

Linear Functions and Graphing

Chapter 8

LESSONS

- 8-1** Relations and Functions
- 8-2** Equations With Two Variables
- 8-3** Slope and y -intercept
- 8-4** Writing Rules for Linear Functions
- 8-5** Scatter Plots
- 8-6** Problem Solving: Solve by Graphing
- 8-7** Solving Systems of Linear Equations
- 8-8** Graphing Linear Inequalities

Key Vocabulary

- domain (p. 400)
- function (p. 400)
- function notation (p. 418)
- function rule (p. 418)
- linear equation (p. 406)
- linear inequality (p. 441)
- negative correlation (p. 425)
- no correlation (p. 425)
- positive correlation (p. 425)
- range (p. 400)
- relation (p. 400)
- scatter plot (p. 423)
- slope (p. 411)
- slope-intercept form (p. 413)
- solution (p. 405)
- system of linear equations (p. 435)
- system of linear inequalities (p. 443)
- trend line (p. 430)
- vertical-line test (p. 401)
- y -intercept (p. 413)



Where You're Going

In this chapter, you will learn how to

- Determine whether a relation is a function.
- Solve linear equations.
- Solve systems of linear equations and inequalities.
- Solve a problem by graphing.



Real-World Snapshots Applying what you learn, on pages 454–455 you will solve problems about electronic devices.

Investigation

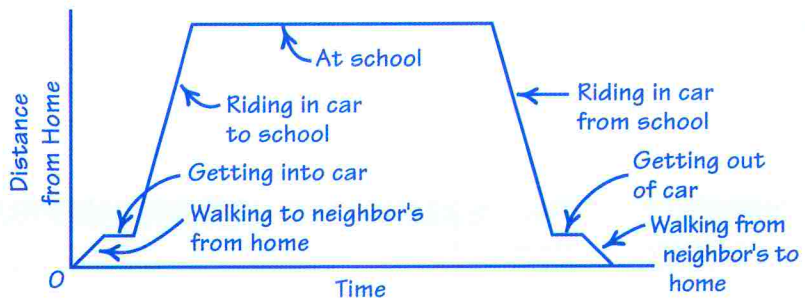
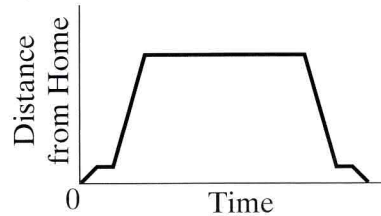
Modeling: Relating Graphs to Events

For Use With Lesson 8-1

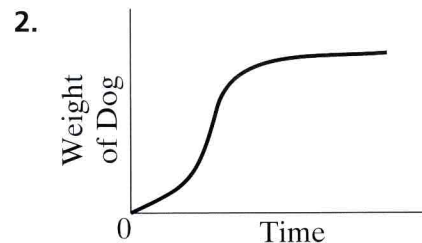
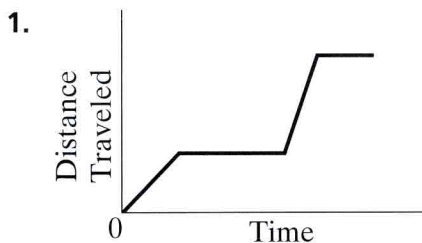
You can use graphs to show real-world relationships visually. Labels can help explain the parts of a graph.

1 EXAMPLE

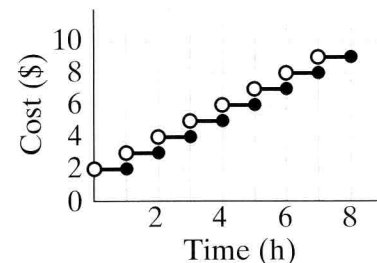
Transportation The graph at the right shows one trip from home to school and back. The trip combines walking and getting a ride from a neighbor. Tell what the graph shows by labeling each part.



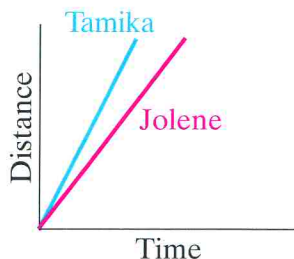
Label the parts of each graph.



3. The graph at the right is a *step graph*. It shows the prices at a parking garage.
- How much does parking cost for an hour or less?
 - How much does parking cost for 4 hours and 20 minutes?
 - A receipt from the parking garage is for \$7. What is the greatest length of time the car could have been in the garage?



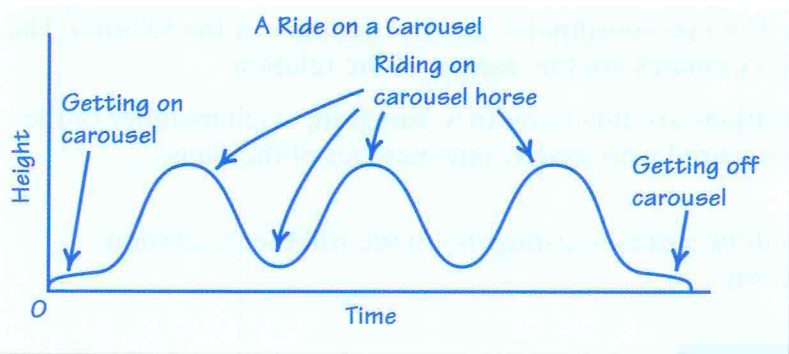
4. **Reasoning** Use the graph at the right. Jolene and Tamika were sprinting. Which girl ran faster? Explain.



When you draw a graph without actual data, you are making a sketch. A sketch can help you visualize relationships.

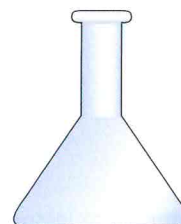
2 EXAMPLE

You go to an amusement park and ride a moving horse on a carousel. Sketch a graph to show your height above the ground. Identify your axes and include labels for each part.



Sketch a graph for each situation. Identify your axes and include labels for each part.

5. the temperature outside during one 24-hour period
6. your speed as you take a trip on a train
7. the total distance you travel as you go to a concert and return home
8. the distance above ground of a pole vaulter's feet at a track meet
9. You pour water at a constant rate into the container shown at the right. Sketch a graph of the water level as you fill the container.



8-1

Relations and Functions

What You'll Learn

OBJECTIVE
1

To determine whether a relation is a function

OBJECTIVE
2

To graph relations and functions

... And Why

To solve real-world problems involving cooking

Check Skills You'll Need


Graph each point.

1. $A(3, 4)$ 2. $B(-3, 1)$
3. $F(2, 0)$ 4. $D(2, -2)$
5. $C(-4, -3)$
6. $E(0, -4)$

 For help, go to Lesson 1-10.

New Vocabulary

- relation
- domain
- range
- function
- vertical-line test

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OBJECTIVE

1

Identifying Relations and Functions

The table shows the results of a canned-food drive.

You can write the data in the table as a **relation**, a set of ordered pairs. The first coordinate of each ordered pair is the number of students in a homeroom. The second coordinate is the number of cans the students in that homeroom collected.

**Food for Life
Canned-Food Drive**

Homeroom	Number of Students	Number of Cans
101	25	133
102	22	216
103	24	148
104	22	195
105	20	74
106	21	150

Here is the relation represented by the table:

$\{(25, 133), (22, 216), (24, 148), (22, 195), (20, 74), (21, 150)\}$.

The braces, $\{ \}$, indicate that these are all the ordered pairs in this relation. The first coordinates are the **domain** of the relation. The second coordinates are the **range** of the relation.

Some relations are functions. In a **function**, each member of the domain is paired with exactly one member of the range.

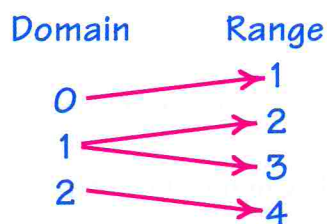
You can draw a *mapping diagram* to see whether a relation is a function.

1 EXAMPLE

Identifying a Function

Is each relation a function? Explain.

- a. $\{(0, 1), (1, 2), (1, 3), (2, 4)\}$



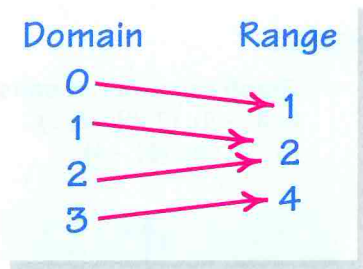
List the domain values and the range values in order.

Draw arrows from the domain values to their range values.

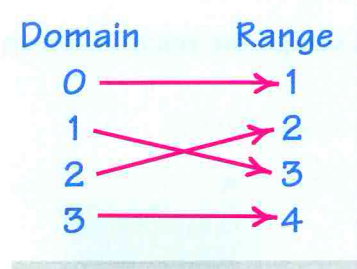
There are two range values for the domain value 1. This relation is *not* a function.

b. $\{(0, 1), (1, 2), (2, 2), (3, 4)\}$

c. $\{(0, 1), (1, 3), (2, 2), (3, 4)\}$



There is one range value for each domain value. This relation is a function.



There is one range value for each domain value. This relation is a function.

Check Understanding Example 1

1. Is each relation a function? Explain.

a. $\{(-2, 3), (2, 2), (2, -2)\}$

b. $\{(-5, -4), (0, -4), (5, -4)\}$

Functions can model many everyday situations when one quantity depends on another. One quantity *is a function of* the other.

2 EXAMPLE Real-World Problem Solving

Cooking Is the time needed to cook a turkey a function of the weight of the turkey? Explain.

The time the turkey cooks (range value) is determined by the weight of the turkey (domain value). This relation is a function.



Real-World Connection

You can estimate the cooking time of a turkey: 20 minutes per pound unstuffed, or 30 minutes per pound stuffed.

Check Understanding Example 2

- For the United States Postal Service, is package weight a function of the postage paid to mail the package? Explain.
- Is the cost of postage a function of package weight? Explain.

OBJECTIVE

2 Graphing Relations and Functions

Graphing a relation on a coordinate plane gives you a visual way to tell whether the relation is a function. If the relation is a function, then any vertical line passes through at most one point on the graph. If you can find a vertical line that passes through two points on the graph, then the relation is *not* a function. This is the **vertical-line test**.



Need Help?

The first value in an ordered pair, the x -coordinate, shows horizontal position.

The second value in an ordered pair, the y -coordinate, shows vertical position.

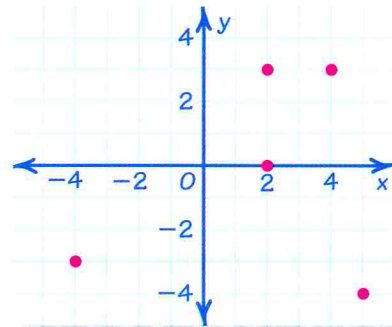
3 EXAMPLE Using the Vertical-Line Test

a. Graph the relation shown in the table.

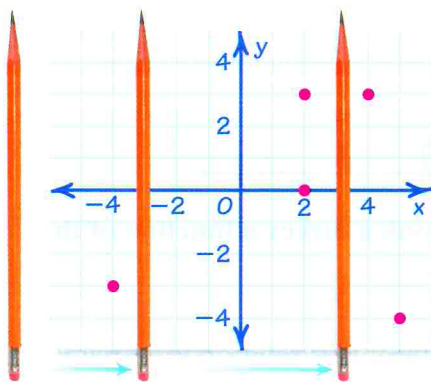
x -coordinates y -coordinates

Domain Value	Range Value
-4	-3
2	0
2	3
4	3
5	-4

Graph the ordered pairs $(-4, -3)$, $(2, 0)$, $(2, 3)$, $(4, 3)$, and $(5, -4)$.



b. Use the vertical-line test. Is the relation a function? Explain.



Pass a pencil across the graph as shown. Keep the pencil vertical (parallel to the y -axis) to represent a vertical line.

The pencil held vertically would pass through both $(2, 0)$ and $(2, 3)$, so the relation is *not* a function.

Check Understanding Example 3

3. **Algebra** Graph the relation shown in each table. Use the vertical-line test. Is the relation a function? Explain.

a.

x	y
-6	-5
-3	-2
0	-2
1	0
4	3
5	7

b.

x	y
-7	4
-2	6
-1	-1
-1	3
0	5
1	5

c.

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

EXERCISES

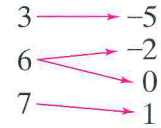
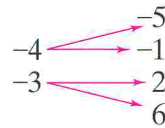
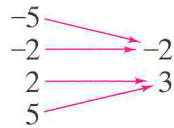
 For more exercises, see *Extra Practice*.

Practice and Problem Solving

A Practice by Example



Example 1
(page 400)

1. Domain Range 2. Domain Range 3. Domain Range



4. $\{(3, -1), (3, 0), (-3, 4), (3, 8)\}$ 5. $\{(-3, -2), (-1, 0), (1, 0), (5, -2)\}$

Example 2
(page 401)

6. **Walking**  Is the time you take to go to the library a function of the distance to the library? Explain.
7. Is the price of a one-year subscription to your favorite magazine a function of the age of the subscriber? Explain.
8. **Sewing**  Is the price of a piece of cloth a function of the length of the cloth? Explain.
9. Is the number of students on a field trip a function of the number of buses used? Explain.
10. Is the number of buses used for a field trip a function of the number of students on the field trip? Explain.

Example 3
(page 402)

Graph the relation shown in each table. Use the vertical-line test. Is the relation a function? Explain.

11.

x	y
-5	2
-1	4
2	-5
4	-1

12.

x	y
-5	-5
-3	-3
1	1
2	2

13.

x	y
-1	3
-1	2
0	-4
4	2

14.

x	y
3	-1
2	-1
-4	0
2	4

B Apply Your Skills

Graph each relation. Is the relation a function? Explain.

15. $\{(0, 1), (3, 5), (2, 2), (-\frac{1}{2}, \frac{4}{5})\}$ 16. $\{(-1, 9), (0, -1), (-1, 4), (4, 9)\}$

17. $\{(-1, 1), (-2, 1), (-2, 2), (0, 2)\}$

18. $\{(4, -8), (4, -6), (1, 2), (1, 5), (1, -6)\}$

19.

x	y
-5	6
-2	3
3	2
6	4

20.

x	y
3	-7
1	-5
-1	-5
-3	-7

21.

x	y
-7	3
-5	1
-5	-1
-7	-3

22.

