.7$ |
| 9. $\frac{24}{f}$ when $f = 8$ | 10. $\frac{t}{5}$ when $t = 4.5$ | 11. $2.5m$ when $m = 4$ |
| 12. $\frac{1}{2}k$ when $k = \frac{2}{3}$ | 13. $y - \frac{1}{2}$ when $y = \frac{5}{6}$ | 14. $h + \frac{1}{3}$ when $h = 1\frac{1}{3}$ |

15. ★ **MULTIPLE CHOICE** What is the value of $2.5m$ when $m = 10$?

- (A) 0.25 (B) 2.5 (C) 12.5 (D) 25

EXAMPLE 3

on p. 3
for Exs. 16–25

WRITING POWERS Write the power in words and as a product.

- | | | | |
|-----------------------|-----------|---------------|---------------|
| 16. 12^5 | 17. 7^3 | 18. $(3.2)^2$ | 19. $(0.3)^4$ |
| 20. $(\frac{1}{2})^8$ | 21. n^7 | 22. y^6 | 23. t^4 |

ERROR ANALYSIS Describe and correct the error in evaluating the power.

24. $(0.4)^2 = 2(0.4) = 0.8$ ✗
25. $5^4 = 4 \cdot 4 \cdot 4 \cdot 4 = 1024$ ✗

EXAMPLE 4

on p. 4
for Exs. 26–37

EVALUATING POWERS Evaluate the power.

- | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|
| 26. 3^2 | 27. 10^2 | 28. 1^5 | 29. 11^3 |
| 30. 5^3 | 31. 3^5 | 32. 2^6 | 33. 6^4 |
| 34. $(\frac{1}{4})^2$ | 35. $(\frac{3}{5})^3$ | 36. $(\frac{2}{3})^4$ | 37. $(\frac{1}{6})^3$ |

EVALUATING EXPRESSIONS Evaluate the expression.


- | | |
|--|---|
| 38. x^2 when $x = \frac{3}{4}$ | 39. p^2 when $p = 1.1$ |
| 40. $x + y$ when $x = 11$ and $y = 6.4$ | 41. kn when $k = 9$ and $n = 4.5$ |
| 42. $w - z$ when $w = 9.5$ and $z = 2.8$ | 43. $\frac{b}{c}$ when $b = 24$ and $c = 2.5$ |
44. ★ **MULTIPLE CHOICE** Which expression has the greatest value when $x = 10$ and $y = 0.5$?
- (A) xy (B) $x - y$ (C) $\frac{x}{y}$ (D) $\frac{y}{x}$

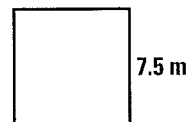
45. ★ **MULTIPLE CHOICE** Let b be the number of tokens you bought at an arcade, and let u be the number you have used. Which expression represents the number of tokens remaining?
- (A) $b + u$ (B) $b - u$ (C) bu (D) $\frac{b}{u}$
46. **COMPARING POWERS** Let x and y be whole numbers greater than 0 with $y > x$. Which has the greater value, 3^x or 3^y ? *Explain.*
47. **CHALLENGE** For which whole number value(s) of x greater than 0 is the value of x^2 greater than the value of 2^x ? *Explain.*


PROBLEM SOLVING

EXAMPLE 2


on p. 3
for Exs. 48–50

48.  **GEOMETRY** The perimeter of a square with a side length of s is given by the expression $4s$. What is the perimeter of the square shown?



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49. **LEOPARD FROG** You can estimate the distance (in centimeters) that a leopard frog can jump using the expression $13l$ where l is the frog's length (in centimeters). What distance can a leopard frog that is 12.5 centimeters long jump?

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50. **MULTI-STEP PROBLEM** Jen was the leading scorer on her soccer team. She scored 120 goals and had 20 assists in her high school career.
- The number n of points awarded for goals is given by $2g$ where g is the number of goals scored. How many points did Jen earn for goals?
 - The point total is given by $n + a$ where a is the number of assists. Use your answer from part (a) to find Jen's point total.

EXAMPLE 5

on p. 4
for Exs. 51–52

51. **MULTI-STEP PROBLEM** You are buying a tank for three fish. You have a flame angel that is 3.5 inches long, a yellow sailfin tang that is 5.5 inches long, and a coral beauty that is 3 inches long. The area (in square inches) of water surface the fish need is given by the expression $12f$ where f is the sum of the lengths (in inches) of all the fish in the tank.

- What is the total length of the three fish?
- How many square inches of water surface do the fish need?

52. ★ **MULTIPLE CHOICE** For a snow sculpture contest, snow is packed into a cube-shaped box with an edge length of 8 feet. The box is frozen and removed, leaving a cube of snow. One cubic foot of the snow weighs about 30 pounds. You can estimate the weight (in pounds) of the cube using the expression $30V$ where V is the volume (in cubic feet) of the snow. About how much does the uncarved cube weigh?

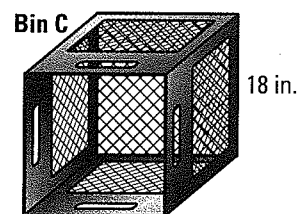
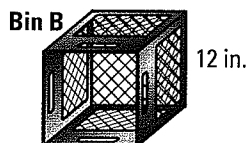
- (A) 240 pounds (B) 1920 pounds
(C) 15,360 pounds (D) 216,000 pounds



53. **FOOTBALL** A football team's net score for the regular season is given by the expression $a - b$ where a is the total number of points the team scored and b is the total number of points scored against the team. The table shows the point totals for the 2003 National Football League Conference Champions. Which team's net score was greater?

Team	Points scored, a	Points scored against, b
New England Patriots	336	238
Carolina Panthers	325	304

54. **★ EXTENDED RESPONSE** A manufacturer produces three different sizes of cube-shaped stacking bins with edge lengths as shown.



- Evaluate** Find the volume of each bin.
- Compare** How many times greater is the edge length of bin B than the edge length of bin A? How many times greater is the volume of bin B than the volume of bin A?
- Compare** Answer the questions in part (b) for bin A and bin C.
- CHALLENGE** Explain how multiplying the edge length of a cube by a number n affects the volume of the cube. Justify your explanation.

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55. **CHALLENGE** You purchase a set of 100 cube-shaped miniature magnets, each with an edge length of $\frac{1}{8}$ inch. You arrange the cubes to form larger cubes, each one with a different edge length. How many cubes can you form? What is their total volume?

MIXED REVIEW

PREVIEW

Prepare for
Lesson 1.2 in
Exs. 56–59.

Perform the indicated operation.

56. $\frac{13}{16} - \frac{1}{8}$ (p. 914)

57. $\frac{3}{4} + \frac{1}{3}$ (p. 914)

58. $\frac{4}{7} \times \frac{7}{9}$ (p. 915)

59. $\frac{3}{20} \div \frac{5}{8}$ (p. 915)

Write the percent as a decimal and as a fraction. (p. 916)


60. 37%


61. 15%

62. 125%

63. 0.2%

Find the perimeter of the rectangle or square. (p. 924)

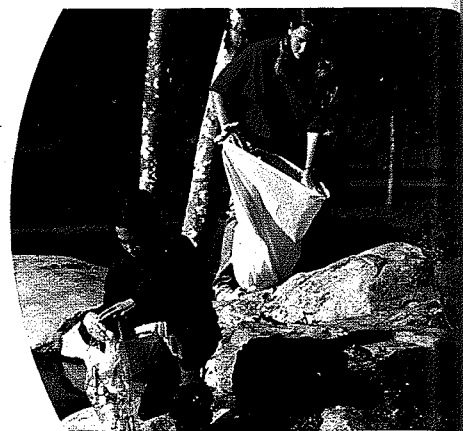
64.  3.5 m
9.1 m

65.  14 in.
14 in.



EXAMPLE 4 Standardized Test Practice

A group of 12 students volunteers to collect litter for one day. A sponsor provides 3 juice drinks and 2 sandwiches for each student and pays \$30 for trash bags. The sponsor's cost (in dollars) is given by the expression $12(3j + 2s) + 30$ where j is the cost of a juice drink and s is the cost of a sandwich. A juice drink costs \$1.25. A sandwich costs \$2. What is the sponsor's cost?



ELIMINATE CHOICES

You can eliminate choices A and D by estimating. When j is about 1 and s is 2, the value of the expression is about $12(3 + 4) + 30$, or \$114.

- (A) \$79 (B) \$123 (C) \$129 (D) \$210

Solution

$$\begin{aligned} 12(3j + 2s) + 30 &= 12(3 \cdot 1.25 + 2 \cdot 2) + 30 && \text{Substitute 1.25 for } j \text{ and 2 for } s. \\ &= 12(3.75 + 4) + 30 && \text{Multiply within parentheses.} \\ &= 12(7.75) + 30 && \text{Add within parentheses.} \\ &= 93 + 30 && \text{Multiply.} \\ &= 123 && \text{Add.} \end{aligned}$$

► The sponsor's cost is \$123. The correct answer is B. (A) (B) (C) (D).



GUIDED PRACTICE for Example 4

11. **WHAT IF?** In Example 4, suppose the number of volunteers doubles. Does the sponsor's cost double as well? *Explain.*

1.2 EXERCISES

HOMEWORK KEY ○ = WORKED-OUT SOLUTIONS on p. WS1 for Exs. 16 and 35
★ = STANDARDIZED TEST PRACTICE Exs. 2, 19, 31, 37, 39, and 40

SKILL PRACTICE

1. **VOCABULARY** According to the order of operations, which operation would you perform first in simplifying $50 - 5 \times 4^2 \div 2$?

2. ★ **WRITING** Describe the steps you would use to evaluate the expression $2(3x + 1)^2$ when $x = 3$.

EVALUATING EXPRESSIONS Evaluate the expression.

- | | | | |
|--------------------------------|---------------------------------|-----------------------------------|-------------------------|
| 3. $13 - 8 + 3$ | 4. $8 - 2^2$ | 5. $3 \cdot 6 - 4$ | 6. $5 \cdot 2^3 + 7$ |
| 7. $48 \div 4^2 + \frac{3}{5}$ | 8. $1 + 5^2 \div 50$ | 9. $2^4 \cdot 4 - 2 \div 8$ | 10. $4^3 \div 8 + 8$ |
| 11. $(12 + 72) \div 4$ | 12. $24 + 4(3 + 1)$ | 13. $12(6 - 3.5)^2 - 1.5$ | 14. $24 \div (8 + 4^2)$ |
| 15. $\frac{1}{2}(21 + 2^2)$ | 16. $\frac{1}{6}(6 + 18) - 2^2$ | 17. $\frac{3}{4}[13 - (2 + 3)]^2$ | 18. $8[20 - (9 - 5)^2]$ |

EXAMPLES

1 and 2
on pp. 8–9
for Exs. 3–21

19. ★ **MULTIPLE CHOICE** What is the value of $3[20 - (7 - 5)^2]$?

- (A) 48 (B) 56 (C) 192 (D) 972

ERROR ANALYSIS Describe and correct the error in evaluating the expression.

$$\begin{aligned} 20. \quad (1 + 13) \div 7 + 7 &= 14 \div 7 + 7 \\ &= 14 \div 14 \\ &= 1 \end{aligned}$$



$$\begin{aligned} 21. \quad 20 - \frac{1}{2} \cdot 6^2 &= 20 - 3^2 \\ &= 20 - 9 \\ &= 11 \end{aligned}$$



EXAMPLE 3
on p. 9
for Exs. 22–31

EVALUATING EXPRESSIONS Evaluate the expression.