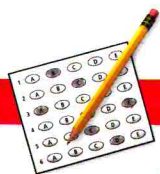
x	y
6	-2
1	-1
0	-2
-1	-3

23. **Writing in Math** Is every relation a function? Is every function a relation? Explain.
24. **Geometry** Explain why the area of a square is a function of the length of a side of the square.
25. **Error Analysis** Your friend says that a relation is not a function when two ordered pairs have the same y -coordinate. Explain your friend's error.

C Challenge

Patterns In each function below, there is a pattern to how the range values relate to the domain values. Describe the pattern.

26. $\{(-2, 0), (0, 2), (3, 5), (8, 10)\}$ 27. $\{(-5, 5), (-1, 1), (0, 0), (3, -3)\}$
28. $\{(-1, -0.5), (2, 1), (7, 3.5)\}$ 29. $\{(1, 1), (2, 4), (3, 9), (4, 16)\}$
30. a. **Open-Ended** Write two different relations for which the domain is $\{-1, 0, 1\}$ and the range is $\{1, 2\}$.
 b. Graph your relations. Use the vertical-line test to tell whether each relation is a function.



Test Prep

Multiple Choice

For Exercises 31 and 32, which choice best explains why the relation IS or IS NOT a function?

31. $\{(-5, 7), (-2, -1), (0, 3), (4, 7)\}$
 A. A function; only one range value exists for each domain value.
 B. A function; two domain values exist for range value 7.
 C. Not a function; the relation passes the vertical line test.
 D. Not a function; two domain values exist for range value 7.
32. $\{(-8, -4), (-2, 0), (1, 3), (-2, 6)\}$
 F. A function; only one range value exists for each domain value.
 G. A function; two range values exist for domain value -2 .
 H. Not a function; the relation passes the vertical line test.
 I. Not a function; two range values exist for domain value -2 .



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Short Response

33. Answer and explain. (a) Is the number of people expected to attend a picnic a function of the number of sandwiches made for the picnic? (b) Is the number of sandwiches made for a picnic a function of the number of people expected to attend?

Mixed Review

- Lesson 7-8** 34. **Banking** You invest \$1,200 in an account that earns 3.5% interest compounded annually. Find the account balance after four years.

Lessons 7-1 and 7-3 Solve each equation.

35. $-42 + 3c = -6$ 36. $\frac{3}{2}t - 4 = \frac{1}{2}$ 37. $2m - 4.9 = -3.6$

Equations With Two Variables

8-2

OBJECTIVE

1 Finding Solutions of Two-Variable Equations

In previous chapters, you solved equations with one variable, such as $2x + 5 = 7x$. In this chapter, you will find solutions of equations with two variables, such as $y = 3x + 4$. An ordered pair that makes such an equation a true statement is a **solution** of the equation.

1 EXAMPLE Finding a Solution

Find the solution of $y = 3x + 4$ for $x = -1$.

$$y = 3x + 4$$

$$y = 3(-1) + 4 \quad \text{Replace } x \text{ with } -1.$$

$$y = -3 + 4 \quad \text{Multiply.}$$

$$y = 1 \quad \text{Add.}$$

- A solution of the equation is $(-1, 1)$.

✓ Check Understanding Example 1

1. Find the solution of each equation for $x = -3$.
 - a. $y = 2x + 1$
 - b. $y = -4x + 3$
 - c. $y = 0x - 4$

You can use two-variable equations to model real-world situations.

2 EXAMPLE Real-World Problem Solving

Meteorology The equation $t = 21 - 0.01n$ models the normal low July temperature in degrees Celsius at Mount Rushmore, South Dakota. In the equation, t is the temperature at n meters above the base of the mountain. Find the normal low July temperature at 300 m above the base.

$$t = 21 - 0.01n$$

$$t = 21 - 0.01(300) \quad \text{Replace } n \text{ with } 300.$$

$$t = 21 - 3 \quad \text{Multiply.}$$

$$t = 18 \quad \text{Subtract.}$$



- A solution of the equation is $(300, 18)$. The normal low July temperature at 300 m above the base of the mountain is 18°C .

What You'll Learn

OBJECTIVE

- 1 To find solutions of equations with two variables

OBJECTIVE

- 2 To graph linear equations with two variables

... And Why

To solve real-world problems involving meteorology and oceanography

✓ Check Skills You'll Need

Evaluate each expression for $x = 2$.

1. $2 + x$ 2. $x - 12$

3. $8x - 13$ 4. $24 \div 2x$

For help, go to Lesson 1-3.

New Vocabulary

- solution
- linear equation



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Check Understanding Example 2

2. Find the normal low July temperature at 700 m above the base of Mount Rushmore.

OBJECTIVE

2

Graphing Equations With Two Variables

An equation with two variables can have many solutions. One way to show these solutions is to graph them, which also gives a graph of the equation. A **linear equation** is any equation whose graph is a line. All the equations in this lesson are linear equations.

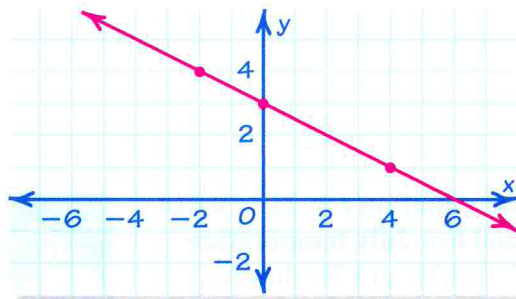
3 EXAMPLE **Graphing a Linear Equation**

Graph $y = -\frac{1}{2}x + 3$.

Make a table of values to show ordered-pair solutions.

x	$-\frac{1}{2}x + 3$	(x, y)
-2	$-\frac{1}{2}(-2) + 3 = 1 + 3 = 4$	$(-2, 4)$
0	$-\frac{1}{2}(0) + 3 = 0 + 3 = 3$	$(0, 3)$
4	$-\frac{1}{2}(4) + 3 = -2 + 3 = 1$	$(4, 1)$

Graph the ordered pairs. Draw a line through the points.



Need Help?

The expression $-\frac{1}{2}x$ means "the opposite of $\frac{1}{2}x$." So when the value of x is -2 , the expression $-\frac{1}{2}x$ represents the opposite of one half of -2 , which is 1 .

Check Understanding Example 3

3. Graph each linear equation.

a. $y = 2x + 1$

b. $y = 3x - 2$

c. $y = -\frac{1}{2}x + 4$

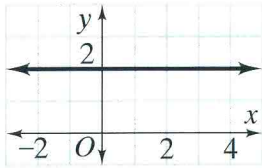
If you use the vertical-line test on the graph in Example 3, you see that every x -value has exactly one y -value. This means that the relation $y = -\frac{1}{2}x + 3$ is a function. A linear equation is a function *unless* its graph is a vertical line.

4 EXAMPLE Graphing $y = a$ and $x = b$

Graph each equation. Is the equation a function?

a. $y = 2$

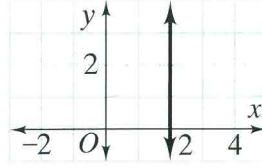
For every value of x , $y = 2$.



This is a horizontal line.
The equation $y = 2$ is
a function.

b. $x = 2$

For every value of y , $x = 2$.



This is a vertical line.
The equation $x = 2$ is
not a function.

✓ Check Understanding Example 4

4. Graph each equation. Is the equation a function?

a. $x = 1$

b. $y = -4$

c. $x = 0$

You may find it helpful to solve an equation for y before you find solutions and graph the equation.

5 EXAMPLE Graphing by Solving for y

Solve $3x + y = -5$ for y . Then graph the equation.

Solve the equation for y .

$$3x + y = -5$$

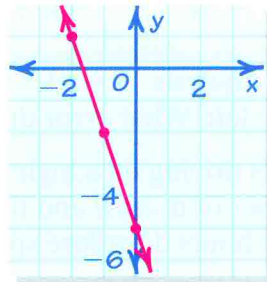
$$3x + y - 3x = -5 - 3x \quad \text{Subtract } 3x \text{ from each side.}$$

$$y = -3x - 5 \quad \text{Simplify.}$$

Make a table of values.

x	$-3x - 5$	(x, y)
-2	$-3(-2) - 5 = 1$	$(-2, 1)$
-1	$-3(-1) - 5 = -2$	$(-1, -2)$
0	$-3(0) - 5 = -5$	$(0, -5)$

Graph.



✓ Check Understanding Example 5

5. Solve each equation for y . Then graph the equation.

a. $2x + y = 3$

b. $y - x = 5$

c. $-3x + 2y = 6$

EXERCISES

For more exercises, see *Extra Practice*.

Practice and Problem Solving

A Practice by Example

Example 1
(page 405)

Find the solution of each equation for $x = -5$.

1. $y = 4x + 2$ 2. $y = -3x - 1$ 3. $y = 8x$

Find the solution of $y = -x - 3$ for the given value of x .

4. -2 5. -1 6. 0 7. 1 8. 2 9. 3

Example 2
(page 405)

The equation $k = 1.6d$ gives an approximate relationship between d miles and k kilometers. Express each distance in kilometers.

10. the 430 miles between Boise, Idaho, and Reno, Nevada
11. the 665 miles between Columbus, Ohio, and Des Moines, Iowa

Examples 3 and 4
(pages 406 and 407)

Graph each linear equation. Is the equation a function?

12. $y = x - 3$ 13. $y = -x - 2$ 14. $y = \frac{2}{3}x - 2$
15. $y = x + 3$ 16. $y = x - 10$ 17. $y = 2x - 1$
18. $x = 7$ 19. $y = 0$ 20. $x = -2$

Example 5
(page 407)

Solve each equation for y . Then graph the equation.

21. $-4x + y = 16$ 22. $-3y = 3x - 9$ 23. $2x - 4y = 12$
24. $y - 6 = 0.5x$ 25. $-3x = 2y$ 26. $2y - 3x = 10$

B Apply Your Skills

27. **Writing in Math** Explain how you can determine from a linear equation whether the solutions of the equation form a function.

Is each ordered pair a solution of $4x - 3y = 6$? Explain.

28. $(3, 2)$ 29. $(-3, -2)$ 30. $(0, 2)$ 31. $(2, 0)$

Find the solutions of each equation for $x = -2, 1,$ and 4 .

32. $y = 7 - 3x$ 33. $y = \frac{1}{4}x + 6$ 34. $y = \frac{3}{5}x - 6$


$$\begin{aligned} 3x + 4y &= 12 \\ 4y &= 12 - 3x \\ y &= 3 - \frac{3}{4}x \end{aligned}$$

35. **Error Analysis** A student solved $3x + 4y = 12$ for y . Her work is at the left. What error did the student make?

36. José is driving on a highway. The equation $d = 55t$ relates the number of miles d and the amount of time in hours t . About how many hours does José spend driving 100 mi?

C Challenge

37. If you swim the backstroke, you burn 9 cal/min (calories per minute). If you swim the butterfly stroke, you burn 12 cal/min. The equation $9x + 12y = 360$ models how you can burn 360 cal by swimming the backstroke for x min and the butterfly for y min.
a. Find the solutions of the equation for $x = 0$ and $y = 0$. Explain what your solutions mean.

- b. Graph the solutions you found in part (a). Draw a line through the two points.
-  c. **Language Arts** The solutions you found in part (a) are the *y*-intercept and the *x*-intercept of the line. Explain why these names are appropriate.
- d. Use your graph from part (b). If you swim the butterfly stroke for 10 min, how long should you swim the backstroke to burn a total of 360 calories?



Test Prep

Multiple Choice

For Exercises 38 and 39, which ordered pair is a solution for the given equation?

38. $y = 2x + 7$
 A. (13, 3) B. (3, 13) C. (2, 8) D. (8, 2)
39. $y = -3x - 4$
 F. (1, -1) G. (1, 1) H. (-7, 1) I. (1, -7)

Reading Comprehension

Read the passage below before doing Exercises 40 and 41.

Mountains Under the Sea

There is a mountain range in the Pacific Ocean far beneath the surface. Jacques Piccard and Donald Walsh descended to 35,814 ft to make a record dive in these mountains in a submersible.

There is tremendous pressure at these depths. The pressure of the air at sea level is 14.7 lb/in.², and the pressure increases about 0.44 lb/in.² for every foot an object descends below sea level.

40. What is the pressure at 10 ft below sea level?
41. The equation $y = 14.7 + 0.44x$ gives the pressure y in pounds per square inch at a depth of x feet below sea level.
- Find the pressure at the depth of the record dive.
 - Find the pressure at half the depth of the record dive.



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Mixed Review

Lesson 8-1 Is each relation a function? Explain.

42. $\{(2, 4), (3, 6), (-3, 6), (1, 2)\}$ 43. $\{(0, 3), (2, 1), (-7, 2), (1, 1)\}$
 44. $\{(3, 4), (2.3, 6), (3, -7)\}$ 45. $\{(0, -1), (0, 0), (-1, 0), (-2, -1)\}$

- Lessons 4-9 and 5-5**  46. **Astronomy** The sun orbits the Milky Way galaxy at about 135 mi/s. How far does the sun travel in an hour? In a week? Write your answers in scientific notation.



A *direct variation* is a linear function modeled by the equation $y = kx$, where $k \neq 0$. The coefficient k is the *constant of variation*. In a direct variation, you can find k from one ordered pair (x, y) . The graph of a direct variation always includes the origin.

1 EXAMPLE

Write an equation for the direct variation that includes $A(3, 5)$.

Step 1 First find the value of k .

$$y = kx \quad \text{direct-variation equation}$$

$$5 = k(3) \quad \text{Replace } y \text{ with } 5 \text{ and } x \text{ with } 3.$$

$$k = \frac{5}{3} \quad \text{Solve for } k.$$

Step 2 Write the equation using the value of k .

$$y = kx \quad \text{direct-variation equation}$$

$$y = \frac{5}{3}x \quad \text{Replace } k \text{ with } \frac{5}{3}.$$

You can write a direct variation to find the conversion factor between two measurement systems.

2 EXAMPLE

Measurement A segment measures 5 in., or 12.7 cm. Let x represent inches and let y represent centimeters. Write a direct variation to convert inches to centimeters. Then convert 24 in. to centimeters.

$$y = kx \quad \text{Use the equation for a direct variation.}$$

$$12.7 = k(5) \quad \text{Replace } x \text{ with } 5 \text{ and } y \text{ with } 12.7.$$

$$2.54 = k \quad \text{Solve for } k.$$

$$y = 2.54x \quad \text{Replace } k \text{ with } 2.54 \text{ to write a direct variation.}$$

$$y = 2.54(24) \quad \text{Solve for } x = 24.$$

$$y = 60.96 \quad \text{Multiply.}$$

24 in. is also 60.96 cm.

EXERCISES

Write an equation for a direct variation that includes each point.

1. $(4, 3)$

2. $(2, 3)$

3. $(8, 3)$

4. $(5.9, 22.42)$

5. **Measurement** A carton contains 2 qt, or 1.89 L, of juice. Write a direct variation for the relationship between quarts and liters. Find the number of liters in 8 quarts.

Slope and y-intercept

8-3

OBJECTIVE

1

Finding the Slope of a Line

Investigation

Understanding Slope

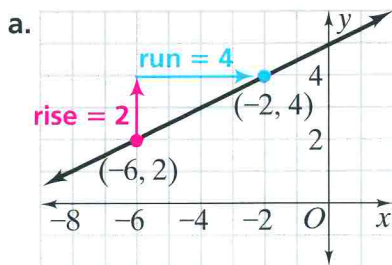
- Graph $y = x$, $y = 2x$, and $y = 3x$ on one coordinate plane.
 - How does the graph of $y = kx$ change as k , the coefficient of x , increases?
- Graph $y = x$ and $y = -x$ on the same coordinate plane.
 - How are the graphs of $y = x$ and $y = -x$ alike? Different?

The ratio that describes the tilt of a line is its slope. If a line slants upward from left to right, it has positive slope. If it slants downward, it has negative slope. To calculate slope, you use this ratio.

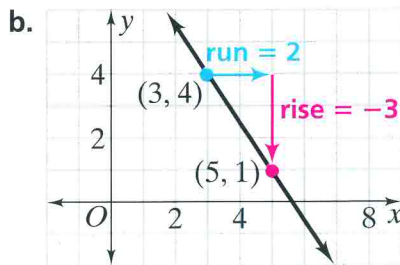
$$\text{slope} = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{\text{rise}}{\text{run}}$$

1 EXAMPLE Using Rise and Run to Find Slope

Find the slope of each line.



$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{2}{4} = \frac{1}{2}$$



$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{-3}{2} = -\frac{3}{2}$$

Check Understanding Example 1

- What is the slope of the ski trail at the right?

What You'll Learn

OBJECTIVE 1 To find the slope of a line

OBJECTIVE 2 To use slope-intercept form in graphing a linear equation

... And Why

To solve real-world problems involving the incline of a ramp or the slant of a roof

Check Skills You'll Need

Find each difference.

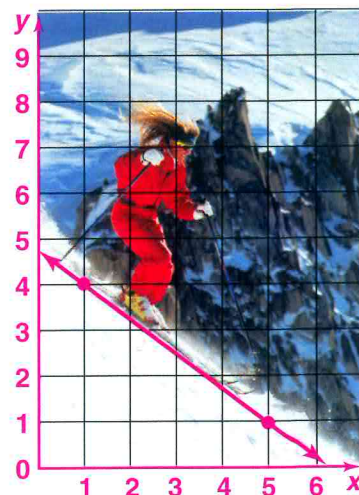
1. $-4 - 5$ 2. $3 - (-2)$

3. $6 - 9$ 4. $-1 - (-1)$

For help, go to Lesson 1-6.

New Vocabulary

- slope
- y-intercept
- slope-intercept form



TEXT Interactive lesson includes instant self-check, tutorials, and activities.

If you know two points of a line, you can find the slope of the line using the following formula.

$$\text{slope} = \frac{\text{difference in } y\text{-coordinates}}{\text{difference in } x\text{-coordinates}}$$

The y -coordinate you use first in the numerator must correspond to the x -coordinate you use first in the denominator.

2 EXAMPLE Using Coordinates to Find Slope

Find the slope of the line through $C(-2, 6)$ and $D(4, 3)$.

$$\text{slope} = \frac{\text{difference in } y\text{-coordinates}}{\text{difference in } x\text{-coordinates}} = \frac{3 - 6}{4 - (-2)} = \frac{-3}{6} = \frac{-1}{2} = -\frac{1}{2}$$

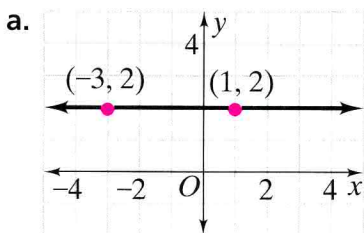
✓ Check Understanding Example 2

2. Find the slope of the line through each pair of points.
- a. $V(8, -1), Q(0, -7)$ b. $S(-4, 3), R(-10, 9)$

Horizontal and vertical lines are special cases for slope.

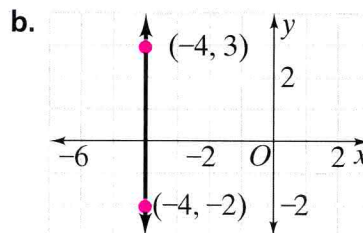
3 EXAMPLE Finding Slope for Special Cases

Find the slope of each line.



$$\text{slope} = \frac{2 - 2}{1 - (-3)} = \frac{0}{4} = 0$$

Slope is 0 for a horizontal line.



$$\text{slope} = \frac{-2 - 3}{-4 - (-4)} = \frac{-5}{0}$$

Division by zero is undefined. Slope is *undefined* for a vertical line.

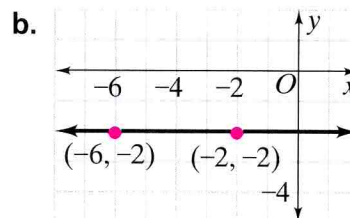
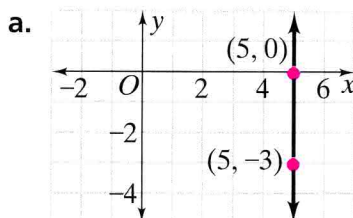


Test-Taking Tip

You may say that a vertical line has *no slope*. But be sure that you do not confuse *no slope* with *slope 0*.

✓ Check Understanding Example 3

3. Find the slope of each line.



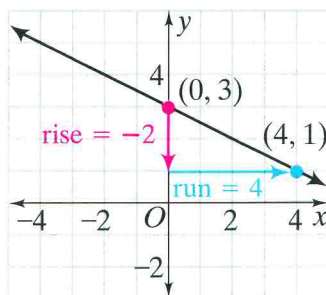
OBJECTIVE

2 Using Slope to Graph Linear Equations

Here is the graph of $y = -\frac{1}{2}x + 3$.

The slope of the line is $-\frac{2}{4}$, or $-\frac{1}{2}$.

The **y-intercept** of the line is the point where the line crosses the y-axis. The constant in the equation is the y-intercept.



$$y = -\frac{1}{2}x + 3$$

↑
↑
slope
y-intercept

Reading Math

The word *intercept* sounds like *intersect*, which means “to cross.” Think of the y-intercept as where the line crosses the y-axis.

Key Concepts Slope-Intercept Form

The equation $y = mx + b$ is the **slope-intercept form**. In this form, m is the slope of the line, and b is the y-intercept.

You can use slope-intercept form to help you graph an equation.

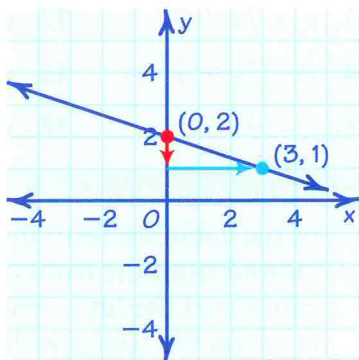
4 EXAMPLE Real-World Problem Solving

Engineering A ramp slopes from a warehouse door down to a street. The function $y = -\frac{1}{3}x + 2$ models the ramp, where x is the horizontal distance in feet from the bottom of the door and y is the height in feet above the street. Graph the equation.

Step 1 Since the y-intercept is 2, graph $(0, 2)$.

Step 2 Since the slope is $-\frac{1}{3}$ or $\frac{-1}{3}$, move 1 unit down from $(0, 2)$. Then move 3 units right to graph a second point.

Step 3 Draw a line through the points.



✓ Check Understanding Example 4

4. Graph each equation.

a. $y = 2x - 3$

b. $y = -x + 4$

EXERCISES

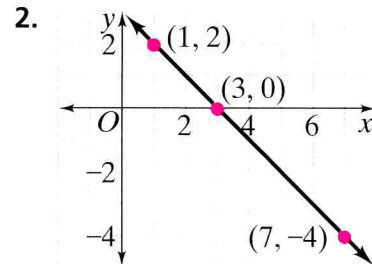
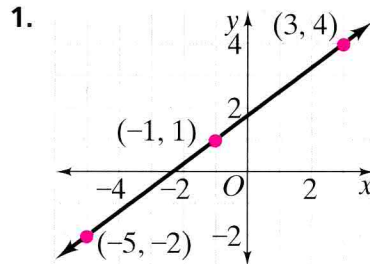
 For more exercises, see *Extra Practice*.

Practice and Problem Solving

A Practice by Example

Find the slope of each line.

Example 1
(page 411)



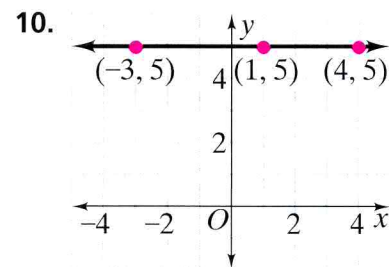
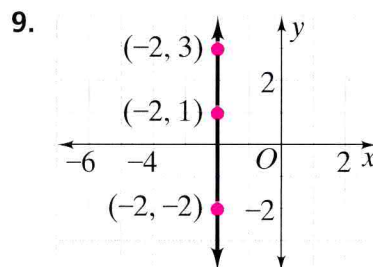
Example 2
(page 412)

Find the slope of the line through each pair of points.

- | | |
|-------------------------|-------------------------|
| 3. $A(2, 6), B(8, 1)$ | 4. $E(1, -2), F(4, -8)$ |
| 5. $N(-5, 2), Q(1, -4)$ | 6. $G(3, 4), H(6, 10)$ |
| 7. $P(-3, 0), Q(4, -5)$ | 8. $A(2, 4), B(-1, -2)$ |

Example 3
(page 412)


Find the slope of each line.



Example 4
(page 413)

Identify the slope and y -intercept of the graph of each equation. Then graph the equation.

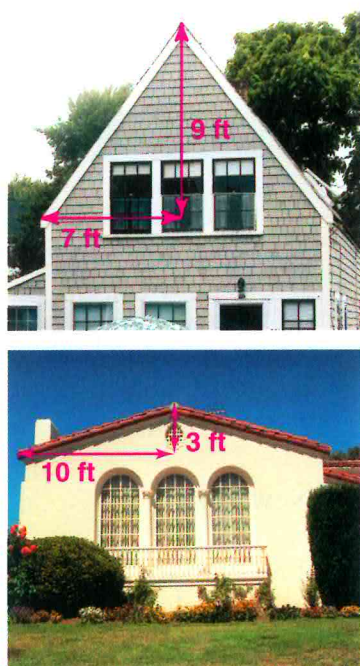
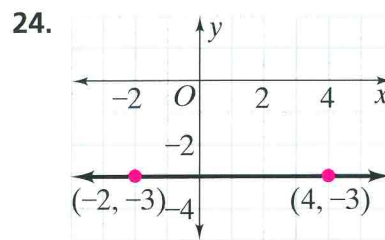
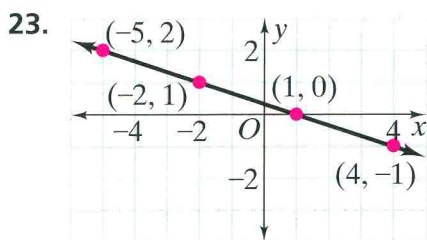
- | | | |
|------------------|-------------------|-----------------------------|
| 11. $y = 7x + 3$ | 12. $y = -x$ | 13. $y = \frac{1}{2}x - 8$ |
| 14. $y = 2x + 1$ | 15. $y = -3x - 1$ | 16. $y = x - 4$ |
| 17. $y = 4$ | 18. $y = -3x + 3$ | 19. $y = -\frac{3}{2}x + 6$ |

-  **20. Architecture** The roof of an A-frame cabin slopes from the peak of the cabin down to the ground. It suggests the letter A when viewed from the front or the back. The equation $y = -3x + 15$ can model the line formed by one side of the roof. For a point (x, y) on the roof, x is the horizontal distance in feet from the center of the base of the house, and y is the height of the roof in feet. Graph the equation.

B Apply Your Skills

- 21. Error Analysis** A student said that the slope of the line through $(8, 4)$ and $(2, 2)$ is 3. What error could this student have made?
- 22. Open-Ended** Write equations for five different lines that intersect at $(0, 3)$.

Find the slope of each line.



25. **Construction** The slope of a roof is its *pitch*. You indicate the pitch of a roof by a ratio $a : b$, where a is the number of feet of rise for every b feet of run. In the photos at the left, which house has a roof with steeper pitch? Explain.

Find the slope of the line through each pair of points.

26. $C\left(\frac{1}{2}, \frac{3}{4}\right), D\left(\frac{1}{4}, \frac{3}{4}\right)$ 27. $L(7, -6.3), M(5, -1.3)$
 28. $J(2.1, 3), K(2.1, 4.2)$ 29. $A\left(\frac{2}{3}, \frac{2}{3}\right), B\left(2\frac{2}{3}, \frac{2}{3}\right)$

Solve each equation for y . Then graph the equation.