22. $4n - 12$ when $n = 7$ 23. $2 + 3x^2$ when $x = 3$ 24. $6t^2 - 13$ when $t = 2$
25. $11 + r^3 - 2r$ when $r = 5$ 26. $5(w - 4)$ when $w = 7$ 27. $3(m^2 - 2)$ when $m = 1.5$
28. $\frac{9x + 4}{3x + 1}$ when $x = 7$ 29. $\frac{k^2 - 1}{k + 3}$ when $k = 5$ 30. $\frac{b^3 - 21}{5b + 9}$ when $b = 3$

31. ★ **MULTIPLE CHOICE** What is the value of $\frac{x^2}{25} + 3x$ when $x = 10$?

- (A) 26 (B) 34 (C) 43 (D) 105

CHALLENGE Insert grouping symbols in the expression so that the value of the expression is 14.

32. $9 + 39 + 22 \div 11 - 9 + 3$ 33. $2 \times 2 + 3^2 - 4 + 3 \times 5$

PROBLEM SOLVING

EXAMPLE 4
on p. 10
for Exs. 34–37

34. **SALES** Your school's booster club sells school T-shirts. Half the T-shirts come from one supplier at a cost of \$5.95 each, and half from another supplier at a cost of \$6.15 each. The average cost (in dollars) of a T-shirt is given by the expression $\frac{5.95 + 6.15}{2}$. Find the average cost.

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35. **MULTI-STEP PROBLEM** You join an online music service. The total cost (in dollars) of downloading 3 singles at \$.99 each and 2 albums at \$9.95 each is given by the expression $3 \cdot 0.99 + 2 \cdot 9.95$.

- a. Find the total cost.
b. You have \$25 to spend. How much will you have left?

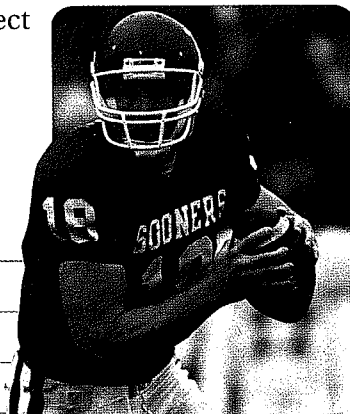
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36. **PHYSIOLOGY** If you know how tall you were at the age of 2, you can estimate your adult height (in inches). Girls can use the expression $25 + 1.17h$ where h is the height (in inches) at the age of 2. Boys can use the expression $22.7 + 1.37h$. Estimate the adult height of each person to the nearest inch.

- a. A girl who was 34 inches tall at age 2
b. A boy who was 33 inches tall at age 2

37. **★ OPEN-ENDED** Write a numerical expression including parentheses that has the same value when you remove the parentheses.
38. **ONLINE SHOPPING** The regular shipping fee (in dollars) for an online computer store is given by the expression $0.5w + 4.49$ where w is the weight (in pounds) of the item. The fee (in dollars) for rush delivery is given by $0.99w + 6.49$. You purchase a 26.5 pound computer. How much do you save using regular shipping instead of rush delivery?
39. **★ SHORT RESPONSE** You make and sell flags for \$10 each. Each flag requires \$4.50 worth of fabric. You pay \$12.99 for a kit to punch holes to hang the flags. Your expenses (in dollars) are given by the expression $4.50m + 12.99$ where m is the number of flags you make. Your income is given by the expression $10s$ where s is the number of flags you sell. Your profit is equal to the difference of your income and your expenses.
- You make 50 flags and sell 38 of them. Find your income and your expenses. Then find your profit.
 - Explain* how you could use a single expression to determine your profit.
40. **★ EXTENDED RESPONSE** Each year Heisman Trophy voters select the outstanding college football player. Each voter selects three players ranked first to third. A first place vote is worth 3 points, a second place vote is worth 2 points, and a third place vote is worth 1 point. Let f , s , and t be, respectively, the number of first place, second place, and third place votes a player gets. The table shows the votes for the winner and the runner-up in 2003.

Player	First place	Second place	Third place
Jason White	319	204	116
Larry Fitzgerald	253	233	128



- Analyze** *Explain* why the expression $3f + 2s + t$ represents a player's point total.
- Calculate** Use the expression in part (a) to determine how many more points Jason White got than Larry Fitzgerald got.
- CHALLENGE** Can you rearrange the order of the votes for each player in such a way that Larry Fitzgerald would have won? *Explain*.

MIXED REVIEW

PREVIEW
Prepare for
Lesson 1.3 in
Exs. 41–48.

Copy and complete. (p. 929)

41. $360 \text{ in.} = \underline{\quad} \text{ ft}$ 42. $250 \text{ g} = \underline{\quad} \text{ kg}$ 43. $8 \text{ ft}^2 = \underline{\quad} \text{ in.}^2$ 44. $80 \text{ L} = \underline{\quad} \text{ mL}$

Find the value of the expression when $x = 5$. (p. 2)

45. $x + 4.7$ 46. $19.3 - x$ 47. $\frac{1}{2}x$ 48. $x - \frac{3}{4}$

Evaluate the power. (p. 2)

49. 6^2 50. 10^4 51. $(0.2)^2$ 52. $\left(\frac{2}{3}\right)^3$

1.2 Use Order of Operations

QUESTION How can you use a graphing calculator to evaluate an expression?

You can use a graphing calculator to evaluate an expression. When you enter the expression, it is important to use grouping symbols so that the calculator performs operations in the correct order.

EXAMPLE Evaluate an expression

Use a graphing calculator to evaluate an expression.

Lean body mass is the mass of the skeleton, muscles, and organs. Physicians use lean body mass to determine dosages of medicine.

Scientists have developed separate formulas for the lean body masses of men and women based on their mass m (in kilograms) and height h (in meters). Lean body mass is measured in units called BMI (Body Mass Index) units.

$$\text{Men: } 1.10m - \frac{128m^2}{10,000h^2} \quad \text{Women: } 1.07m - \frac{148m^2}{10,000h^2}$$

Find the lean body mass (in BMI units) of a man who is 1.8 meters tall and has a mass of 80 kilograms.

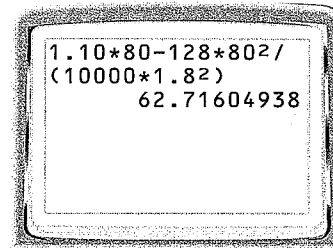
Solution

Enter the expression for men in the calculator. Substitute 80 for m and 1.8 for h . Because the fraction bar is a grouping symbol, enter the denominator using parentheses.

Use the following keystrokes.

1.10 \times 80 $-$ 128 \times 80 x^2 \div (10000 \times 1.8 x^2)

► The lean body mass of a man who is 1.8 meters tall and has a mass of 80 kilograms is about 62.7 BMI units.



PRACTICE

Use a calculator to evaluate the expression for $n = 4$. Round to the nearest thousandth.

1. $3 + 5 \cdot n \div 10$

2. $2 + \frac{3n^2}{4}$

3. $\frac{83}{3n^2} - 1.3$

4. $\frac{14.2n}{8 + n^3}$

5. $\frac{7 - n}{n^2}$

6. $5n^2 + \frac{4n^3 + 1}{3}$

7. Find the lean body mass (to the nearest tenth of a BMI unit) of a woman who is 1.6 meters tall and has a mass of 54 kilograms.

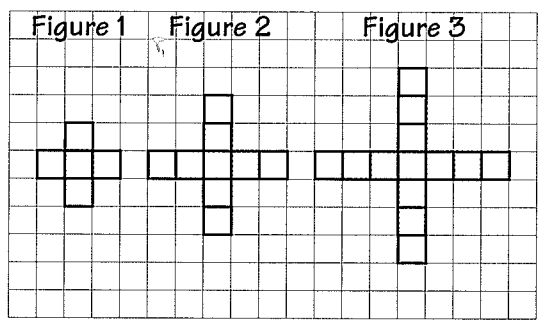
1.3 Patterns and Expressions

MATERIALS • graph paper

QUESTION How can you use an algebraic expression to describe a pattern?

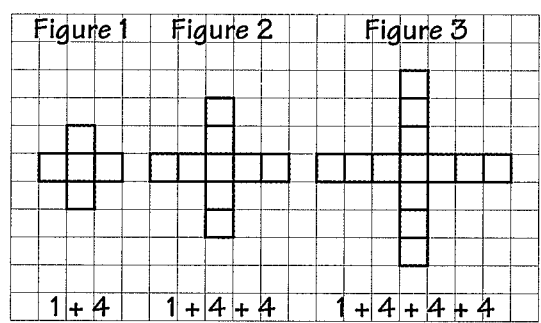
EXPLORE Create and describe a pattern

STEP 1



Draw a figure Draw a unit square on graph paper. Then draw a unit square against each side of the first square to form figure 1. Copy figure 1 and draw a square on each “arm” to form figure 2. Use the same method to form figure 3.

STEP 2

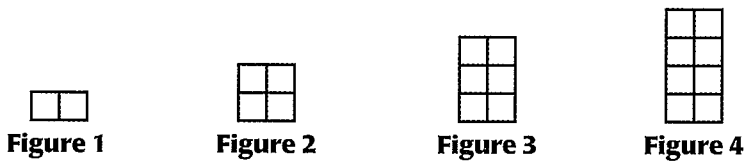


Write expressions For each figure, write a numerical expression that describes the number of squares in the figure.

DRAW CONCLUSIONS Use your observations to complete these exercises

In Exercises 1–3, use the pattern in Steps 1 and 2 above.

- How is the figure number related to the number of times 4 is added in the numerical expression? Predict the number of squares in the fourth figure. Create figure 4 and check your prediction.
- Describe how to calculate the number of squares in the n th figure.
- Write an algebraic expression for the number of squares in the n th figure. (*Hint:* Remember that repeated addition can be written as multiplication.)
- Write an algebraic expression for the number of squares in the n th figure of the pattern shown.



1.3 EXERCISES

HOMEWORK KEY:

○ = WORKED-OUT SOLUTIONS
on p. WS1 for Exs. 11, 21, and 33

★ = STANDARDIZED TEST PRACTICE
Exs. 2, 13, 14, 34, and 37

SKILL PRACTICE

EXAMPLE 1

on p. 15
for Exs. 3–14

1. **VOCABULARY** Copy and complete: A(n) ? is a fraction that compares two quantities measured in different units.

2. ★ **WRITING** Explain how to write $\frac{20 \text{ miles}}{4 \text{ hours}}$ as a unit rate.

TRANSLATING PHRASES Translate the verbal phrase into an expression.

3. 8 more than a number x

4. The product of 6 and a number y

5. $\frac{1}{2}$ of a number m

6. 50 divided by a number h

7. The difference of 7 and a number n

8. The sum of 15 and a number x

9. The quotient of twice a number t and 12

10. 3 less than the square of a number p

11. 7 less than twice a number k

12. 5 more than 3 times a number w

13. ★ **MULTIPLE CHOICE** Which expression represents the phrase “the product of 15 and the quantity 12 more than a number x ”?