30. $y - 2x = 4$ 31. $y + 3 = 5x$ 32. $2y + 2x = 2$
 33. $3y + 2x = 3$ 34. $y - \frac{1}{2}x = 0$ 35. $y + 3 = 0$
 36. $2y = x - 8$ 37. $-4y = x + 48$ 38. $3y - 2x = 15$

39. Does the point $(-3, 4)$ lie on the graph of $y = -2x + 1$? Explain.
 40. Does the point $(-2, -4)$ lie on the graph of $2y - 6x = 4$? Explain.

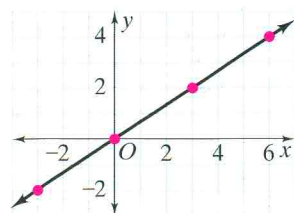
Challenge

Graph each line.

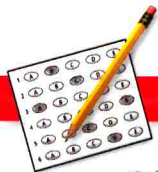
41. no slope, through $(4, -2)$ 42. slope $\frac{2}{3}$, through $(0, -4)$
 43. a. Graph the groups of equations on three coordinate planes.

Group 1	Group 2	Group 3
$y = 2x - 5$	$y = -3x - 1$	$y = -6$
$y = 2x$	$y = -3x$	$y = 1$
$y = 2x + 3$	$y = -3x + 4$	$y = 4.5$

- b. **Writing in Math** How are the lines in each group related to each other? Explain.
 c. **Reasoning** What is the coefficient of x in the equation of a graph that has slope 0?



44. **Construction** The slope of a road is its *grade*. What do you think it means for the grade of a road to be 4%?
 45. Find the slope of the line at the left using two points. Then find the slope using two other points. Are the slopes the same? Explain.



Test Prep

Gridded Response

For Exercises 46–48, what is the slope of the line through the points of each pair?

46. $T(0, 5)$, $U(-3, -2)$ 47. $Q(9, 5)$, $R(4, -5)$ 48. $C(1, 7)$, $D(-8, 7)$



Take It to the NET

Online lesson quiz at
www.PHSchool.com

Web Code: ada-0803

For Exercises 49–51, what is the y-intercept of the graph of each equation?

49. $y = -4x + 7$ 50. $y = -2x$ 51. $y = 1.9$

Mixed Review

Lesson 7-6

Solve and graph each inequality.

52. $4x + 5 < 17$ 53. $18 \leq 5 - 2x$ 54. $-x + 6 > 31$

Lesson 6-8

Find each percent of change. Tell whether the change is an increase or a decrease.

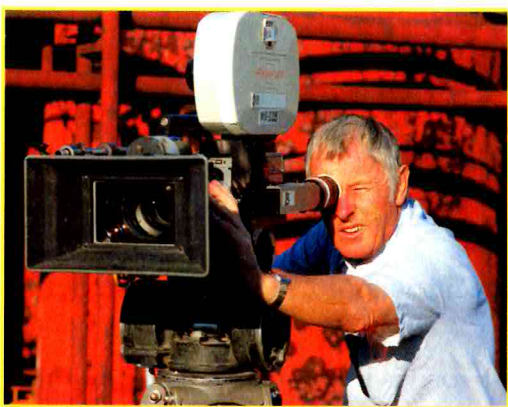
55. from 10 to 9 56. from 20 to 30 57. from 52 to 39

Lesson 6-7

58. Ticket Sales During the 1998–1999 season, New York theatergoers bought 11.7 million tickets for a total of \$588.5 million. Theatergoers spent a total of 5.5% more than the season before. What was the total amount spent during the 1997–1998 season?

Math at Work

Movie-Camera Operator



Lights ... camera ... action! These are familiar words for movie-camera operators. When the action begins, movie-camera operators are responsible for capturing the action on film. One scene in a movie can cost hundreds of thousands of dollars, so a scene has to be filmed correctly in as few tries as possible. Camera operators are trained in the effective use of lighting, lens filters, and camera angles. The operators determine the precise movements of the camera and its platform and the camera angles in advance of the actual shooting. It takes a good understanding of algebra and coordinate geometry to do that!



Take It to the NET

For more information about movie-camera operators, go to www.PHSchool.com.

Web Code: adb-2031



Technology

Graphing Lines

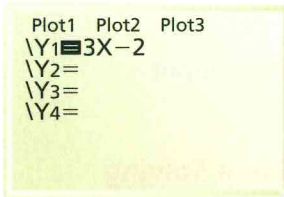
For Use With Lesson 8-3

You can use a graphing calculator to graph equations in slope-intercept form and find solutions.

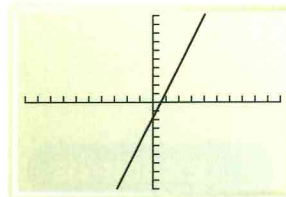
EXAMPLE

Graph $y = 3x - 2$.

Step 1 Press the **Y=** key.
Enter $3x - 2$.



Step 2 Press **ZOOM 6** to graph your equation with the standard viewing window.

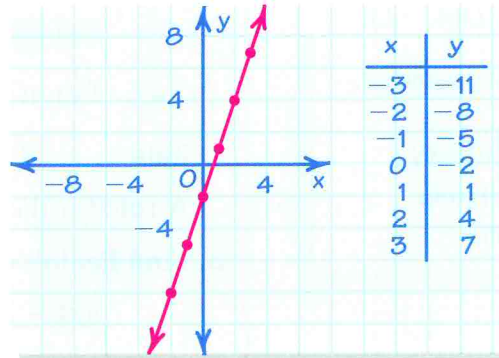


Step 3 Press **TABLE** to see solutions.

X	Y1	
-3	-11	
-2	-8	
-1	-5	
0	-2	
1	1	
2	4	
3	7	

X=-3

Step 4 Sketch the graph using values from the table of solutions.



EXERCISES

Graph each equation.

- $y = 2x + 1$
- $y = x - 4$
- $y = 3x + 2$
- $y = -x$
- $y = -x + 4$
- $y = 4x - 3$
- $y = -3x - 2$
- $y = \frac{1}{2}x - 5$
- $y = -\frac{1}{2}x + 2$
- Graph $y = \frac{2}{3}x - 2$, $y = \frac{2}{3}x + 2$, and $y = \frac{2}{3}x + 6$, in the standard viewing window. Tell what you observe, and explain.

Writing Rules for Linear Functions

What You'll Learn

OBJECTIVE

1

To write a function rule for a word relationship

OBJECTIVE

2

To write a function rule by analyzing a table or graph

... And Why

To solve real-world problems involving measurements

Check Skills You'll Need

Find the slope of the line through each pair of points.

- $A(3, 1), B(2, 1)$
- $S(3, 4), T(1, 2)$
- $P(0, -2), Q(0, 2)$
- $C(-5, 2), D(4, -1)$

For help, go to Lesson 8-3.

New Vocabulary

- function notation
- function rule

TEXT Interactive lesson includes instant self-check, tutorials, and activities.

OBJECTIVE

1

Writing Rules From Words

You can write a function using **function notation**, in which you use $f(x)$ instead of y . You read $f(x)$ as “ f of x .” You can think of a domain value as an *input* and the resulting range value as the *output*. A **function rule** is an equation that describes a function.

function rule		function rule	
$y = 3x + 7$		$f(x) = 3x + 7$	
↑	↑	↑	↑
output	input	output	input

1 EXAMPLE

Real-World Problem Solving

Sales Commissions Paulo works at a local store. Each week he earns a \$300 salary plus a 3% commission on his sales.

a. Write a function rule that relates total earnings to sales.

Words total earnings are \$300 plus 3% of sales

Let s = the amount of his sales.

Let $t(s)$ = total earnings, a function of his sales.

Rule $t(s) = 300 + 0.03 \cdot s$

A rule for the function is $t(s) = 300 + 0.03s$.

b. Find Paulo's earnings for one week if his sales are \$2,500.

$$t(s) = 300 + 0.03s$$

$$t(2,500) = 300 + 0.03(2,500) \quad \text{Replace } s \text{ with } 2,500.$$

$$t(2,500) = 300 + 75 \quad \text{Multiply.}$$

$$t(2,500) = 375 \quad \text{Add.}$$

Paulo earns \$375 if his sales are \$2,500.

Check Understanding Example 1

- Scrumptious Snack Mix is sold by mail order. It costs \$3/lb, plus \$4 for shipping and handling. Write a function rule for the total cost $c(p)$ based on the number of pounds p bought. Use your function to find the total cost of 5 lb of snack mix.

2 Writing Rules From Tables or Graphs

To write a function rule from a table, look for a pattern. The slope m is $\frac{\text{difference in } f(x) \text{ values}}{\text{difference in } x \text{ values}}$, and b is the value of $f(x)$ when $x = 0$.

2 EXAMPLE Writing a Function Rule From a Table

Write a rule for the linear function in the table below.

x	$f(x)$
-2	-5
0	1
2	7
4	13

As the x values increase by 2, the $f(x)$ values increase by 6.

$$\text{So } m = \frac{6}{2} = 3.$$

When $x = 0$, $f(x) = 1$. So $b = 1$.

- A rule for the function is $f(x) = 3x + 1$.

Check Understanding Example 2

2. Write a rule for each linear function.

a.

x	$f(x)$
-1	-2
0	0
1	2
2	4

b.

x	$f(x)$
-3	6
0	0
3	-6
6	-12

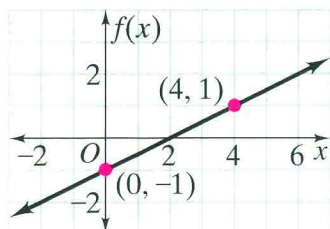
c.

x	y
-6	-11
-4	-7
-2	-3
0	1

You can use slope-intercept form, $f(x) = mx + b$ or $y = mx + b$, when you write a rule for a linear function.

3 EXAMPLE Writing a Function Rule From a Graph

Write a rule for the linear function graphed below.



$$\text{slope} = \frac{1 - (-1)}{4 - 0} = \frac{2}{4} = \frac{1}{2}$$

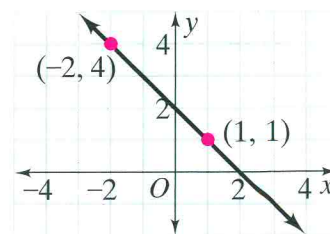
$$\text{y-intercept} = -1$$

$$\text{A rule for the function is } f(x) = \frac{1}{2}x - 1.$$

Reading Math
 y and $f(x)$ may be used interchangeably in a function rule.

Check Understanding Example 3

3. Write a rule for the function graphed at the right.



EXERCISES

For more exercises, see *Extra Practice*.

Practice and Problem Solving

A Practice by Example

Write a function rule for each situation. Then use your function as indicated.

Example 1
(page 418)

- 1. Money** You give a salesperson \$20 for a purchase and receive change. Use your function to find the amount of change from a \$4.50 purchase.
- 2. Science** The temperature t in *Kelvin* is 273.15 more than the temperature c in degrees *Celsius*. Use your function to find the equivalent temperature in Kelvin for 100°C .
- 3. Physics** The force of gravity is less on Mars than it is on Earth. As a result, the weight of an object on Mars m is 40% of its weight on Earth w . Use your function to find the weight on Mars of a space probe that weighs 15 lb on Earth.

Example 2
(page 419)

In Exercises 4–8, write a rule for each linear function.

4.

x	$f(x)$
-9	-18
0	-9
9	0
18	9

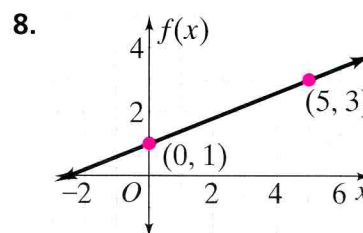
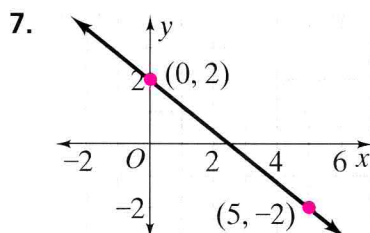
5.

x	$f(x)$
-4	4
-2	2
0	0
2	-2

6.

x	y
0	-2.4
2	-4.8
4	-7.2
6	-9.6

Example 3
(page 419)



- a. Writing in Math** Describe the advantages you see in using a rule for a function rather than listing function values in a table.
 - b.** Describe the disadvantages.
- 10. Measurement** Write a rule that expresses the number of quarts q of a liquid as a function of each of the following.
 - a.** the number of pints p
 - b.** the number of fluid ounces f
- 11. a. Measurement** Express the number of inches $n(d)$ as a function of the number of yards d .
 - b.** Use your function to find the number of inches in 4 yards.
- 12. a. Geometry** Write a rule that expresses the perimeter $p(s)$ of a square as a function of the length s of one side.
 - b.** Use your function to find the perimeter of a square with side length 7 cm.

B Apply Your Skills



Need Help?

8 fluid ounces = 1 cup
2 cups = 1 pint
2 pints = 1 quart
4 quarts = 1 gallon

Examples 2 and 3 suggest that you can write a rule for a linear function if you know any of the following about its graph.

- (a) the slope m and y -intercept b ;
- (b) the slope m and any point (p, q) of the graph;
- (c) any two points (r, s) and (u, v) of the graph.

Sample A line through points $(-2, 6)$ and $(4, 3)$ has slope

$$\frac{3 - 6}{4 - (-2)} = -\frac{1}{2}.$$

Using $-\frac{1}{2}$ for the slope, an equation of the line is $y = -\frac{1}{2}x + b$.

Using $(4, 3)$, substitute 4 for x and 3 for y : $3 = -\frac{1}{2}(4) + b$

So, $3 = -2 + b$, and the y -intercept b is 5. The rule is $y = -\frac{1}{2}x + 5$.

Write a rule for the linear function whose graph has slope m and y -intercept b .

13. $m = 2, b = -4$ 14. $m = -\frac{1}{3}, b = -2$ 15. $m = 0, b = 2$

Write a rule for the linear function whose graph has slope m and contains the given point.

16. $m = -\frac{1}{4}; (4, 0)$ 17. $m = 3; (-2, -2)$ 18. $m = \frac{3}{4}; (6, 4)$

Write a rule for the linear function whose graph contains the two given points.

19. $(1, 1), (2, 5)$ 20. $(3, 0), (8, 2)$ 21. $(11, 19), (-6, -15)$
 22. $(-3, 2), (4, -1.5)$ 23. $(1, -1), (4, -1)$ 24. $(1, 2.4), (-1, 3.8)$

Challenge

25. a. Choose two points from the table and write a rule for the linear function.
 b. Choose two other points from the table and write a rule for the linear function.
 c. **Writing in Math** Compare the rules from parts (a) and (b) Justify your observations.

x	y
-6	-15
1	-1
7	11
11	19

Data Analysis For Exercises 26 and 27, use the data below.

26. Write a function rule for the total monthly cost for electric space heating.
27. a. Write a function rule for the total monthly bill of a home customer.
 b. Suppose a home customer receives a bill for \$22.52 one month. How many kilowatt-hours did the customer use that month?

Electricity Rates

Type of Account	Charge per	
	Kilowatt-hour (¢/kWh)	Monthly Charge (\$)
Home	4.968	6.87
Space Heating	5.691	7.77



Test Prep

Multiple Choice

28. Which rule gives the same relationship between x and y as $x + y = 6$?
 A. $y = x + 6$ B. $y = x - 6$ C. $y = 6 - x$ D. $y = -6 - x$
29. Which function rule describes the number of centimeters y as a function of a number of millimeters x ?
 F. $y = 100x$ G. $y = 10x$ H. $y = 0.1x$ I. $y = 0.01x$
30. Which rule shows the relationship of pounds, p , to ounces, z ?
 A. $z = 16p$ B. $z = 32p$ C. $p = 16z$ D. $p = 32z$



Take It to the NET

Online lesson quiz at
www.PHSchool.com
 Web Code: ada-0804

Short Response

31. a. One gallon equals 4 quarts. Write a rule that expresses the number of quarts q as a function of the number of gallons g .
 b. Use your function from part (a) to find the number of quarts in 17 gallons.

Mixed Review

Lesson 8-3

Find the slope of the line through each pair of points.

32. $C(0, -2), D(2, 1)$ 33. $J(3, -1), K(6, 1)$ 34. $G(12, 8), H(6, 2)$

Lesson 6-4

Probability Find each probability for choosing a letter at random from the letters in the word **FUNCTION**.

35. $P(N \text{ or } C)$ 36. $P(\text{consonant})$ 37. $P(\text{not } T)$

Lesson 3-5

38. **Sports** In 1999, Hicham El Guerrouj of Morocco ran the mile in world-record time. Had he taken 1.26 seconds longer, his time would have matched the previous record of 3 min, 44.39 s. Write and solve an equation to find the 1999 record time.



Checkpoint Quiz 1

Lessons 8-1 through 8-4



TEXT Instant self-check quiz online and on CD-ROM

- Find three solutions of $9x - 2y = 18$.
- Graph $3x - y = 5$ on a coordinate plane.
- Is $\{(-2, 0), (-1, 3), (0, -2), (3, -1)\}$ a function? Explain.
- Writing in Math** Explain how to use the vertical-line test to determine whether a relation is a function.

Find the slope of the line through the given points.

- $A(1, 5), B(3, 15)$ 6. $D(-2, -4), F(0, -6)$ 7. $G(-3, 4), H(-3, -6)$
- What are the slope and the y -intercept of $y = -2x + 5$?
- Measurement** Write a rule to describe the number of pounds $p(n)$ as a function of a number of tons n .

Scatter Plots

8-5

OBJECTIVE

1 Interpreting and Drawing Scatter Plots

Investigation

Making Scatter Plots

- Data Collection** For each person in your group, measure the height and *hand span*, the greatest distance possible between the tips of the thumb and little finger on one hand.
- Graph the lengths as ordered pairs (height, hand span).
- Share your data with the class. Make a graph of the class data.
 - Reasoning** Compare the two graphs you made. Does one graph show a relationship between heights and hand spans more clearly than the other? Explain.

A **scatter plot** is a graph that shows the relationship between two sets of data. To make a scatter plot, graph the data as ordered pairs.

1 EXAMPLE Real-World Problem Solving

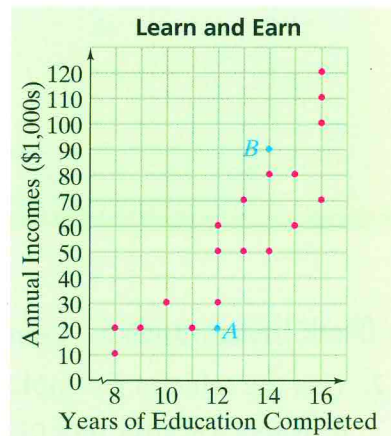
Income The scatter plot shows education and income data.

- Describe the person represented by point A.

This person has 12 years of education and earns \$20,000 in a year.

- How many years of education does the person who earns \$100,000 have?

The point (16, 100) has income coordinate 100. The person earning \$100,000 in a year has 16 years of education.



Check Understanding Example 1

- Describe the person represented by point B.
 - How many people have exactly 12 years of education?

What You'll Learn

OBJECTIVE 1 To interpret and draw scatter plots

OBJECTIVE 2 To use scatter plots to find trends

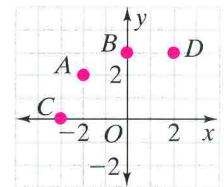
... And Why

To solve real-world problems involving trends

Check Skills You'll Need

Write the coordinates of each point.

- A
- B
- C
- D



For help, go to Lesson 1-10.

New Vocabulary

- scatter plot
- positive correlation
- negative correlation
- no correlation

TEXT Interactive lesson includes instant self-check, tutorials, and activities.

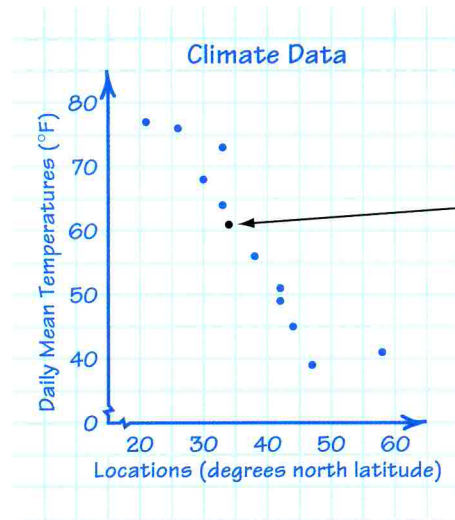
2 EXAMPLE**Real-World Problem Solving**

Climate Use the table to make a scatter plot of the latitude and temperature data.

Climate Data

City	Location (degrees north latitude)	Daily Mean Temperature (°F)	Mean Annual Precipitation (inches)
Atlanta, GA	34	61	51
Boston, MA	42	51	42
Chicago, IL	42	49	36
Duluth, MN	47	39	30
Honolulu, HI	21	77	22
Houston, TX	30	68	46
Juneau, AK	58	41	54
Miami, FL	26	76	56
Phoenix, AZ	33	73	8
Portland, ME	44	45	44
San Diego, CA	33	64	10
Wichita, KS	38	56	29

SOURCES: *The World Almanac* and *The Statistical Abstract of the United States*. Go to www.PHSchool.com for a data update. Web Code: adg-2041

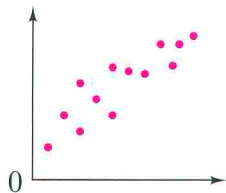
**Check Understanding Example 2**

2. Use the table in Example 2.
 - a. Make a scatter plot of the latitude and precipitation data.
 - b. Make a scatter plot of the temperature and precipitation data. Plot temperatures along the horizontal axis of the graph.

OBJECTIVE

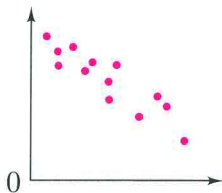
2 Using Scatter Plots to Find Trends

You can use scatter plots to look for trends. The next three scatter plots show the types of relationships two sets of data may have.



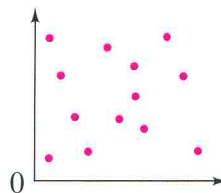
Positive correlation

As one set of values increases, the other set tends to increase.



Negative correlation

As one set of values increases, the other set tends to decrease.



No correlation

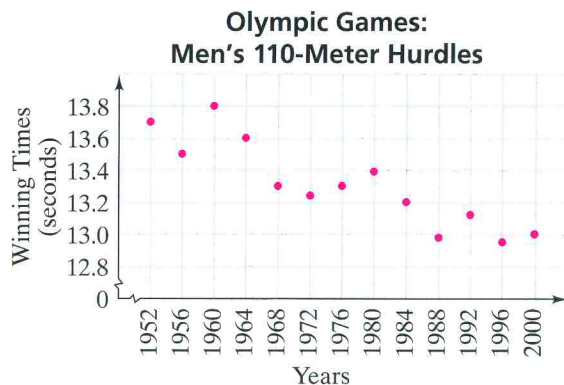
The values show no relationship.

Reading Math

"Positive slope" in a scatter plot suggests a positive correlation. "Negative slope" suggests a negative correlation.

3 EXAMPLE Real-World Problem Solving

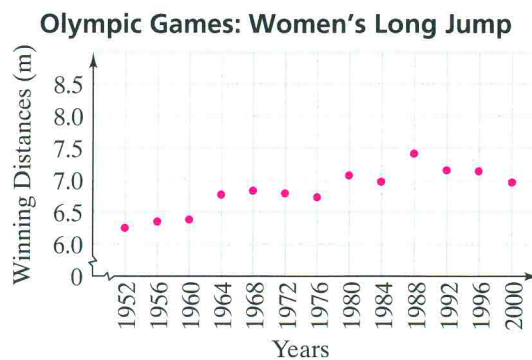
Sports Use the scatter plot below. Is there a *positive correlation*, a *negative correlation*, or *no correlation* between the years and the winning times? Explain.



Since 1952, the winning times have generally decreased. There is a negative correlation.

Check Understanding Example 3

3. **Sports** Use the scatter plot at the right. Is there a *positive correlation*, a *negative correlation*, or *no correlation* between the years and the winning distances? Explain.



EXERCISES

For more exercises, see *Extra Practice*.

Practice and Problem Solving

A Practice by Example

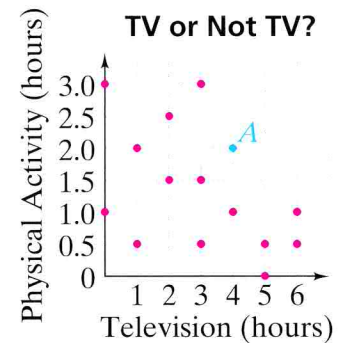
Example 1
(page 423)

Reading Math

For help with reading and solving Exercises 1–3, see page 429.

Statistics The scatter plot shows the average times that 15 students spent watching television and on physical activities in a day.

- Describe the student represented by point A.
- How many students averaged 1 hour of physical activity?
- How many students averaged 5 hours of watching television?



Example 2
(page 424)

Nutrition For Exercises 4–6, use the table below. Make a scatter plot for the data indicated. Graph calories on the horizontal axis.

Nutritional Values for 100 Grams of Food

Food	Fat (grams)	Protein (grams)	Carbohydrate (grams)	Energy (calories)
Bread	4	8	50	267
Cheese	33	25	1	403
Chicken	4	31	0	165
Eggs	11	13	1	155
Ground beef	19	27	0	292
Milk	3	3	5	61
Peanuts	49	26	16	567
Pizza	5	12	33	223
Tuna	1	26	0	116

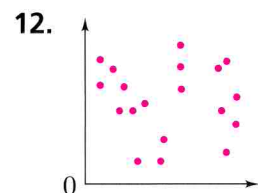
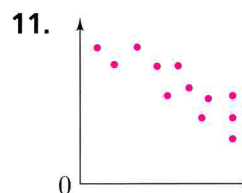
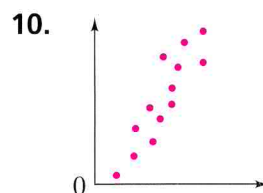
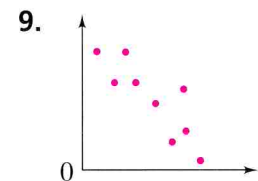
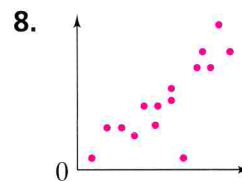
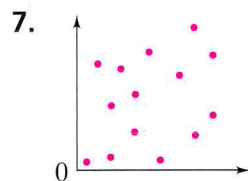


SOURCE: U. S. Department of Agriculture Nutrient Database for Standard Reference

- calories and grams of protein
- calories and grams of fat
- calories and grams of carbohydrates

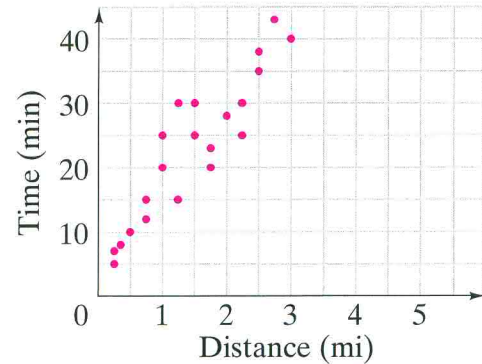
Example 3
(page 425)

Is there a *positive correlation*, a *negative correlation*, or *no correlation* between the sets of data in each scatter plot? Explain.



B Apply Your Skills

Data Analysis The scatter plot below shows the relationship between the distances from school and the times it takes to get to school for the students in one class.



13. How long does it take the student who lives 0.5 mi from school to get to school?
14. How many students live closer than 1 mi from school?
15. How many students take longer than 35 min to get to school?

Would you expect a *positive correlation*, a *negative correlation*, or *no correlation* between each pair of data sets? Explain.

16. the age of pets in a home and the number of pets in that home
17. the temperature outside and the number of layers of clothing
18. your grade on a test and the amount of time you studied
19. the shoe sizes and the shirt sizes for men
20. the times candles take to burn and their original heights
21. the number of students in a school and the number of stores near a school
22. latitude and precipitation (see p. 424 Check Understanding 2a)
23. temperature and precipitation (see p. 424 Check Understanding 2b)

C Challenge

24. **Writing in Math** Describe a pair of data sets, different from any in this lesson, for which you would expect to see a scatter plot with a negative correlation. Explain.