(A) $15 + 12 \cdot x$

(B) $(15 + 12)x$

(C) $15(x + 12)$

(D) $15 \cdot 12 + x$

14. ★ **MULTIPLE CHOICE** Which expression represents the phrase “twice the quotient of 50 and the sum of a number y and 8”?

(A) $\frac{2 \cdot 50}{y} + 8$

(B) $2\left(\frac{50 + y}{8}\right)$

(C) $2\left(\frac{50}{y + 8}\right)$

(D) $\frac{2}{50} + (y + 8)$

EXAMPLES

2 and 3

on p. 16
for Exs. 15–21

WRITING EXPRESSIONS Write an expression for the situation.

15. Number of tokens needed for v video games if each game takes 4 tokens

16. Number of pages of a 5 page article left to read if you’ve read p pages

17. Each person’s share if p people share 16 slices of pizza equally

18. Amount you spend if you buy a shirt for \$20 and jeans for j dollars

19. Number of days left in the week if d days have passed so far

20. Number of hours in m minutes

21. Number of months in y years

EXAMPLE 4

on p. 17
for Exs. 22–27

UNIT RATES Find the unit rate.


22. $\frac{32 \text{ students}}{4 \text{ groups}}$


23. $\frac{4.5 \text{ pints}}{3 \text{ servings}}$

24. $\frac{12 \text{ runs}}{5 \text{ innings}}$

25. $\frac{\$136}{20 \text{ shares}}$

ERROR ANALYSIS Describe and correct the error in the units.

26. $\frac{\$2}{\text{foot}} \cdot 24 \text{ feet} = \frac{\$48}{\text{ft}^2}$ 

27. $9 \text{ yards} \cdot \frac{3 \text{ feet}}{1 \text{ yard}} \cdot \frac{\$2}{\text{foot}} = \frac{\$54}{\text{ft}}$ 

COMPARING RATES In Exercises 28 and 29, tell which rate is greater.

28. $1\frac{1}{4}$ miles in 2 minutes and 4 seconds, or $1\frac{3}{16}$ miles in 1 minute and 55 seconds

29. \$1.60 for 5 minutes, or \$19.50 for 1 hour

30. **CHALLENGE** Look for a pattern in the expressions shown below. Use the pattern to write an expression for the sum of the whole numbers from 1 to n . Then find the sum of the whole numbers from 1 to 50.

$$1 + 2 = \frac{2 \cdot 3}{2}$$

$$1 + 2 + 3 = \frac{3 \cdot 4}{2}$$

$$1 + 2 + 3 + 4 = \frac{4 \cdot 5}{2}$$

PROBLEM SOLVING

EXAMPLE 5

on p. 17

for Exs. 31–34

31. **TICKET PRICES** Tickets to a science museum cost \$19.95 each. There is a \$3 charge for each order no matter how many tickets are ordered. Write an expression for the cost (in dollars) of ordering tickets. Then find the total cost if you order 5 tickets.

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32. **FOSSIL FUELS** Fossil fuels are produced by the decay of organic material over millions of years. To make one gallon of gas, it takes about 98 tons of organic material, roughly the amount of wheat that could be harvested in a 40 acre field. Write an expression for the amount (in tons) of organic material it takes to make g gallons of gas. How many tons would it take to make enough gas to fill a car's 20 gallon gas tank?

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33. **MULTI-STEP PROBLEM** A 48 ounce container of juice costs \$2.64. A 64 ounce container of the same juice costs \$3.84.

- Find the cost per ounce of each container.
- Which size container costs less per ounce?
- You want to buy 192 ounces of juice. How much do you save using the container size from your answer to part (b)?

34. **★ OPEN-ENDED** Describe a real-world situation that can be modeled by the rate $\frac{30}{x}$ where x is a period of time (in hours). Identify the units for 30. Choose a value for x and find the unit rate.

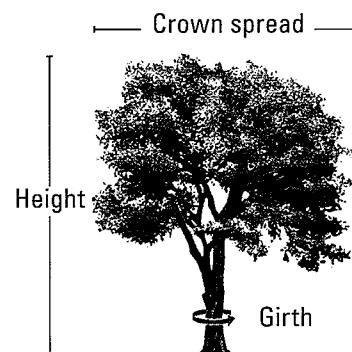
35. **WILDLIFE EDUCATION** A wildlife center presents a program about birds of prey. The center charges a basic fee of \$325 and an additional fee for each bird exhibited. If 5 birds are exhibited, the additional fee is \$125. What is the total cost if 7 birds are exhibited?

36. **DIGITAL PHOTOS** Your printer takes 36 seconds to print a small photo and 60 seconds to print a large one. Write an expression for the time (in seconds) your printer would take to print a batch including both small and large photos. Then find the time your printer would take to print 12 small photos and 5 large photos.



37. ★ **EXTENDED RESPONSE** A national survey determines the champion tree in a species. The champion is the tree with the greatest score, based on the tree's girth, its height, and its crown spread as shown.

A tree's score is the sum of the girth in inches, the height in feet, and $\frac{1}{4}$ the crown spread in feet. The data for three champion trees are given. Note that the girth is given in feet.

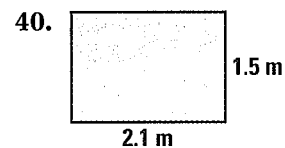
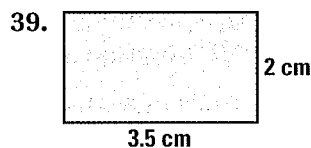
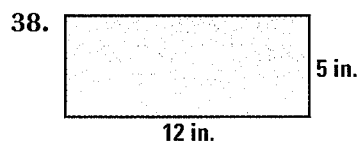


Species	Girth (ft)	Height (ft)	Crown spread (ft)
Narrowleaf cottonwood	12	97	24
Green ash	21.5	95	95
Green buttonwood	14.5	51	68

- a. **Write** Write an expression for a tree's score.
 b. **Evaluate** Find the score for each tree in the table.
 c. **CHALLENGE** Let n be any number greater than 0. Which change would have the greatest effect on a tree's score, an increase of n feet in the girth, in the height, or in the crown spread? *Explain* your reasoning.

MIXED REVIEW

Find the area of the rectangle. (p. 924)



PREVIEW
 Prepare for
 Lesson 1.4
 in Exs. 41–46.

Evaluate the expression.

41. $18x$ when $x = 5$ (p. 2) 42. $y - 6$ when $y = 22$ (p. 2) 43. $5 + z$ when $z = 11$ (p. 2)
 44. $\frac{g}{7} + 2$ when $g = 35$ (p. 10) 45. $5 - 2y^2$ when $y = 1$ (p. 10) 46. $\frac{a + 9}{2}$ when $a = 4$ (p. 10)

QUIZ for Lessons 1.1–1.3

Evaluate the expression.

1. $y + 10$ when $y = 43$ (p. 2) 2. $15 - b$ when $b = 9$ (p. 2) 3. t^2 when $t = 20$ (p. 2)
 4. $3n - 5$ when $n = 8$ (p. 8) 5. $2y^2 - 1$ when $y = 5$ (p. 8) 6. $\frac{3x - 6}{8}$ when $x = 8$ (p. 8)

Translate the verbal phrase into an expression. (p. 15)

7. 7 less than a number y 8. 5 more than a number t 9. Twice a number k
 10. **CAMPING** The rental cost for a campsite is \$25 plus \$2 per person. Write an expression for the total cost. Then find the total cost for 5 people. (p. 15)

1.4 EXERCISES

HOMEWORK KEY

○ = WORKED-OUT SOLUTIONS
on p. WS1 for Exs. 7 and 41

★ = STANDARDIZED TEST PRACTICE
Exs. 2, 16, 37, 44, 45, and 46

SKILL PRACTICE

EXAMPLE 1

on p. 21
for Exs. 3–16

- VOCABULARY** Give an example of an open sentence.
- ★ **WRITING** Describe the difference between an expression and an equation.

WRITING OPEN SENTENCES Write an equation or an inequality.

- The sum of 42 and a number n is equal to 51.
- The difference of a number z and 11 is equal to 35.
- The difference of 9 and the quotient of a number t and 6 is 5.
- The sum of 12 and the quantity 8 times a number k is equal to 48.
- The product of 9 and the quantity 5 more than a number t is less than 6.
- The product of 4 and a number w is at most 51.
- The sum of a number b and 3 is greater than 8 and less than 12.
- The product of 8 and a number k is greater than 4 and no more than 16.
- The difference of a number t and 7 is greater than 10 and less than 20.

STORE SALES Write an inequality for the price p (in dollars) described.

12.  **Sale!**
Nothing over \$10!

13.  Prices start at \$12.99

ERROR ANALYSIS Describe and correct the error in writing the verbal sentence as an equation or an inequality.

- The sum of a number n and 4 is no more than 13.
- The quotient of a number t and 4.2 is at most 15.

$$n + 4 < 13 \quad \times$$

$$\frac{t}{4.2} > 15 \quad \times$$

- ★ **MULTIPLE CHOICE** Which equation corresponds to the sentence “The product of a number b and 3 is no less than 12”?

- (A) $3b < 12$ (B) $3b \leq 12$ (C) $3b > 12$ (D) $3b \geq 12$

EXAMPLE 2

on p. 22
for Exs. 17–28

CHECK POSSIBLE SOLUTIONS Check whether the given number is a solution of the equation or inequality.

- | | | |
|---------------------------------|--------------------------------|-----------------------------------|
| 17. $x + 9 = 17$; 8 | 18. $9 + 4y = 17$; 1 | 19. $6f - 7 = 29$; 5 |
| 20. $\frac{k}{5} + 9 = 11$; 10 | 21. $\frac{r}{3} - 4 = 4$; 12 | 22. $\frac{x-5}{3} \geq 2.8$; 11 |
| 23. $15 - 4y > 6$; 2 | 24. $y - 3.5 < 6$; 9 | 25. $2 + 3x \leq 8$; 2 |
| 26. $2p - 1 \geq 7$; 3 | 27. $4z - 5 < 3$; 2 | 28. $3z + 7 > 20$; 4 |

EXAMPLE 3

on p. 22
for Exs. 29–34

MENTAL MATH Solve the equation using mental math.

29. $x + 8 = 13$

30. $y + 16 = 25$

31. $z - 11 = 1$

32. $5w = 20$

33. $8b = 72$

34. $\frac{f}{6} = 4$


EQUATIONS AND INEQUALITIES In Exercises 35 and 36, write an open sentence. Then check whether $3\frac{1}{2}$ is a solution of the open sentence.35. 2 less than the product of 3 and a number x is equal to the sum of x and 5.36. 4 more than twice a number k is no greater than the sum of k and 11.37. ★ **MULTIPLE CHOICE** Which equation has the same solution as $z - 9 = 3$?

- Ⓐ $z - 4 = 16$ Ⓑ $\frac{1}{2}z = 7$ Ⓒ $z + 15 = 27$ Ⓓ $5z = 45$


38. **CHALLENGE** Use mental math to solve the equation $3x + 4 = 19$. *Explain* your thinking.**PROBLEM SOLVING****EXAMPLES****4 and 5**

on p. 23
for Exs. 39–43

39. **CHARITY WALK** You are taking part in a charity walk, and you have walked 12.5 miles so far. Your goal is to walk 20 miles. How many more miles do you need to walk to meet your goal?