25. **Ticket Prices** The table at the right shows the average prices of movie tickets and the numbers of movie admissions.

Year	Number of Admissions (millions)	Average Ticket Price
1990	1,189	\$4.23
1992	1,173	\$4.15
1994	1,292	\$4.18
1996	1,339	\$4.42
1998	1,481	\$4.69

SOURCE: Motion Picture Association of America

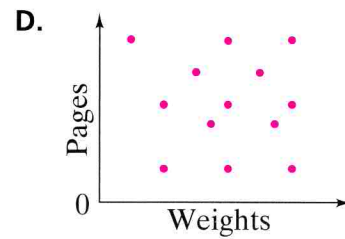
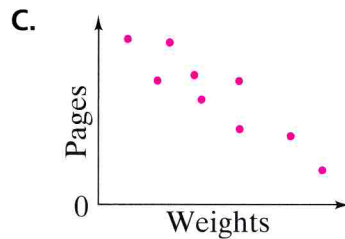
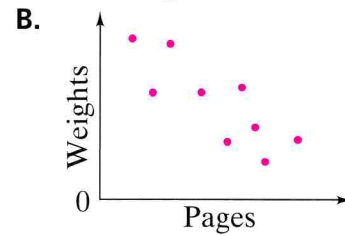
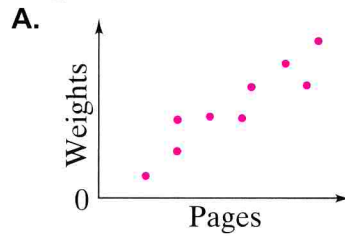
- a. Make a scatter plot of the data in the table. Graph the prices of tickets on the horizontal axis.
- b. **Data Analysis** Is there a *positive correlation*, a *negative correlation*, or *no correlation* between the numbers of admissions and the prices of tickets?
- c. **Reasoning** Would your answer to part (b) be the same if you graphed ticket prices on the vertical axis instead? Explain.



Test Prep

Multiple Choice

26. Which scatter plot shows that as the numbers of pages in magazines increase, the weights of the magazines increase?



27. Which pair of data sets would most likely have no correlation?

- F. the distances cars can travel on full tanks of gasoline and the amounts of gasoline their tanks can hold
- G. the ages of children under 12 years old and their heights
- H. people's ring sizes and the numbers of rings they own
- I. the numbers of students and the numbers of teachers in each school in your state

Short Response

In Exercises 28–30, (a) describe a graph with each given type of correlation. (b) Sketch a graph showing each type of correlation.

28. positive 29. negative 30. no correlation

Mixed Review

Lesson 8-4

Write a rule for each function.

31.

x	y
-4	-10
-2	-5
0	0
2	5

32.

x	y
-6	5
-3	3
0	1
3	-1

33.

x	f(x)
-2	9
1	6
4	3
7	0

Lesson 7-7

Solve each formula for the variable indicated in red.

34. $V = \frac{1}{3}Bh$

35. $A = \frac{1}{2}(b + c)h$

36. $S = \frac{a}{1 - r}$

Lesson 6-7

37. **Personal Finance** Ms. Jimenez earns \$27,000 per year. She is paid weekly. She puts 8% of her salary in a retirement fund. How much money goes into this fund each week?



To read a graph, you must understand its parts. You must also be able to analyze what it shows. Graphs called *scatter plots* show correlations. They tell you how, if at all, pairs of data sets are related.

EXAMPLE

Statistics The scatter plot shows the average times that 15 students spent watching television and the average times they spent on physical activity in a day.

1. Describe the student represented by point *A*.
2. How many students averaged 1 hour of physical activity?
3. How many students averaged 5 hours of watching television?

• **Understand the parts.**

The labeling of the axes provides the key to understanding the graph. You find hours of TV viewing on the horizontal axis. You find hours of physical activity on the vertical axis. A plotted point corresponds to an ordered pair (TV hours, activity hours).

1. Describe the student represented by point *A*.

This student averaged 4 hours of TV viewing and 2 hours of physical activity daily.

2. How many students averaged 1 hour of physical activity?

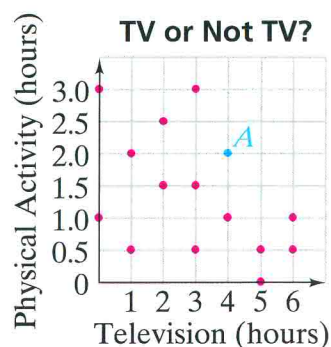
Find 1 hour of physical activity on the vertical axis. Look across and find three points. Three students averaged 1 hour of physical activity.

3. How many students averaged 5 hours of watching TV?

Find 5 hours of television viewing on the horizontal axis. Look above and find two points. Two students averaged 5 hours watching TV.

• **Analyze what the graph shows.**

This graph is a scatter plot. You should decide what kind of correlation, if any, the graph shows.



EXERCISES

1. Would you expect there to be a positive correlation, a negative correlation, or no correlation between hours of physical activity and hours of watching television? Justify your choice.
2. Does the scatter plot suggest a positive correlation, a negative correlation, or no correlation? Explain.

8-6

Problem Solving

Solve by Graphing

OBJECTIVE

1

Solve by Graphing

What You'll Learn

OBJECTIVE 1 To solve problems by graphing

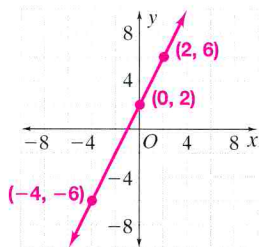
... And Why

To solve real-world problems involving wildlife populations

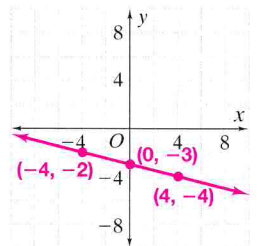
Check Skills You'll Need

Write a rule for each linear function.

1.



2.



For help, go to Lesson 8-4.

New Vocabulary

- trend line

Math Strategies in Action

Businesses and government agencies use scatter plots to look for trends and make predictions.

For example, the park service at Isle Royale, Michigan, surveys the moose and wolf populations each spring. They use a scatter plot to show the relationship between them.

On the scatter plot they draw a **trend line** that closely fits the data points in the scatter plot. Using the trend line, they can predict the size of one population from the size of the other.



Real-World Connection

Moose, like the one shown above, have wolves as a principal predator.

1 EXAMPLE

Real-World Problem Solving

Wildlife Use the data in the table below. Suppose there were 18 wolves one year. About how many moose would you expect to be on the island that year?

Isle Royale Populations

Year	Wolf	Moose	Year	Wolf	Moose	Year	Wolf	Moose
1982	14	700	1988	12	1,653	1994	15	1,800
1983	23	900	1989	11	1,397	1995	16	2,400
1984	24	811	1990	15	1,216	1996	22	1,200
1985	22	1,062	1991	12	1,313	1997	24	500
1986	20	1,025	1992	12	1,600	1998	14	700
1987	16	1,380	1993	13	1,880	1999	25	750

SOURCE: Isle Royale National Park Service

Read and Understand

1. What are the two variables?
2. What are you trying to predict?

Plan and Solve

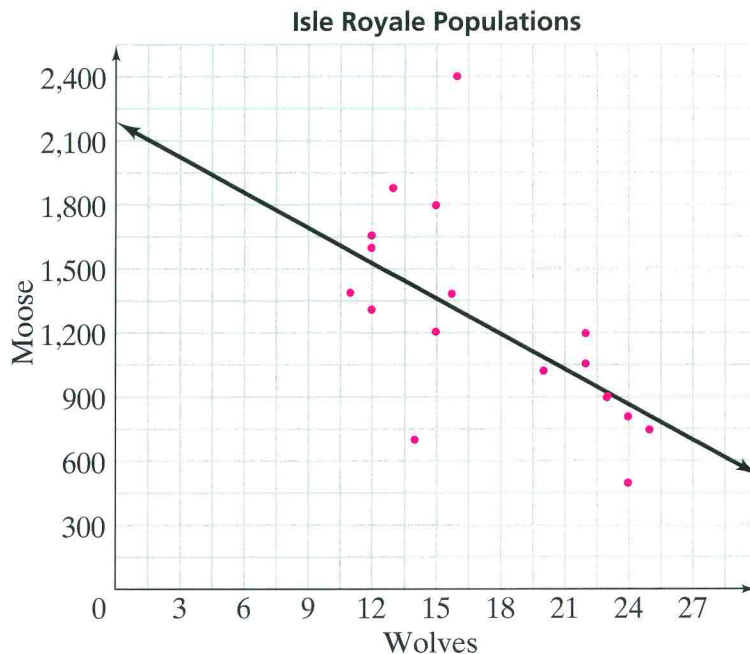
You can graph the data in a scatter plot. If the points show a correlation, you can draw a trend line. You can then use the line to predict other data values.

Step 1 Make a scatter plot by graphing the (wolf, moose) ordered pairs. Use the x -axis for wolves and the y -axis for moose.

Step 2 Sketch a trend line. The line should be as close as possible to each data point. There should be about as many points above the trend line as below it.

Step 3 To predict the number of moose when there are 18 wolves, find 18 along the horizontal axis. Look up to find the point on the trend line that corresponds to 18 wolves. Then look across to the value on the vertical axis, which is about 1,200.

There will be about 1,200 moose when there are 18 wolves.



Look Back and Check

You can write an equation for a trend line. You can use the equation to make predictions.

✓ Check Understanding

3. a. What is the y -intercept of the trend line above?
b. Locate one other point on the trend line. Then find the slope of the trend line.
c. Write an equation for the trend line in slope-intercept form.
d. Use the equation you wrote in part (c). Find the solution of the equation when $x = 18$.

EXERCISES

 For more exercises, see *Extra Practice*.

Practice and Problem Solving

A Practice by Example

Example 1
(page 430)

Solve each problem by graphing.

Statistics For Exercises 1 and 2, use the data below. The table shows the populations of some states and the numbers of cars registered in those states.

State Populations and Cars

State	Population (millions)	Registered Cars (millions)	State	Population (millions)	Registered Cars (millions)
FL	14.4	7.2	NY	18.1	7.9
GA	7.3	3.8	OH	11.2	6.6
IL	11.8	6.2	PA	12.0	5.9
KS	2.6	1.2	SC	3.7	1.8
ME	1.2	0.6	TN	5.3	3.0
MS	2.7	1.3	TX	19.1	7.4
NV	1.6	0.6	WA	5.5	2.6

SOURCE: *Statistical Abstract of the United States*. Go to www.PHSchool.com for a data update. Web Code: adg-2041

Strategies

- Account for All Possibilities
- Draw a Diagram
- Look for a Pattern
- Make a Model
- Make a Table
- Simplify the Problem
- Simulate the Problem
- Solve by Graphing
- Try, Test, Revise
- Use Multiple Strategies
- Work Backward
- Write an Equation
- Write a Proportion

- Use the data to make a scatter plot of the data. Use the population data for the horizontal axis.
 - Draw a trend line.
 - Predict how many cars are registered by the 32.2 million people in California.
 - Write an equation for your trend line. Predict the number of cars registered by the 7.3 million people in North Carolina.
- Writing in Math** Is there a correlation between the two data sets? Explain.
- Data Analysis** Use the data in the table below. Predict the number of gallons bought for \$15.

Gasoline Purchases

Dollars Spent	12	14	11	12	10	6	10	8
Gallons Bought	7.3	8.0	5.9	6.5	5.7	3.5	5.1	4.4

B Apply Your Skills

Solve using any strategy.

Writing in Math

For help with justifying your answer to Exercise 5, see page 434.

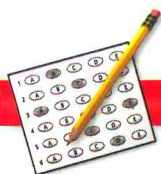
- Elections** Four candidates are running for president of the student council. Three other candidates are running for vice-president. How many different ways can the two offices be filled?
- Business** A supermarket charges \$1.17 for a 12-oz jar of salsa and \$1.89 for a 20-oz jar. Now the producer is introducing a 16-oz jar of the same salsa. What do you think would be a fair price for this new size? Justify your answer to the manager of the store.

6. **Algebra** A plumber charges \$45 for a service call, plus \$70/h for her time.
- Find the cost of a two-hour service call.
 - How long was a service call that cost \$150?
7. **Engineering** To provide wheelchair access, a ramp with a slope of $\frac{1}{15}$ is being built to a door of a building. Suppose that the bottom of the door is 3 ft above street level. How far will the ramp extend from the building?



Challenge

8. **Physics** As the weight held by a spring increases, the length of the spring increases proportionally. Suppose a 2-lb weight stretches a spring to 15 in., and a 12-lb weight stretches the same spring to 20 in. What is the length of the spring with no weight attached?
9. The data table on page 430 shows 18 data pairs. Its scatter plot (page 431) shows 17 plotted points. Make a conjecture as to why this is so. Study the table to verify or disprove your conjecture.



Test Prep

Multiple Choice

10. Which ordered pair is a solution for $4x - 3y = 6$?
 A. $(-3, 2)$ B. $(3, 2)$ C. $(3, -2)$ D. $(-3, -2)$
11. What is the slope of the line through $A(2, 6)$ and $B(8, -1)$?
 F. $-\frac{6}{7}$ G. $-\frac{4}{9}$ H. $\frac{5}{6}$ I. $-\frac{7}{6}$
12. What is the slope of the graph of $3x - 2y = 6$?
 A. $-\frac{3}{2}$ B. $-\frac{2}{3}$ C. $\frac{2}{3}$ D. $\frac{3}{2}$
13. What is the y -intercept of the graph of $3x - 2y = 6$?
 F. -3 G. 2 H. 3 I. 6



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Short Response

14. One gallon equals 4 quarts. (a) Write a rule that expresses the number of gallons g of a liquid as a function of the number of quarts q . (b) Use the rule to find the number of gallons in 30 quarts.

Mixed Review

Lesson 8-2

Find the solutions of each equation for $x = -3, 0,$ and 2 .

15. $y = -3x$ 16. $y = \frac{1}{3}x + 4$ 17. $y = 0.5x - 2$

Lessons 7-2 and 7-5

Solve each equation.