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40. **COMPACT DISCS** You buy a storage rack that holds 40 CDs. You have 27 CDs. Write an inequality that describes how many more CDs you can buy and still have no more CDs than the rack can hold. You buy 15 CDs. Will they all still fit?

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41. **ECO-CHALLENGE** Eco-Challenge Fiji was a competition that included jungle trekking, ocean swimming, mountain biking, and river kayaking. In 2002, the U.S. team finished second about 6 hours after the winning team from New Zealand. The U.S. team finished in about 173 hours. What was the winning team's time?

42. **BAKING MEASUREMENTS** You are baking batches of cookies for a bake sale. Each batch takes 2.5 cups of flour. You have 18 cups of flour. Can you bake 8 batches? *Explain.*43. **EMPLOYMENT** Your friend takes a job cleaning up a neighbor's yard and mowing the grass, and asks you and two other friends to help. Your friend divides the amount the neighbor pays equally among all the members of the group. Each of you got \$25. How much did the neighbor pay?44. ★ **OPEN-ENDED** Describe a real-world situation you could model using the equation $5x = 50$. Use mental math to solve the equation. *Explain* what the solution means in this situation.

45. ★ **SHORT RESPONSE** You have two part-time jobs. You earn \$6 per hour running errands and \$5 per hour walking dogs. You can work a total of 10 hours this weekend and hope to earn at least \$55. Let r be the number of hours you spend running errands.
- Write an inequality that describes the situation. Your inequality should involve only one variable, r .
 - If you spend the same amount of time at each job, will you meet your goal? *Explain.*
 - Can you meet your goal by working all 10 hours at only one job? *Explain.*
46. ★ **EXTENDED RESPONSE** Your school's service club is sponsoring a dance in the school gym to raise money for a local charity. The expenses will be \$600. The club members will sell tickets for \$10. They hope to raise enough money to cover the expenses and have enough left to donate \$1000 to the charity.
- How many tickets must they sell to cover their expenses?
 - How many tickets must they sell to cover their expenses and meet their goal?
 - The school allows no more than 200 students in the gymnasium for a dance. Can the club members sell enough tickets to exceed their goal? What is the greatest possible amount by which they can exceed their goal? *Explain* your reasoning.
47. **CHALLENGE** You and your friend are reading the same series of science fiction books. You tell your friend, "I've read 3 times as many books as you have." Your friend replies, "You've read only 4 more books than I have." How many books have each of you read?
48. **CHALLENGE** Each of the long sides of a rectangle has a length of x inches. Each of the other sides is 1 inch shorter than the long sides. The perimeter of the rectangle is 22 inches. Find the length and the width of the rectangle. *Justify* your answer.

MIXED REVIEW

PREVIEW

Prepare for
Lesson 1.5
in Exs. 49–54.

Write the percent as a decimal. (p. 916)

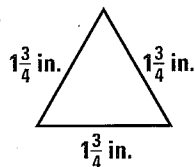
49. 3%

50. 3.5%

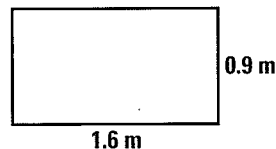
51. 5.25%

Find the perimeter of the triangle or rectangle. (p. 924)

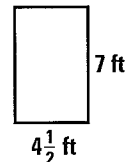
52.



53.



54.



Evaluate the expression. (p. 8)

55. $9 \cdot 3^2 - 2$

56. $4 \div 2^2 + \frac{1}{7}$

57. $5 \div 0.25 \cdot 3$





Lessons 1.1–1.4

1. MULTI-STEP PROBLEM You are making a photo quilt by transferring photos to squares of fabric. Each square should be big enough so that you can turn over an edge $\frac{5}{8}$ inch long on each side and have a finished square with a side length of $5\frac{3}{4}$ inches.

- What are the dimensions of each fabric square?
- How many square inches of fabric do you need if you want to include 48 squares?
- The fabric you buy is 36 inches wide. How long a piece of fabric do you need?
- You buy a piece of fabric that has the length you found in part (c). Once you've cut all the squares, how many square inches of fabric are left over?

2. MULTI-STEP PROBLEM A rule of thumb states that the ideal weight (in ounces) of a baseball bat for a high school baseball player is 5 ounces more than one third of the player's height (in inches).



- Write an expression that describes the ideal weight (in ounces) of a bat for a high school baseball player who is h inches tall.
- One player was 66 inches tall last year. This year the player is 69 inches tall. How much heavier should the player's new bat be than the bat used last year?

3. SHORT RESPONSE You collect miniature cars and display them on shelves that hold 20 cars each.

- Which expression would you evaluate to find the number of shelves you need for x cars: $20x$, $\frac{x}{20}$, or $\frac{20}{x}$? *Justify* your choice.
- Find the number of shelves you need to display 120 cars.

4. OPEN-ENDED Describe a real-world situation that you could model with the inequality $3x < 15$. *Explain* what a solution of the inequality means in this situation.

5. SHORT RESPONSE You pay \$7.50 for 3 quarts of strawberries. You realize that you need more strawberries for your recipe. You return to the store with \$4.50. Will you have enough money to buy 2 more quarts of strawberries? *Explain* your reasoning.

6. EXTENDED RESPONSE The number of calories in one serving of any food is the sum of the calories from fat, protein, and carbohydrate. The table shows the calories in 1 gram of each of the three food components.

Component	Calories in 1 gram
Fat	9
Protein	4
Carbohydrate	4

- Write an expression for the total number of calories in a serving of food that contains f grams of fat, p grams of protein, and c grams of carbohydrate.
- A serving of cheddar cheese contains 14 grams of fat, 11 grams of protein, and 1 gram of carbohydrate. How many calories are in a serving of cheddar cheese?
- A 100 pound teenager requires about 45 grams of protein per day. If the teenager tried to get all the required protein for one day from cheddar cheese, how many calories would the teenager consume? *Explain*.

7. GRIDDED ANSWER You are comparing two dorm-size refrigerators, both with cube-shaped interiors. One model has an interior edge length of 14 inches. Another model has an interior edge length of 16 inches. How many more cubic inches of storage space does the larger model have?

1.5 EXERCISES

HOMEWORK KEY

- = WORKED-OUT SOLUTIONS on p. WS2 for Exs. 5 and 17
- ★ = STANDARDIZED TEST PRACTICE Exs. 2, 11, 12, 20, and 22
- ◆ = MULTIPLE REPRESENTATIONS Ex. 21

SKILL PRACTICE

1. **VOCABULARY** Give an example of a formula.
2. ★ **WRITING** Describe how you can use a formula to solve the following problem: The inner edges of a cube-shaped pot have a length of 1.5 feet. How much does it cost to fill the planter if soil costs \$4 per cubic foot?

EXAMPLES

1 and 2

on pp. 28–29
for Exs. 3–5


READING AND UNDERSTANDING In Exercises 3–5, identify what you know and what you need to find out. You do *not* need to solve the problem.

3. **CRAFT SHOW** You make 35 dog collars and anticipate selling all of them at a craft show. You spent \$85 for materials and hope to make a profit of \$90. How much should you charge for each collar?
4. **DISTANCE RUNNING** A runner ran at a rate of 0.15 mile per minute for 40 minutes. The next day, the runner ran at a rate of 0.16 mile per minute for 50 minutes. How far did the runner run altogether?
5. **TEMPERATURE** One day, the temperature in Rome, Italy, was 30°C. The temperature in Dallas, Texas, was 83°F. Which temperature was higher?


ERROR ANALYSIS Describe and correct the error in solving the problem.

A town is fencing a rectangular field that is 200 feet long and 150 feet wide. At \$10 per foot, how much will it cost to fence the field?

6.

$$P = 200 + 150 = 350$$
$$\underline{\$10(350) = \$3500}$$


7.

$$A = (200)(150) = 30,000$$
$$\underline{\$10(30,000) = \$300,000}$$


EXAMPLE 3

on p. 30
for Exs. 8–12

CHOOSING A FORMULA In Exercises 8–10, state the formula that is needed to solve the problem. You do *not* need to solve the problem.

8. The temperature is 68°F. What is the temperature in degrees Celsius?
9. A store buys a baseball cap for \$5 and sells it for \$20. What is the profit?
10. Find the area of a triangle with a base of 25 feet and a height of 8 feet.
11. ★ **MULTIPLE CHOICE** What is the interest on \$1200 invested for 2 years in an account that earns simple interest at a rate of 5% per year?
(A) \$12 (B) \$60 (C) \$120 (D) \$240
12. ★ **MULTIPLE CHOICE** A car travels at an average speed of 55 miles per hour. How many miles does the car travel in 2.5 hours?
(A) 22 miles (B) 57.5 miles (C) 110 miles (D) 137.5 miles
13. **CHALLENGE** Write a formula for the length l of a rectangle given its perimeter P and its width w . Justify your thinking.


PROBLEM SOLVING

EXAMPLES


1, 2, and 3

on pp. 28–30
for Exs. 14–18

14. **DVD STORAGE** A stackable storage rack holds 22 DVDs and costs \$21. How much would it cost to buy enough racks to hold 127 DVDs?

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15. **FRAMING** For an art project, you make a square print with a side length of 8 inches. You make a frame using strips of wood $1\frac{1}{4}$ inches wide. What is the area of the frame?

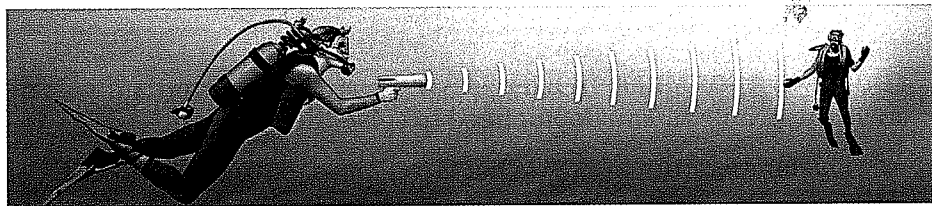
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16. **MOUNTAIN BOARDS** You have saved \$70 to buy a mountain board that costs \$250. You plan to save \$10 each week. How many weeks will it take to save for the mountain board?

17. **HIKING** You are hiking. The total weight of your backpack and its contents is $13\frac{3}{8}$ pounds. You want to carry no more than 15 pounds. How many extra water bottles can you add to your backpack if each bottle weighs $\frac{3}{4}$ pound?

18. **PIZZA** Thick crust pizza requires about 0.15 ounce of dough per square inch of surface area. You have two rectangular pans, one that is 16 inches long and 14 inches wide, and one that is 15.5 inches long and 10 inches wide. How much more dough do you need to make a thick crust pizza in the larger pan than in the smaller one?

19. **SONAR** A diver uses a sonar device to determine the distance to her diving partner. The device sends a sound wave and records the time it takes for the wave to reach the diving partner and return to the device. Suppose the wave travels at a rate of about 4800 feet per second.



- a. The wave returns 0.2 second after it was sent. How far did the wave travel?
- b. How far away is the diving partner?

20. **★ EXTENDED RESPONSE** A gardener is reseeding a city park that has the shape of a right triangle with a base of 150 feet and a height of 200 feet. The third side of the park is 250 feet long.

- a. One bag of grass seed covers 3750 square feet and costs \$27.50. How many bags are needed? What is the total cost?
- b. Wire fencing costs \$23.19 for each 50 foot roll. How much does it cost to buy fencing to enclose the area?
- c. Fence posts cost \$3.19 each and should be placed every 5 feet. How many posts are needed, and how much will they cost altogether? *Explain.*



21. **MULTIPLE REPRESENTATIONS** Homeowners are building a square closet in a rectangular room that is 24 feet long and 18 feet wide. They want the remaining floor area to be at least 400 square feet. Because they don't want to cut any of the 1 foot by 1 foot square floor tiles, the side length of the closet floor should be a whole number of feet.
- Making a Table** Make a table showing possible side lengths of the closet floor and the remaining area for each side length.
 - Writing an Inequality** Write an inequality to describe the situation. Use your table to find the greatest possible side length of the closet floor.
22. **★ SHORT RESPONSE** A farmer plans to build a fence around a rectangular pen that is 16 feet long. The area of the pen is 80 square feet. Is 40 feet of fencing enough to fence in the pen? *Explain.*
23. **CHALLENGE** You and your friend live 12 miles apart. You leave home at the same time and travel toward each other. You walk at a rate of 4 miles per hour and your friend bicycles at a rate of 11 miles per hour.
- How long after you leave home will you meet? How far from home will each of you be?
 - Suppose your friend bicycles at a rate of 12 miles per hour. How much sooner will you meet? How far from home will each of you be?

MIXED REVIEW

Write the decimal as a fraction and as a percent. (p. 916)

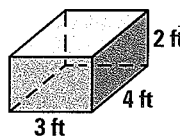
24. 0.85

25. 1.25

26. 0.245

27. 0.007

28. Find the surface area and volume of the rectangular prism. (p. 927)



Translate the verbal phrase into an expression. (p. 15)

29. $\frac{1}{3}$ multiplied by a number v

30. 22 divided by a number h

31. 7 more than twice a number m

32. Twice the sum of a number y and 3

PREVIEW

Prepare for
Lesson 1.6 in
Exs. 29–32.

QUIZ for Lessons 1.4–1.5

Write an equation or an inequality. (p. 21)

- 4 more than twice a number n is equal to 25.
- The quotient of a number x and 2 is no more than 9.

Check whether the given number is a solution of the equation or inequality. (p. 21)

3. $13 - 2x = 5$; 4

4. $5d - 4 \geq 16$; 4

5. $4y + 3 \geq 15$; 3

6. **CAR TRAVEL** One car travels about 28.5 miles on each gallon of gas. Suppose the average price of gas is \$2 per gallon. About how much would the gas for a 978 mile trip cost? (p. 28)

Another Way to Solve Example 1, page 28



MULTIPLE REPRESENTATIONS In Example 1 on page 28, you saw how to solve a problem about running using an equation. You can also solve the problem by using the strategy *draw a diagram*.

PROBLEM

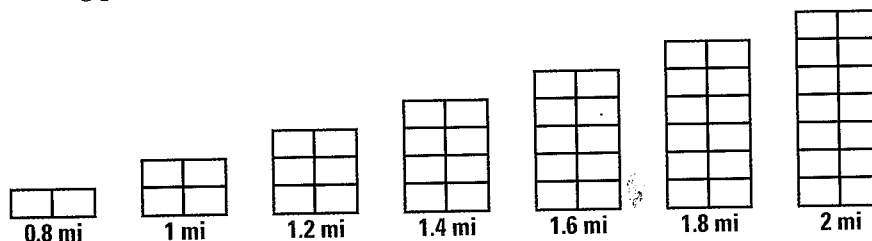
RUNNING You run in a city where the short blocks on north-south streets are 0.1 mile long. The long blocks on east-west streets are 0.15 mile long. You will run 2 long blocks east, a number of short blocks south, 2 long blocks west, then back to your starting point. You want to run a total of 2 miles. How many short blocks should you run?

METHOD

Drawing a Diagram You can draw a diagram to solve the problem.

STEP 1 Read the problem carefully. It tells you the lengths of a short block and a long block. You plan to run 4 long blocks and a distance of 2 miles.

STEP 2 Draw a pair of rectangles to represent running 1 short block in each direction. The total distance is $4(0.15) + 2(0.1) = 0.8$ mile. Continue adding pairs of rectangles until the total distance run is 2 miles.



► You should run 14 short blocks.

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PRACTICE

- BAKING** A cake pan is 9 inches wide and 11 inches long. How many 3 inch by 3 inch square pieces can you cut? Solve this problem using an equation. Then draw a diagram. *Explain* why a diagram is useful.
- SWIMMING** A 12 foot rope strung through 4 floats marks off the deep end of a pool. Each end of the rope is 3 feet from a float. The floats are equally spaced. How far apart are they? Solve this problem using two different methods.

- ERROR ANALYSIS** Describe and correct the error in solving Exercise 2.

$$4x + 6 = 12$$

$$4(1.5) + 6 = 12$$

~~X~~

The floats are 1.5 feet apart.

- GEOMETRY** The length of a rectangle is twice its width. The perimeter is 72 inches. What is its length? Solve this problem using two different methods.

1.6 EXERCISES

HOMEWORK KEY

- = WORKED-OUT SOLUTIONS on p. WS2 for Exs. 7 and 23
- ★ = STANDARDIZED TEST PRACTICE Exs. 2, 11, 12, 13, 26, and 27
- ◆ = MULTIPLE REPRESENTATIONS Exs. 23 and 24

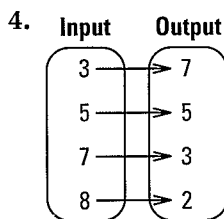
SKILL PRACTICE

- VOCABULARY** Copy and complete: A(n) ? is a number in the domain of a function. A(n) ? is a number in the range of a function.
- ★ **WRITING** In the equation $b = a - 2$, which variable is the independent variable and which is the dependent variable? *Explain.*

DOMAIN AND RANGE Identify the domain and range of the function.

3.

Input	Output
0	5
1	7
2	15
3	44



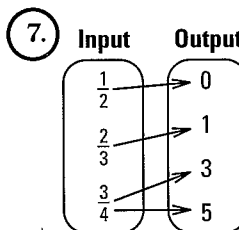
5.

Input	Output
6	5
12	7
21	10
42	17

IDENTIFYING FUNCTIONS Tell whether the pairing is a function.

6.

Input	Output
0	7.5
1	9.5
2	11.5
3	13.5



8.

Input	Output
7	13
11	8
21	13
35	20

ERROR ANALYSIS In Exercises 9 and 10, describe and correct the error related to the function represented by the table.

Input, x	1	2	3	4	5
Output, y	6	7	8	6	9

9. The pairing is not a function. One output is paired with two inputs.

10. The pairing is a function. The range is 1, 2, 3, 4, and 5.

- ★ **OPEN-ENDED** Draw a mapping diagram for a function with 6 inputs. Then make a table to represent the function.
- ★ **MULTIPLE CHOICE** The domain of the function $y = 5x - 1$ is 1, 3, 4, 5, and 6. Which number is in the range of the function?
 - (A) 0
 - (B) 4
 - (C) 9
 - (D) 15
- ★ **MULTIPLE CHOICE** Each output of a function is 0.5 less than the corresponding input. Which equation is a rule for the function?
 - (A) $y = x - 0.5$
 - (B) $y = x + 0.5$
 - (C) $y = 0.5 - x$
 - (D) $y = 0.5x$

EXAMPLES 1 and 2
on pp. 35–36
for Exs. 3–11

EXAMPLES 3 and 4
on pp. 36–37
for Exs. 12–21

TABLES Make a table for the function. Identify the range of the function.

14. $y = x - 3$
Domain: 12, 15, 22, 30

15. $y = x + 3.5$
Domain: 4, 5, 7, 8, 12

16. $y = 3x + 4$
Domain: 0, 5, 7, 10

17. $y = \frac{1}{2}x + 3$
Domain: 4, 6, 9, 11

18. $y = \frac{2}{3}x + \frac{1}{3}$
Domain: 4, 6, 8, 12

19. $y = \frac{0.5x + 1}{2}$
Domain: 0, 2, 4, 6

FUNCTION RULES Write a rule for the function.20.

Input, x	0	1	2	3
Output, y	2.2	3.2	4.2	5.2

21.

Input, x	15	20	21	30	42
Output, y	7	12	13	22	34

- 22.
- CHALLENGE**
- Fill in the table in such a way that when
- t
- is the independent variable, the pairing is a function, and when
- t
- is the dependent variable, the pairing is not a function.

t	?	?	?	?
v	?	?	?	?

PROBLEM SOLVING

EXAMPLE 5
on p. 37
for Exs. 23–26

- 23.
- MULTIPLE REPRESENTATIONS**
- You have 10 quarters that you can use for a parking meter.

- a. **Describing in Words** Copy and complete: Each time you put 1 quarter in the meter, you have 1 less quarter, so ? is a function of ?.
- b. **Writing a Rule** Write a rule for the number y of quarters that you have left as a function of the number x of quarters you have used so far. Identify the domain of the function.
- c. **Making a Table** Make a table and identify the range of the function.

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- 24.
- MULTIPLE REPRESENTATIONS**
- At a yard sale, you find 5 paperback books by your favorite author. Each book is priced at \$.75.

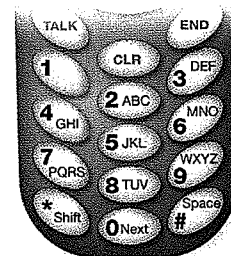
- a. **Describing in Words** Copy and complete: For each book you buy, you spend \$.75, so ? is a function of ?.
- b. **Writing a Rule** Write a rule for the amount (in dollars) you spend as a function of the number of books you buy. Identify the domain of the function.
- c. **Making a Table** Make a table and identify the range of the function.

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- 25.
- SAVINGS**
- You have \$100 saved and plan to save \$20 each month. Write a rule for the amount saved (in dollars) as a function of the number of months from now. Identify the independent and dependent variables, the domain, and the range. How much will you have saved altogether 12 months from now?

- 26.
- ★ OPEN-ENDED**
- Write a function rule that models a real-world situation. Identify the independent variable and the dependent variable.

27. ★ **SHORT RESPONSE** Consider a pairing of the digits 2 through 9 on a telephone keypad with the associated letters.
- Make a table showing the pairing with the digits as inputs and the letters as outputs. Is the pairing a function? *Explain.*
 - Make a table showing the pairing with the letters as inputs and the digits as outputs. Is the pairing a function? *Explain.*



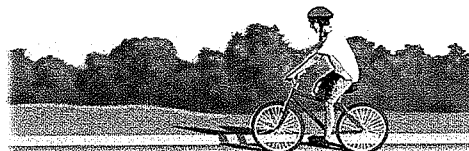
28. **MULTI-STEP PROBLEM** The table shows the fuel efficiency of four compact cars from one manufacturer for model year 2004.

City fuel efficiency (mi/gal), c	24	26	27	28
Highway fuel efficiency (mi/gal), h	32	34	35	36

- Write a Rule** Use the table to write a rule for the cars' highway fuel efficiency as a function of their city fuel efficiency.
 - Predict** Another of the manufacturer's compact cars has a city fuel efficiency of 30 miles per gallon. Predict the highway fuel efficiency.
 - Calculate** A study found that if gas costs \$2 per gallon, you can use the expression $\frac{11,550}{c} + \frac{9450}{h}$ to estimate a car's annual fuel cost (in dollars) for a typical driver. Evaluate the expression for the car in part (b).
29. **CHALLENGE** Each week you spend a total of 5 hours exercising. You swim part of the time and bike the rest.