18. $3x + 7 = 4x - 12$ 19. $7t + 3 - 4t = -6$
 20. $8(2 - c) - 12 = -3c$ 21. $-2x + 3(5 - x) = 5$

Lesson 6-6

22. **Food** About 150 million of the 20 billion hot dogs consumed in the United States each year are eaten during the Fourth of July weekend. What percent of the hot dogs are eaten at this time?

When you present mathematical information to persuade someone to your point of view, you should do the following:

- Identify your audience and your goal.
- Summarize the mathematics behind your view.
- Create a graph or other visual display to support your view.

EXAMPLE

Business A supermarket charges \$1.17 for a 12-oz jar of salsa and \$1.89 for a 20-oz jar. Now the manufacturer is introducing a 16-oz jar of the same salsa. What do you think would be a fair price for this new size? Justify your answer.

- Identify your audience and your goal.
Your audience is the manager. Your goal is to decide on a price for the 16-oz jar and then convince the manager that this price is fair.

- Summarize the mathematics behind your thinking.
Writing solutions to word problems is excellent practice for this. Here, you find the unit price for each jar size.

$$\frac{\$1.17}{12 \text{ oz}} = \$.0975/\text{oz} \quad \text{Find the 12-oz-jar unit price.}$$

$$\frac{\$1.89}{20 \text{ oz}} = \$.0945/\text{oz} \quad \text{Find the 20-oz-jar unit price.}$$

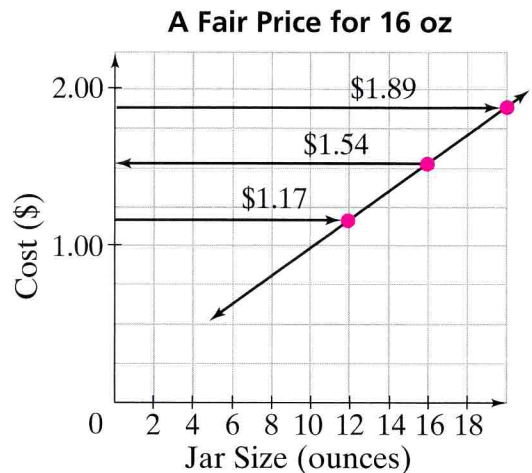
16 oz is halfway between 12 oz and 20 oz. A unit price halfway between \$.0975 and \$.0945 seems fair.

$$\frac{\$.0975 + \$.0945}{2} = \$.096 \quad \text{Find the average.}$$

$$16 \cdot \$.096 \approx \$1.54 \quad \text{Find the 16-oz-jar price.}$$

A fair price for a 16-oz jar is \$1.54.

- Make a visual display (at right) to support your view.



EXERCISES

1. What do you think would be a reasonable price for an 18-oz jar of the salsa in the example?
2. Your family eats two boxes of cereal each week. Your family buys 15-oz boxes costing \$2.89 each. A 28-oz box of the same cereal is \$4.79. You think that buying the larger size is better. Persuade your family to your point of view using mathematics, explanation, and a visual display. (*Hint: Show what happens over an extended length of time, such as a year.*)

Solving Systems of Linear Equations

8-7

OBJECTIVE

1 Graphing Systems of Linear Equations

Two or more linear equations form a **system of linear equations**.

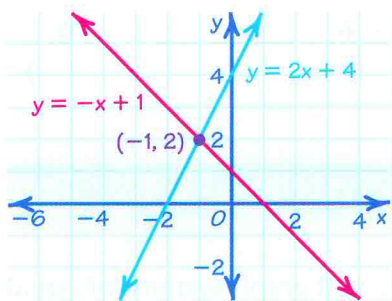
A *solution of the system* is any ordered pair that is a solution of each equation in the system.

You can solve some systems of equations by graphing the equations on a coordinate plane and identifying the point(s) of intersection.

1 EXAMPLE Solving a System by Graphing

Solve the system $y = -x + 1$ and $y = 2x + 4$ by graphing.

Step 1 Graph each line.



Step 2 Find the point of intersection.

The lines intersect at one point, $(-1, 2)$. The solution is $(-1, 2)$.

Check See whether $(-1, 2)$ makes both equations true.

$$y = -x + 1$$

$$y = 2x + 4$$

$$2 \stackrel{?}{=} -(-1) + 1$$

← Replace x with -1 and y with 2 . →

$$2 \stackrel{?}{=} 2(-1) + 4$$

$$2 = 2 \quad \checkmark$$

The solution checks.

$$2 = 2 \quad \checkmark$$

Check Understanding Example 1

1. Solve each system of equations by graphing. Check each solution.

a. $y = x - 6$
 $y = -2x$

b. $y = 3x - 3$
 $x + y = 1$

When the graphs of two equations are parallel, there is no point of intersection. The system has *no solution*.

When the graphs of two equations are the same line, all the points on the line are solutions. The system has *infinitely many solutions*.

What You'll Learn

OBJECTIVE 1

To solve systems of linear equations by graphing

OBJECTIVE 2

To use systems of linear equations to solve problems

... And Why

To solve real-world problems involving carpentry

Check Skills You'll Need

Graph each equation.

1. $y = -x - 4$

2. $y = 2x - 1$

3. $-4x = 6y$

4. $3x - 2y = 5$

For help, go to Lesson 8-2.

New Vocabulary

- system of linear equations

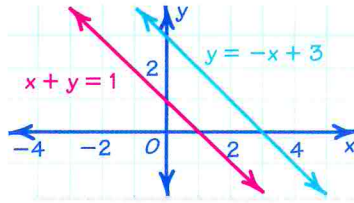


Interactive lesson includes instant self-check, tutorials, and activities.

2 EXAMPLE Solving Special Systems

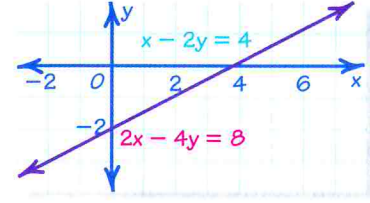
Solve each system of equations by graphing.

a. $x + y = 1$; $y = -x + 3$



The lines are parallel.
They do not intersect.
There is no solution.

b. $x - 2y = 4$; $2x - 4y = 8$



The graphs are the same line.
There are infinitely many solutions.

✓ Check Understanding Example 2

2. Solve each system by graphing.

a. $y = x - 6$;
 $x - y = 6$

b. $y = x + 4$;
 $y = x$

OBJECTIVE

2 Using Systems of Linear Equations

You can write and graph systems of equations to solve problems.

3 EXAMPLE Using a System of Equations

Find two numbers with a sum of 6 and a difference of 4.

Step 1 Write equations.

Let x = the greater number.

Let y = the lesser number.

Equation 1 Sum is 6.
 $x + y = 6$

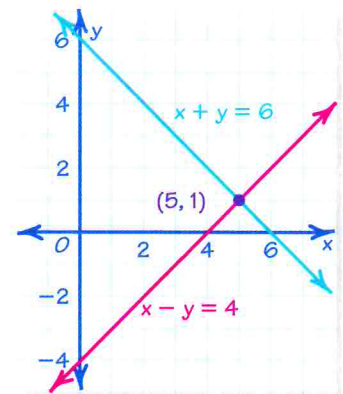
Equation 2 Difference is 4.
 $x - y = 4$

Step 2 Graph the equations.

The lines intersect at (5, 1).

The numbers are 5 and 1.

Check Since the sum of 5 and 1 is 6 and the difference of 5 and 1 is 4, the answer is correct.



Graphing Calculator Hint

You can use a graphing calculator to check your solution of a system. Write the equations in slope-intercept form, press **Y=**, and enter them as Y_1 and Y_2 . Then use the **CALC** menu to find the coordinates of the intersection point.

✓ Check Understanding Example 3

3. Find two numbers with a difference of 2 and a sum of -8 .

You can solve some problems involving two variables by writing and graphing a system of equations, or you may be able to use one variable to write and solve an equation.

More Than One Way

Carpentry A carpenter cuts an 8-ft board into two pieces. One piece is three times as long as the other. What is the length of each piece?

Roberto's Method

Write and graph a system of equations.

Let x = length of longer piece; y = length of shorter piece.

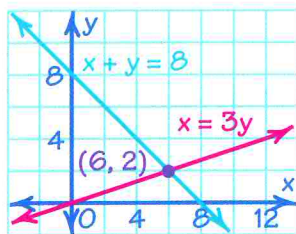
Equation 1 Longer piece is three times shorter piece.

$$x = 3 \cdot y$$

Equation 2 Sum of lengths is eight.

$$x + y = 8$$

Graph the equations.



The lines intersect at $(6, 2)$. The lengths are 6 ft and 2 ft.



Michelle's Method

Write a one-variable equation.

Let x = length of shorter piece; $3x$ = length of longer piece.

Equation Shorter piece plus longer piece is 8 feet.

$$x + 3x = 8$$

$$4x = 8$$

$$x = 2$$

The shorter piece is 2 ft, and the longer piece is $3(2) = 6$ ft.



Choose a Method

- Which method would you use to find the lengths? Explain.
- In Roberto's Method, suppose x = length of shorter piece. What difference would this make in the equations and the graph?

EXERCISES

 For more exercises, see *Extra Practice*.

Practice and Problem Solving

A Practice by Example

Example 1
(page 434)

Check whether $(-1, 5)$ is a solution of each system of equations. Show your work.

1. $x + y = 4$
 $x - y = 6$

2. $y = -2x + 3$
 $y = x - 4$

3. $2x = y - 7$
 $2y = -x + 9$

Solve each system of equations by graphing. Check each solution.

4. $y = x + 1$
 $y = 3x - 7$

5. $y = 2x + 5$
 $x + y = 8$

6. $y = x + 1$
 $y = -x - 3$

7. $y = x + 5$
 $y = -2x + 8$

8. $y = x - 4$
 $y = 3x$

9. $y = 2x - 2$
 $y = 6$

Example 2
(page 435)

10. $-3x + y = 5$
 $y = 3x - 7$

11. $y = -x - 3$
 $y = -x + 2$

12. $y = -6 - 2x$
 $2x + y = -6$

13. $y = -2x + 1$
 $2x + y = -1$

14. $y = 3x$
 $-y = -3x$

15. $y = x + 2$
 $x - y = -2$

Example 3
(page 435)


16. Find two numbers with a sum of -8 and a difference of 4 . Let x be the greater number and y be the lesser number.

B Apply Your Skills

Is each ordered pair a solution of the given system of equations? Show your work.

17. $2x + 5y = 3$
 $y = 7.5x; (1.5, 0.2)$

18. $6x - 6y = 2$
 $3x + 9y = -7; \left(-\frac{1}{3}, -\frac{2}{3}\right)$

 **19. Kites** A four-foot-long wooden rod is cut into two pieces to make a kite. One piece is three times as long as the other.

a. Let x = the length of the longer piece.

Let y = the length of the shorter piece.

Write a system of equations to find the length of each piece.

b. Solve the system by graphing. State the length of each piece.

Solve each system of equations by graphing. Check each solution.

20. $x + y = 3$
 $2x = 10 - 2y$

21. $y = 2x - 4$
 $2x - y = 4$

22. $x - y = -4$
 $x + y = 6$

23. $2x - 4y = 4$
 $y = 0.5x - 1$

24. $y = x - 2$
 $x + 3y = 6$

25. $3y - 2x = 3$
 $6y = 4x + 6$

26. **Geometry** The perimeter of a rectangle is 24 ft. Its length is five times its width. Let x be the length and y be the width. What is the area of the rectangle?

27. The difference of two numbers is 5. The result when the greater number is decreased by twice the lesser is 9. Let x be the greater number and y be the lesser number. Find the numbers.

28. There are 11 animals in a barnyard. Some are chickens and some are cows. There are 38 legs in all. Let x be the number of chickens and y be the number of cows. How many of each animal are in the barnyard?
29. One sales position pays \$200/wk plus 10% commission. Another sales position pays \$150/wk plus 20% commission.
- For each job, write an equation that relates the amount of sales x for one week to the money earned y .
 - Solve the system from part (a) to find the amount of sales in a week that will earn the same amount from each job. Show your work.
 - If weekly sales at each job are about \$600, at which job can you earn more money? Explain.
30. a. Graph each system of equations on a separate coordinate plane.
 $y = 3x + 1; y = 3x - 2$ $y = -2x - 1; y = -2x + 4$
- b. **Writing in Math** Based on part (a), write a conjecture about solutions to systems of equations that have the same slope.

C Challenge

Open-Ended Write a system of equations with the given solutions.

31. no solution 32. one solution 33. infinitely many
34. **Geometry** The graphs of $y = 3, y = 7, x = 2,$ and $x = 5$ contain the sides of a rectangle. Find the area of the rectangle.
35. Solve the system $y = x + 2, y = 4x + 11,$ and $y = -2x - 7$.



Test Prep

Multiple Choice

36. What is the solution of the system
 $y = x + 4; y = 4x + 1$?
- A. (0, 1) B. (0, 4) C. (1, 4) D. (1, 5)
37. How many solutions does the system have
 $2x + 4y = 10; x + 2y = 10$?
- F. 0 G. 1 H. 2 I. infinitely many
38. Use the system $x + y = -6; x - y = 2$. How are the x -coordinate and the y -coordinate of the solution related?
- A. $y = -2x$ B. $y = 2x$ C. $x = -2y$ D. $x = 2y$

Extended Response

39. There are 16 questions on a test. Each question is worth either 5 points or 10 points. The total is 100 points.
- Let x = the number of 5-point questions.
 Let y = the number of 10-point questions.
 Write a system of equations to find the number of each type of question.
 - Solve the system by graphing.
 - How many questions of each type are on the test?

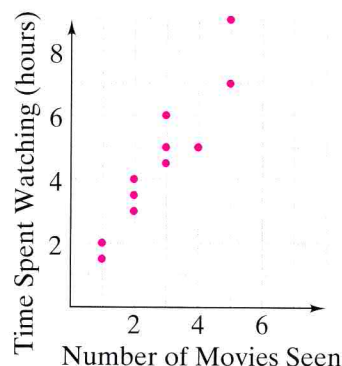


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Mixed Review

- Lesson 8-5** 40. Use the scatter plot at the right.
- How much time did the person who saw four movies spend?
 - How many people saw more than three movies?
 - How many people spent less than three hours watching movies?