300 calories per hour



440 calories per hour

- Write a rule for the total number of calories you burn for the whole 5 hours as a function of the time you spend swimming.
- One week you spend half the time swimming. How many calories do you burn during the whole 5 hours?

MIXED REVIEW

PREVIEW

Prepare for
Lesson 1.7 in
Exs. 30–33.

Plot the point in a coordinate plane. (p. 921)

30. $A(1, 3)$

31. $B(3, 1)$

32. $C(2, 4)$

33. $D(6, 2)$

Write an equation or an inequality. (p. 21)

34. The difference of 13 and a number w is 5.

35. The quotient of 21 and a number d is no less than 7.

36. **TRAVEL** On a 1375 mile flight, an airplane's average speed is 550 miles per hour. The flight is within a single time zone and leaves at 10 A.M. What time will the airplane arrive at its destination? (p. 28)

1.6 Make a Table

QUESTION How can you use a graphing calculator to create a table for a function?

You can use a graphing calculator to create a table for a function when you want to display many pairs of input values and output values or when you want to find the input value that corresponds to a given output value.

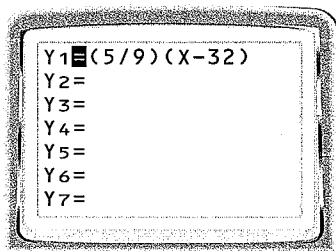
In the example below, you will make a table to compare temperatures in degrees Celsius and temperatures in degrees Fahrenheit for temperatures at or above the temperature at which water freezes, 32°F.

EXAMPLE Use a graphing calculator to make a table

The formula $C = \frac{5}{9}(F - 32)$ gives the temperature in degrees Celsius as a function of the temperature in degrees Fahrenheit. Make a table for the function.

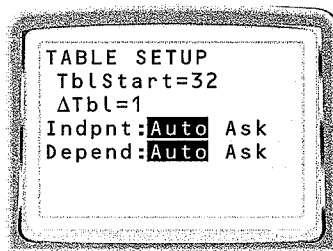
STEP 1 Enter equation

Rewrite the function using x for F and y for C . Press $\boxed{Y=}$ and enter $\frac{5}{9}(x - 32)$.



STEP 2 Set up table

Go to the TABLE SETUP screen. Use a starting value (TblStart) of 32 and an increment (Δ Tbl) of 1.



STEP 3 View table

Display the table. Scroll down to see pairs of inputs and outputs.

X	Y1	Y2
32		0
33	.55556	
34	1.11111	
35	1.66667	
36	2.22222	
37	2.77778	

PRACTICE

- You see a sign that indicates that the outdoor temperature is 10°C. Find the temperature in degrees Fahrenheit. *Explain* how you found your answer.
- Water boils at 100°C. What is the temperature in degrees Fahrenheit?

Make a table for the function. Use the given starting value and increment.

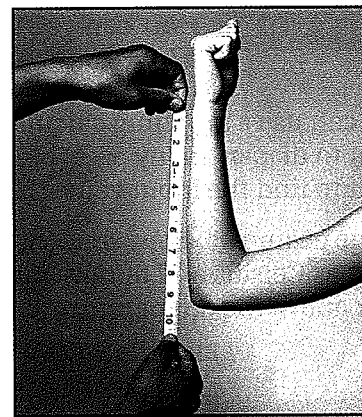
- | | |
|---|---|
| 3. $y = \frac{3}{4}x + 5$
TblStart = 0, Δ Tbl = 1 | 4. $y = 4x + 2$
TblStart = 0, Δ Tbl = 0.5 |
| 5. $y = 7.5x - 0.5$
TblStart = 1, Δ Tbl = 1 | 6. $y = 0.5x + 6$
TblStart = 3, Δ Tbl = 3 |

1.7 Scatter Plots and Functions

MATERIALS • tape measure • graph paper

QUESTION How can you tell whether a graph represents a function?

A *scatter plot* is a type of display for paired data. Each data pair is plotted as a point. In this activity, you will work in a group to make a scatter plot. You will measure the height of each student in your group and the length of his or her forearm. The length of the forearm is the distance from the elbow to the wrist.

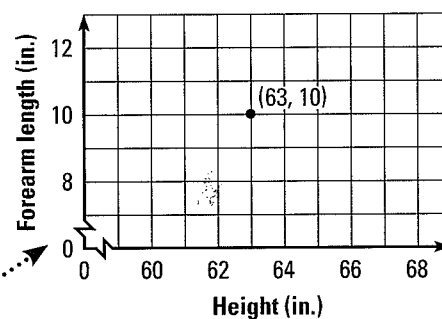



EXPLORE Collect data and make a scatter plot

STEP 1 *Collect data* Measure the height of each student in your group and the length of his or her forearm. Record the results for each student in one row of a table like the one shown.

Height (inches)	Forearm length (inches)
63	10
?	?

STEP 2 *Make a scatter plot* Use graph paper to draw axes labeled as shown. Then plot the data pairs (*height*, *forearm length*). For example, plot the point (63, 10) for a student with a height of 63 inches and a forearm length of 10 inches.



The symbol  on an axis represents a break in the axis.

DRAW CONCLUSIONS Use your observations to complete these exercises

1. Examine your scatter plot. What does it suggest about the relationship between a person's height and the person's forearm length?
2. Compare your table with those of the other groups in your class. Determine which of the tables represent functions and which do not.
3. Is it possible to determine whether a table represents a function by looking at the corresponding scatter plot? *Explain.*

1.7 EXERCISES

HOMEWORK KEY

○ = WORKED-OUT SOLUTIONS
on p. WS2 for Exs. 3 and 17

★ = STANDARDIZED TEST PRACTICE
Exs. 2, 13, 18, 19, and 20

SKILL PRACTICE

1. **VOCABULARY** Copy and complete: Each point on the graph of a function corresponds to an ordered pair (x, y) where x is in the ? of the function and y is in the ? of the function.

2. ★ **WRITING** Given the graph of a function, describe how to write a rule for the function.

EXAMPLE 1

on p. 43
for Exs. 3–9

GRAPHING FUNCTIONS Graph the function.

3. $y = x + 3$; domain: 0, 1, 2, 3, 4, and 5

4. $y = \frac{1}{2}x + 1$; domain: 0, 1, 2, 3, 4, and 5

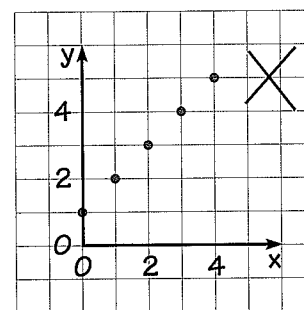
5. $y = 2x + 2$; domain: 0, 2, 5, 7, and 10

6. $y = 3x - 1$; domain: 1, 2, 3, 4, and 5

7. $y = x + 5$; domain: 0, 2, 4, 6, 8, and 10

8. $y = 2.5x$; domain: 0, 1, 2, 3, and 4

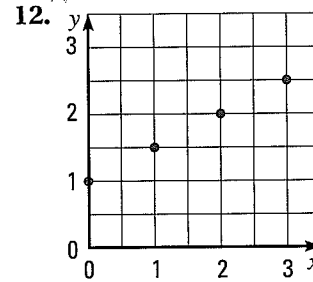
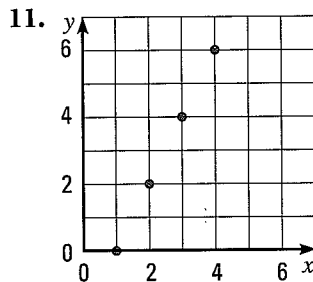
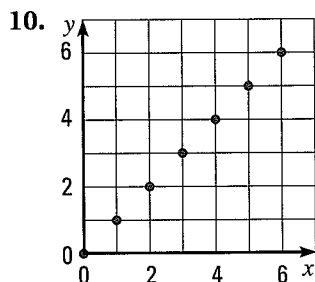
9. **ERROR ANALYSIS** Describe and correct the error in graphing the function $y = x - 1$ with domain 1, 2, 3, 4, and 5.



EXAMPLE 3

on p. 44
for Exs. 10–12

WRITING FUNCTION RULES Write a rule for the function represented by the graph. Identify the domain and the range of the function.



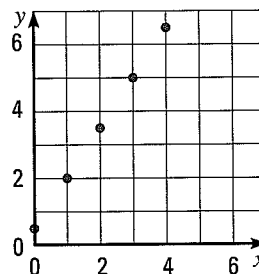
13. ★ **MULTIPLE CHOICE** The graph of which function is shown?

(A) $y = \frac{1}{2}x + \frac{1}{2}$

(B) $y = x + \frac{1}{2}$

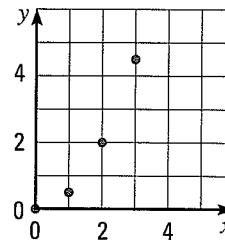
(C) $y = \frac{3}{2}x + \frac{1}{2}$

(D) $y = 2x + \frac{1}{2}$



14. **CHALLENGE** The graph represents a function.

- Write a rule for the function.
- Find the value of y so that $(1.5, y)$ is on the graph of the function.



PROBLEM SOLVING

EXAMPLE 2

on p. 44
for Exs. 15–17

15. **ADVERTISING** The table shows the cost C (in millions of dollars) of a 30 second Super Bowl ad on TV as a function of the time t (in years) since 1997. Graph the function.

Years since 1997, t	0	1	2	3	4	5	6	7
Cost (millions of dollars), C	1.2	1.3	1.6	2.1	2.1	1.9	2.1	2.3

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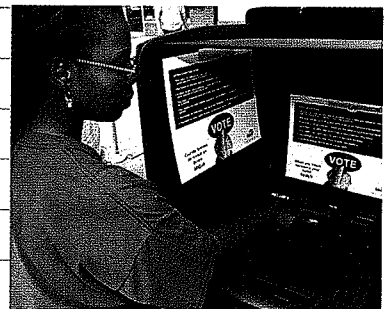
16. **CONGRESS** The table shows the number r of U.S. representatives for Texas as a function of the time t (in years) since 1930. Graph the function.

Years since 1930, t	0	10	20	30	40	50	60	70
Number of representatives, r	21	21	22	23	24	27	30	32

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17. **ELECTIONS** The table shows the number v of voters in U.S. presidential elections as a function of the time t (in years) since 1984. First copy and complete the table. Round to the nearest million. Then graph the function represented by the first and third columns.

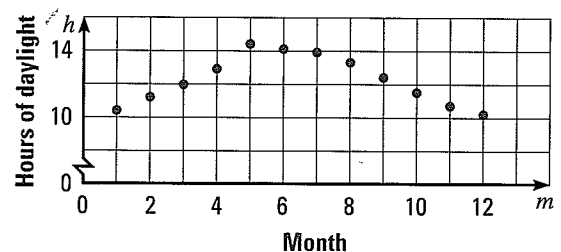
Years since 1984	Voters	Voters (millions)
0	92,652,680	?
4	91,594,693	?
8	104,405,155	?
12	96,456,345	?
16	105,586,274	?



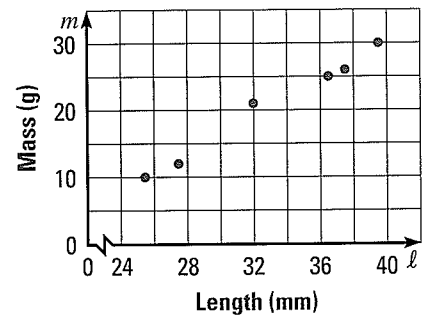
EXAMPLE 4

on p. 45
for Exs. 18–19

18. **★ WRITING** The graph shows the number of hours of daylight in Houston, Texas, on the fifteenth day of the month, with 1 representing January, and so on. Identify the independent variable and the dependent variable. Describe how the number of hours of daylight changes over a year.

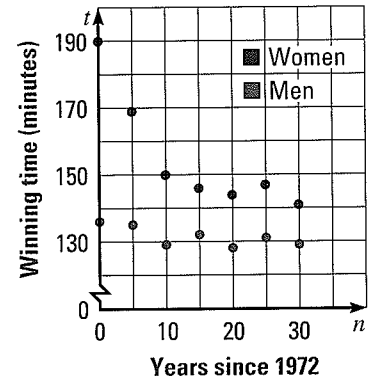


19. ★ **SHORT RESPONSE** A field biologist collected and measured alligator snapping turtle eggs. The graph shows the mass m (in grams) of an egg as a function of its length l (in millimeters).



- a. **Describe** As the lengths of the eggs increase, what happens to the masses of the eggs?
 b. **Estimate** Is 27.5 g a reasonable estimate for the mass of an egg that is 38 mm long? *Explain.*

20. ★ **SHORT RESPONSE** Women first officially ran in the Boston Marathon in 1972. The graph shows the winning time t (in minutes) for both men and women as a function of the number n of years since 1972 for that year and every five years thereafter.



- a. **CHALLENGE** *Explain* how you can estimate the difference in the men's and women's winning time for any year shown.
 b. **CHALLENGE** *Compare* any trends you see in the graphs.

MIXED REVIEW

PREVIEW

Prepare for Lesson 2.1 in Exs. 21–24.

Copy and complete the statement using $<$, $>$, or $=$. (p. 909)

21. $0.53 \underline{?} 0.5$ 22. $3.9 \underline{?} 4.0$ 23. $1.64 \underline{?} 1.66$ 24. $0.80 \underline{?} 0.8$

Solve the equation using mental math. (p. 21)

25. $x + 12 = 20$ 26. $12z = 480$ 27. $x - 8 = 5$ 28. $\frac{n}{2} = 32$

Write a rule for the function. (p. 35)

29.

Input, x	2	3	7	10
Output, y	8	7	3	0

30.

Input, x	0	4	8	12
Output, y	5	7	9	11

QUIZ for Lessons 1.6–1.7

1. The domain of the function $y = 12 - 2x$ is 0, 2, 3, 4, and 5. Make a table for the function, then identify the range of the function. (p. 35)

Tell whether the pairing is a function. (p. 35)

2.

x	5	6	7	11
y	1	2	3	7

3.

x	4	6	9	15
y	1	3	6	3

Graph the function. (p. 43)

4. $y = 2x - 5$; domain: 5, 6, 7, 8, and 9 5. $y = 7 - x$; domain: 1, 2, 3, 4, and 5

Extension

Use after Lesson 1.7

Determine Whether a Relation Is a Function

GOAL Determine whether a relation is a function when the relation is represented by a table or a graph.

Key Vocabulary

- **relation**, p. 49

A **relation** is any pairing of a set of inputs with a set of outputs. Every function is a relation, but not every relation is a function. A relation is a function if for every input there is exactly one output.

EXAMPLE 1 Determine whether a relation is a function

Determine whether the relation is a function.

a.

Input	4	4	5	6	7
Output	0	1	2	3	4

b.

Input	3	5	7	9
Output	1	2	3	2

Solution

- a. The input 4 has two different outputs, 0 and 1. So, the relation is *not* a function.
- b. Every input has exactly one output, so the relation is a function.

USING THE GRAPH OF A RELATION You can use the *vertical line test* to determine whether a relation represented by a graph is a function. When a relation is *not* a function, its graph contains at least two points with the same x -coordinate and different y -coordinates. Those points lie on a vertical line.

KEY CONCEPT

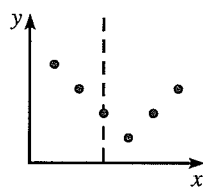
For Your Notebook

Vertical Line Test

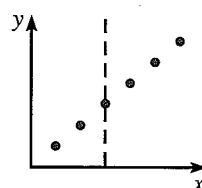
Words

A relation represented by a graph is a function provided that no vertical line passes through more than one point on the graph.

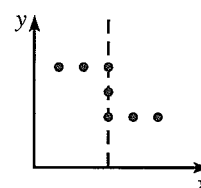
Graphs



Function



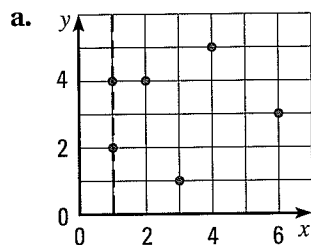
Function



Not a function

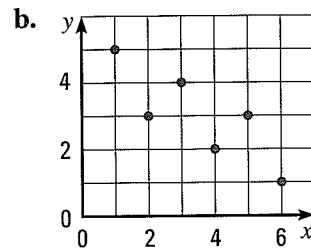
EXAMPLE 2 Use the vertical line test

Determine whether the graph represents a function.



You can draw a vertical line through the points (1, 2) and (1, 4). The graph does *not* represent a function.

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No vertical line can be drawn through more than one point. The graph represents a function.

PRACTICE

EXAMPLE 1

on p. 49
for Exs. 1–3

IDENTIFYING FUNCTIONS Determine whether the relation is a function.

1.

Input	Output
0	1
2	6
5	12
7	5
8	4

2.

Input	Output
3	7
4	8
4	9
5	10
6	11

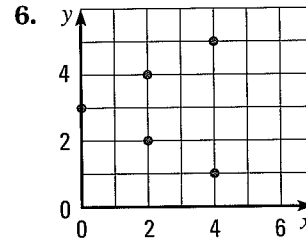
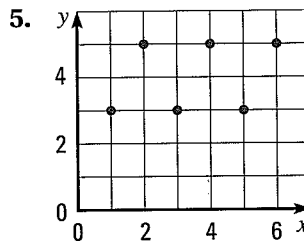
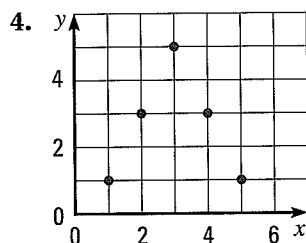
3.

Input	Output
0.7	1.9
1.2	2.4
3.5	4.7
7.5	8.7
7.5	9.7

EXAMPLE 2

on p. 50
for Exs. 4–6

IDENTIFYING FUNCTIONS Determine whether the graph represents a function.



REASONING Tell whether the pairing of x -values and y -values is necessarily a function. *Explain* your reasoning.

- A teacher makes a table that lists the number x of letters in the first name and the number y of letters in the last name of each student in the class.
- Your doctor records your height x (in inches) and your weight y (in pounds) each time you have a medical exam.
- You have a record of your age x (in years) and your height y (in inches) on each of your birthdays since you were born.



Lessons 1.5–1.7

1. **MULTI-STEP PROBLEM** A pizza shop charges \$7 for a large cheese pizza plus \$.95 for each topping.
 - a. Use a verbal model to write an equation for the total cost C (in dollars) of a pizza with n toppings.
 - b. The pizza shop offers 10 toppings. Write an input-output table for the total cost (in dollars) of a pizza as a function of the number n of toppings. *Explain* why the table represents a function and describe the domain and range of the function.
 - c. You have \$15 to spend on a large pizza. What is the greatest number of toppings you can afford?

2. SHORT RESPONSE

Your class is planning a car wash. You need \$75 worth of materials.



- a. Use a verbal model to write an equation that relates your profit to the number of cars you wash. Find your profit if you wash 120 cars.
 - b. Does doubling the number of cars you wash double your profit? *Explain*.
3. **MULTI-STEP PROBLEM** You are painting a room in a community center. The room has four walls that are each 9 feet high and 25 feet long. There are two rectangular windows and two rectangular doors that do not need to be painted. Each window is 3.5 feet wide and 4 feet high. Each door is 3.5 feet wide and 7 feet high.
 - a. Find the combined area of the windows and doors.
 - b. Find the combined area of all four walls, excluding the windows and the doors.
 - c. A gallon of paint covers about 400 square feet. How many one-gallon cans of paint will you need in order to give the room one coat of paint?
 - d. The paint costs \$24.95 per gallon. How much will it cost for one coat of paint?

4. **GRIDDED ANSWER** You consider 68°F to be a comfortable room temperature. The temperature in a room is 18°C . How many degrees Celsius should you raise the temperature so that it will be 68°F ?

5. **SHORT RESPONSE** Your family is driving from Charleston, South Carolina, to Jacksonville, Florida, a total distance of about 250 miles. You leave Charleston at 1:00 P.M. You travel at an average speed of 55 miles per hour without stopping. Will you get to Jacksonville before the 5:00 P.M. rush hour? *Explain*.

6. **GRIDDED ANSWER** A person invests \$1200 in an account earning 3% simple annual interest. How much will be in the account after 2 years?

7. **OPEN-ENDED** Write a problem that involves a real-world situation and that can be solved using the formula for distance traveled. Solve the problem and explain what the solution means in the situation.

8. **EXTENDED RESPONSE** You pay \$40 per hour for windsurfing lessons and rent equipment for \$20 per hour. The cost (in dollars) of lessons and the cost (in dollars) of rentals are both functions of the time (in hours).
 - a. Write a rule for each function.
 - b. Let the domains of the functions be the whole numbers from 0 to 6. Graph each function.
 - c. You rent equipment for every lesson you take. What function gives your total cost? How would the graph of this function compare with the graphs in part (b)?



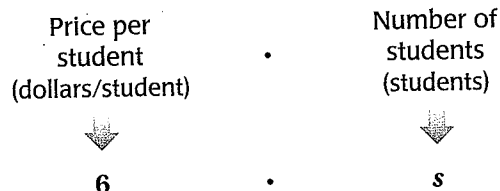
BIG IDEAS

For Your Notebook

Big Idea 1

Writing and Evaluating Algebraic Expressions

The cost of admission for one student at a planetarium is \$6. You can use a verbal model to write an expression for the total cost of admission for any number of students.



An expression is $6s$. Because $\frac{\text{dollars}}{\text{student}} \cdot \text{students} = \text{dollars}$, the expression produces an answer in dollars. The expression is reasonable.

Big Idea 2

Using Expressions to Write Equations and Inequalities

You can use symbols to write an equation or inequality that compares the expression $6s$ to another expression.

The total cost of admission to the planetarium for s students at a rate of \$6 per student is \$150.

$$6s = 150 \quad \text{Equation}$$

The total cost of admission to the planetarium for s students at a rate of \$6 per student is no more than \$150.

$$6s \leq 150 \quad \text{Inequality}$$

Big Idea 3

Representing Functions as Verbal Rules, Equations, Tables, and Graphs

You can use a verbal description, an equation, a table, or a graph to represent a function.

Words The total cost (in dollars) of admission to the planetarium is 6 times the number of students.

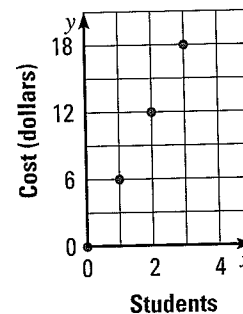
Equation

$$C = 6s$$

Table

Input, s	Input, C
0	0
1	6
2	12
3	18

Graph



REVIEW KEY VOCABULARY

- variable, p. 2
- algebraic expression, p. 2
- evaluate an algebraic expression, p. 2
- power, exponent, base, p. 3
- order of operations, p. 8
- verbal model, p. 16
- rate, unit rate, p. 17
- equation, inequality, p. 21
- open sentence, p. 21
- solution of an equation or inequality, p. 22
- formula, p. 30
- function, p. 35
- input, output, p. 35
- domain, range, p. 35
- independent variable, p. 36
- dependent variable, p. 36

VOCABULARY EXERCISES

In Exercises 1–3, copy and complete the statement.

1. In the power 7^{12} , ? is the base and ? is the exponent.
2. A(n) ? is a statement that contains the symbol =.
3. A(n) ? is an expression that includes at least one variable.
4. **WRITING** Describe how you can tell by looking at the graph of a function which variable is the input variable and which is the output variable.

REVIEW EXAMPLES AND EXERCISES

Use the review examples and exercises below to check your understanding of the concepts you have learned in each lesson of Chapter 1.

1.1 Evaluate Expressions

pp. 2–7

EXAMPLE

Evaluate $6 - n$ when $n = 4$.

$$\begin{aligned} 6 - n &= 6 - 4 && \text{Substitute 4 for } n. \\ &= 2 && \text{Simplify.} \end{aligned}$$

EXERCISES

Evaluate the expression.

5. $3 + x$ when $x = 13$
6. $y - 2$ when $y = 18$
7. $\frac{20}{k}$ when $k = 2$
8. $40w$ when $w = 0.5$
9. z^2 when $z = 20$
10. w^3 when $w = 0.1$
11. **DVD STORAGE** A DVD storage sleeve has the shape of a square with an edge length of 5 inches. What is the area of the front of the sleeve?
12. **NOTEPAPER** You store square notepaper in a cube-shaped box with an inside edge length of 3 inches. What is the volume of the box?

EXAMPLES
1, 4, and 5
on pp. 2–4
for Exs. 5–12

1.2 Apply Order of Operations

pp. 8–12

EXAMPLE

Evaluate $(5 + 3)^2 \div 2 \times 3$.

$$\begin{aligned} (5 + 3)^2 \div 2 \times 3 &= 8^2 \div 2 \times 3 && \text{Add within parentheses.} \\ &= 64 \div 2 \times 3 && \text{Evaluate power.} \\ &= 32 \times 3 && \text{Divide.} \\ &= 96 && \text{Multiply.} \end{aligned}$$

EXERCISES

Evaluate the expression.

13. $12 - 6 \div 2$

14. $1 + 2 \cdot 9^2$

15. $3 + 2^3 - 6 \div 2$

16. $15 - (4 + 3^2)$

17. $\frac{20 - 12}{5^2 - 1}$

18. $50 - [7 + (3^2 \div 2)]$

Evaluate the expression when $x = 4$.

19. $15x - 8$

20. $3x^2 + 4$

21. $2(x - 1)^2$

EXAMPLES
1, 2, and 3
on pp. 8–9
for Exs. 13–21

1.3 Write Expressions

pp. 15–20

EXAMPLE

Write an expression for the entry fee in a jazz band competition if there is a base fee of \$50 and a charge of \$1 per member.

Write a verbal model. Then translate the verbal model into an algebraic expression. Let n represent the number of band members.

Base fee (dollars)	+	Cost per member (dollars/member)	·	Number of members (members)
↓		↓		↓
50	+	1	·	n

► An expression for the entry fee (in dollars) is $50 + n$.

EXERCISES

Translate the verbal phrase into an expression.

22. The sum of a number k and 7

23. 5 less than a number z

24. The quotient of a number k and 12

25. 3 times the square of a number x

26. **TOLL ROADS** A toll road charges trucks a toll of \$3 per axle. Write an expression for the total toll for a truck.

27. **SCHOOL SUPPLIES** You purchase some notebooks for \$2.95 each and a package of pens for \$2.19. Write an expression for the total amount (in dollars) that you spend.

EXAMPLES
1, 2, and 3
on pp. 15–16
for Exs. 22–27

1.4 Write Equations and Inequalities

pp. 21–26

EXAMPLE

Write an inequality for the sentence “The sum of 3 and twice a number k is no more than 15”. Then check whether 4 is a solution of the inequality.

An inequality is $3 + 2k \leq 15$.

To check whether 4 is a solution of the inequality, substitute 4 for k .

$$3 + 2(4) \stackrel{?}{\leq} 15 \quad \text{Substitute 4 for } k.$$

$$11 \leq 15 \checkmark \quad \text{The solution checks. So, 4 is a solution.}$$

EXERCISES

Write an equation or an inequality.

28. The product of a number z and 12 is 60.
29. The sum of 13 and a number t is at least 24.

Check whether the given number is a solution of the equation or inequality.

30. $3x - 4 = 10$; 5 31. $4y - 2 \geq 2$; 3 32. $2d + 4 < 9d - 7$; 3

EXAMPLES

1 and 2

on pp. 21–22
for Exs. 28–32

1.5 Use a Problem Solving Plan

pp. 28–33

EXAMPLE

A rectangular banner is 12 feet long and has an area of 60 square feet. What is the perimeter of the banner?

STEP 1 Read and Understand You know the length of the rectangular banner and its area. You want to find the perimeter.

STEP 2 Make a Plan Use the area formula for a rectangle to find the width. Then use the perimeter formula for a rectangle.

STEP 3 Solve the Problem Substituting 12 for l in the formula $A = lw$, $60 = 12w$. Because $12 \cdot 5 = 60$, $w = 5$. Then substituting 12 for l and 5 for w in the formula $P = 2l + 2w$, $P = 2(12) + 2(5) = 34$ feet.

STEP 4 Look Back Use estimation. Since $l \approx 10$ and $A = 60$, $w \approx 6$. Then $P \approx 2(10) + 2(6) = 32$ feet, so your answer is reasonable.

EXERCISES

33. **U.S. HISTORY** The flag that inspired the national anthem was a rectangle 30 feet wide and 42 feet long. Pieces of the flag have been lost. It is now 30 feet wide and 34 feet long. How many square feet have been lost?
34. **PATTERNS** A grocery clerk stacks three rows of cans of fruit for a display. Each of the top two rows has 2 fewer cans than the row beneath it. There are 30 cans altogether. How many cans are there in each row?

EXAMPLES

1, 2, and 3

on p. 28–30
for Exs. 33–34

1.6 Represent Functions as Rules and Tables

pp. 35-40

EXAMPLE

The domain of the function $y = 3x - 5$ is 2, 3, 4, and 5. Make a table for the function, then identify the range of the function.

x	2	3	4	5
$y = 3x - 5$	$3(2) - 5 = 1$	$3(3) - 5 = 4$	$3(4) - 5 = 7$	$3(5) - 5 = 10$

The range of the function is 1, 4, 7, and 10.

EXERCISES

Make a table for the function. Identify the range of the function.

EXAMPLES

1, 3, and 4

on p. 35-37

for Exs. 35-38

35. $y = x - 5$

Domain: 10, 12, 15, 20, 21

36. $y = 3x + 1$

Domain: 0, 2, 3, 5, 10

Write a rule for the function.

37.

Input, x	0	2	4	5
Output, y	4	6	8	9

38.

Input, x	0	3	4	6
Output, y	0	15	20	30

1.7 Represent Functions as Graphs

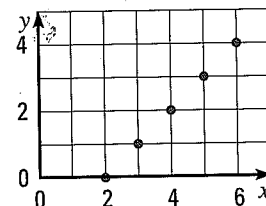
pp. 43-48

EXAMPLE

Write a rule for the function represented by the graph. Identify the domain and the range of the function.

Make a table for the graph.

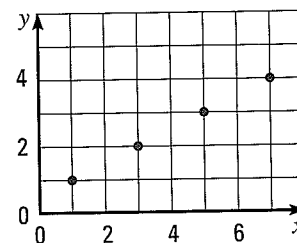
x	2	3	4	5	6
y	0	1	2	3	4



Each y -value is 2 less than the corresponding x -value. A rule for the function is $y = x - 2$. The domain is 2, 3, 4, 5, and 6. The range is 0, 1, 2, 3, and 4.

EXERCISES39. Graph the function $y = 4x - 3$ with domain 1, 2, 3, 4, and 5.

40. Write a rule for the function represented by the graph. Identify the domain and the range of the function.

**EXAMPLES**

1, 3, and 4

on pp. 43-45

for Exs. 39-40

Evaluate the expression.

1. $7 + 3^2 \cdot 2$
2. $(5^2 + 17) \div 7$
3. $(24 - 11) - (3 + 2) \div 4$
4. $\frac{x}{5}$ when $x = 30$
5. n^3 when $n = 20$
6. $15 - t$ when $t = 11$
7. $12 + 4x$ when $x = 1\frac{1}{2}$
8. $3z^2 - 7$ when $z = 6$
9. $2(4n + 5)$ when $n = 2$

Write an expression, an equation, or an inequality.

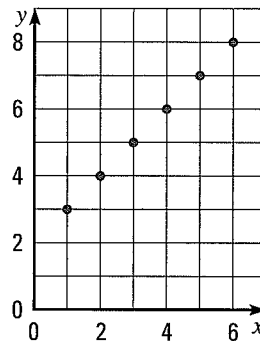
10. The sum of 19 and the cube of a number x
11. The product of 3 and a number y is no more than 21.
12. Twice the difference of a number z and 12 is equal to 10.

Check whether the given number is a solution of the equation or inequality.

13. $2 + 3x = 10$; 2
14. $8 + 3b > 15$; 2
15. $11y - 5 \leq 30$; 3

16. Refer to the graph.

- a. Explain why the graph represents a function.
- b. Identify the domain and the range.
- c. Write a rule for the function.



17. **FOOD PREPARATION** You buy tomatoes at \$1.29 per pound and peppers at \$3.99 per pound to make salsa. Write an expression for the total cost of the ingredients. Then find the total cost of 5 pounds of tomatoes and 2 pounds of peppers.
18. **CAR EXPENSES** A family determined the average cost of maintaining and operating the family car to be about \$.30 per mile. On one trip, the family drove at an average rate of 50 miles per hour for a total of 6.5 hours. On a second trip, they drove at an average rate of 55 miles per hour for a total of 6 hours. Which trip cost more? How much more?
19. **SHOE SIZES** A man's size 6 shoe is the same size as a woman's size $7\frac{1}{2}$. The table shows other corresponding sizes of men's and women's shoes.

Men's size, x	6	$6\frac{1}{2}$	7	$7\frac{1}{2}$	8	$8\frac{1}{2}$	9
Women's size, y	$7\frac{1}{2}$	8	$8\frac{1}{2}$	9	$9\frac{1}{2}$	10	$10\frac{1}{2}$

- a. Using the data in the table, write a rule for women's shoe size as a function of men's shoe size. Identify the domain and the range.
- b. Graph the function.