Lesson 7-6 Solve each inequality.

41. $1 - x < 5$

42. $3t - 1 \leq 17$

43. $-2c + 5 \geq 3$

44. $m + 4 > -10$

Lesson 6-4 **Probability** Find each probability for one roll of a number cube.

45. $P(2)$

46. $P(6 \text{ or } 5)$

47. $P(-1)$

48. $P(4, 2, \text{ or } 5)$



Checkpoint Quiz 2

Lessons 8-5 through 8-7



Instant self-check quiz online and on CD-ROM

- Statistics** Use the table at the right. Make a scatter plot relating daily newspaper circulation and television sets.
 - Is there a *positive correlation*, a *negative correlation*, or *no correlation* between daily newspaper circulation and the number of television sets in homes? Explain.
 - Data Analysis** Draw a trend line on your scatter plot. Use it to predict the number of television sets when newspaper circulation is 55 million.

Media in the United States

Year	Daily Newspaper Circulation (millions)	Television Sets in Homes (millions)
1980	62	128
1985	63	155
1990	62	193
1991	61	193
1992	60	192
1993	60	201
1994	59	211
1995	57	217
1996	57	223

SOURCE: *Statistical Abstract of the United States*.
Go to www.PHSchool.com for a data update.
Web Code: adg-2041

Solve each system by graphing.

2. $y = -4x$
 $y = -x + 6$

3. $x - y = 1$
 $x + y = -7$

4. $6x + 2y = 12$
 $y = 3x$

- Measurement** One gallon of liquid occupies 231 cubic inches. Write a rule that expresses the number of gallons $g(c)$ as a function of the number of cubic inches c .
- Find two numbers with a sum of -4 and a difference of 10.

Graphing Linear Inequalities

8-8

OBJECTIVE

1 Graphing Linear Inequalities

If you replace the equal sign in a linear equation with $>$, $<$, \geq , or \leq , the result is a **linear inequality**. The graph of a linear inequality is a region of the coordinate plane bounded by a line. Every point in the region is a solution of the inequality.

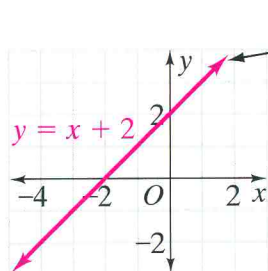
1 EXAMPLE Graphing a Linear Inequality

Graph each inequality on a coordinate plane.

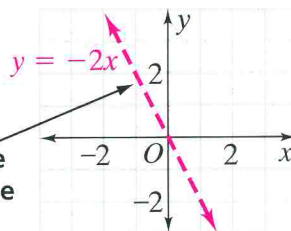
a. $y \leq x + 2$

b. $y < -2x$

Step 1 Graph the boundary line.



Points on the boundary line make $y \leq x + 2$ true. Use a solid line.



Points on the boundary line do *not* make $y < -2x$ true. Use a dashed line.

Step 2 Test a point not on the boundary line.

Test $(0, 0)$ in the inequality.

$$y \leq x + 2$$

$$0 \stackrel{?}{\leq} 0 + 2 \quad \text{Substitute.}$$

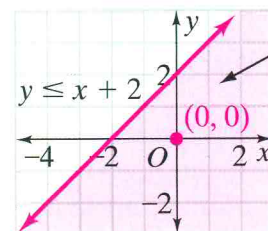
$$0 \leq 2 \quad \checkmark \text{ true}$$

Test $(1, 1)$ in the inequality.

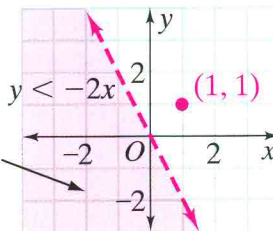
$$y < -2x$$

$$1 \stackrel{?}{<} -2(1) \quad \text{Substitute.}$$

$$1 < -2 \quad \times \text{ false}$$



Since the inequality is true for $(0, 0)$, shade the region containing $(0, 0)$.



Since the inequality is false for $(1, 1)$, shade the region that does *not* contain $(1, 1)$.

What You'll Learn

OBJECTIVE 1 To graph linear inequalities

OBJECTIVE 2 To graph systems of linear inequalities

... And Why

To solve real-world situations involving grocery shopping and earnings from jobs

Check Skills You'll Need

Is the given value of x a solution of the inequality? Explain.

- $x + 3 \geq -2; x = -5$
- $5 - x < 4; x = 1$
- $-2 - 2x \leq 6; x = -4$
- $4x + 1 > -7; x = -2$

For help, go to Lesson 7-6.

New Vocabulary

- linear inequality
- system of linear inequalities

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Need Help?

- < means "is less than."
- > means "is greater than."
- ≤ means "is less than or equal to."
- ≥ means "is greater than or equal to."



Real-World Connection

There are over 3,100 farmers markets in the United States.

Check Understanding Example 1

1. Graph each inequality on its own coordinate plane.

- a. $y \geq 3x - 1$ b. $y > -x + 3$ c. $y < 2x - 4$

2 EXAMPLE Real-World Problem Solving

Grocery Shopping Apricots cost \$3/lb. Tomatoes cost \$1/lb. You plan to spend no more than \$10. How many pounds of each can you buy?

Step 1 Write an inequality.

Words cost of apricots plus cost of tomatoes is at most ten dollars

Let x = number of pounds of apricots.

Let y = number of pounds of tomatoes.

Inequality $3x$ + y ≤ 10

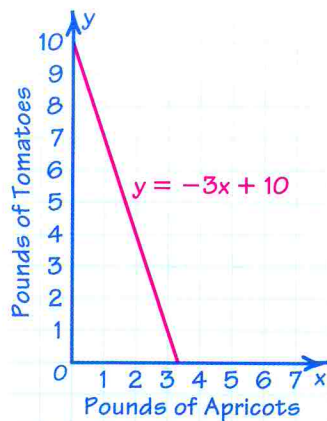
Step 2 Write the equation of the boundary line in slope-intercept form.

$$3x + y \leq 10$$

$$y \leq -3x + 10$$

$$y = -3x + 10$$

Step 3 Graph $y = -3x + 10$ in Quadrant I since weight is not negative.



Step 4 Test (1, 1).

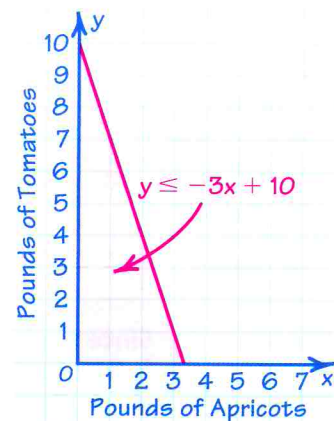
$$y \leq -3x + 10$$

$$1 \stackrel{?}{\leq} -3(1) + 10$$

$$1 \leq 7 \quad \checkmark$$

The inequality is true. (1, 1) is a solution.

Step 5 Shade the region containing (1, 1).



The graph shows the possible solutions. For example, you could buy 1 pound of apricots and 5 pounds of tomatoes.

Check Understanding Example 2

2. Adult tickets to the school play cost \$4. Children's tickets cost \$2. Your goal is to sell tickets worth at least \$30. Let x be the number of children's tickets and y be the number of adult tickets. Graph a linear inequality to show how many of each type of ticket you must sell to reach your goal.

OBJECTIVE

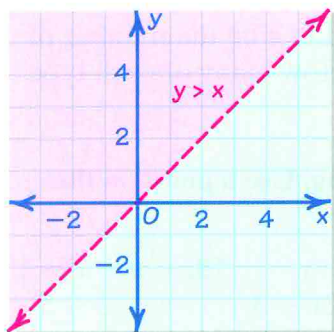
2 Graphing Systems of Linear Inequalities

Two or more linear inequalities form a **system of linear inequalities**. A *solution of a system of linear inequalities* is any ordered pair that makes each inequality in the system true. To solve a system, graph the inequalities on one coordinate plane.

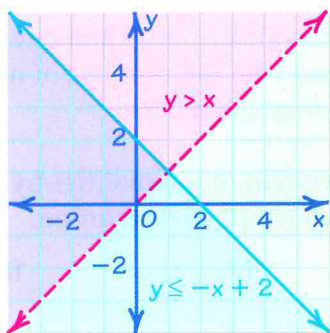
3 EXAMPLE Solving a System of Linear Inequalities

Solve the system $y > x$ and $y \leq -x + 2$ by graphing.

Step 1 Graph $y > x$ on a coordinate plane.



Step 2 Graph $y \leq -x + 2$ on the same coordinate plane.



The solutions are the coordinates of all the points in the region that is shaded in both colors.

Check The point $(-1, 0)$ is in the solution region. Check whether $(-1, 0)$ makes both of the inequalities true.

$y > x$		$y \leq -x + 2$
$0 \stackrel{?}{>} -1$	Replace x with -1 and y with 0 .	$0 \stackrel{?}{\leq} -(-1) + 2$
$0 > -1$ ✓	The solution checks.	$0 \leq 3$ ✓

Check Understanding Example 3

3. Solve each system by graphing.

a. $y \leq -2x - 5$
 $y < \frac{1}{2}x$

b. $y > x - 1$
 $y < 3x + 4$

EXERCISES

 For more exercises, see *Extra Practice*.

Practice and Problem Solving

A **Practice by Example**
Example 1
 (page 441)

The graph of each inequality is bounded by a line. State whether the boundary line is solid or dashed.

1. $y > x$ 2. $y \leq -x + 1$ 3. $y \geq x - 1$

Graph each inequality on its own coordinate plane.


4. $y > x - 6$ 5. $y \leq -x + 8$ 6. $y > x + 2$
 7. $y \geq 2x - 1$ 8. $y < -\frac{1}{3}x + 1$ 9. $y \leq 2x + 1$

Example 2
 (page 442)

Solve each inequality for y .

10. $4x + y < -3$ 11. $-y \leq 2x$ 12. $2x + 3y \leq 7$

For Exercises 13–15, show all the solutions by writing and graphing a linear inequality.

13. Find two nonnegative numbers with a sum greater than three.
 14. A number is greater than or equal to three times another number. What are the numbers?
 15. **Collections**  Melissa has a collection of dimes and nickels with a total face value of less than one dollar. Let x be the number of dimes and y be the number of nickels. How many of each type of coin does she have?

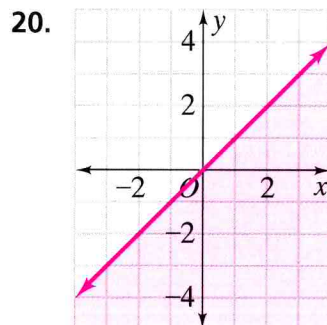
Example 3
 (page 443)

Solve each system of inequalities by graphing. Use a point on the x - or y -axis to check each solution.

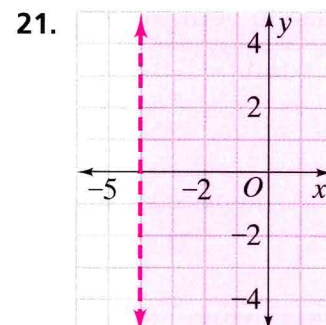
16. $y > -x$ 17. $y \leq x$ 18. $y > -x$ 19. $y \leq -x + 1$
 $y < x + 6$ $y \geq -x - 4$ $y > 2x + 3$ $y > x - 5$

B **Apply Your Skills**

Choose a linear inequality to match each graph.



- A. $-y \geq x$ B. $-y \leq x$
 C. $-y \geq -x$ D. $-y \leq -x$



- F. $x < -4$ G. $x > -4$
 H. $-x < -4$ I. $-x > -4$

22. **Writing in Math** Describe the difference between the graph of $y < -x$ and the graph of $-y < x$.

Graph each inequality on its own coordinate plane.

23. $x - y > 10$ 24. $y \leq 5$ 25. $y \geq -\frac{2}{3}x$
 26. $9x + 3y < 3$ 27. $x - 2y \geq -12$ 28. $-6x - 4y > 8$

29. **a. Income** You can earn \$6/h mowing lawns and \$3/h baby-sitting. You want to earn at least \$45. Let x = number of hours mowing lawns and y = number of hours baby-sitting. Write a linear inequality to model this situation.
b. Graph the linear inequality.
c. If you baby-sit for 6 hours, what is the number of hours you will need to mow lawns to earn \$45?

Write the equation of each boundary line in slope-intercept form. State whether the boundary line is solid or dashed.

30. $x + y < -3$ 31. $x - y \geq 7$ 32. $-y > 4x$
 33. $-y \leq -\frac{1}{2}x$ 34. $5x + 3y \leq 9$ 35. $4x - 2y > 10$

36. Medium drinks cost \$2 and large drinks cost \$3. Let x be the number of medium drinks sold and y be the number of large drinks sold. How many drinks must the vendor sell to have at least \$60 in sales? Show all possible solutions by graphing a linear inequality.

Solve each system of inequalities by graphing.

37. $2x + y \leq 4$ 38. $x + y > -3$ 39. $x < 6$
 $y + 1 \geq -2x$ $x - y < 5$ $y \leq 2x$
 40. $y < 4$ 41. $-2x + y > 1$ 42. $3x + y > 5$
 $x > -5$ $x + 2y < 2$ $y \geq -2$

43. **Writing in Math** How is graphing an inequality on a coordinate plane similar to graphing an inequality on a number line? How is it different?

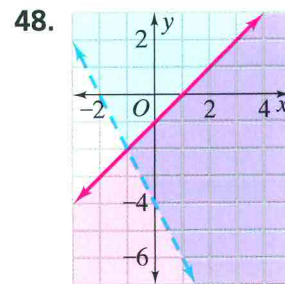
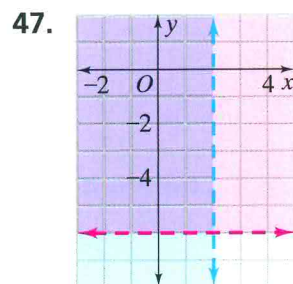


Challenge

Open-Ended Write a system of inequalities with the solutions indicated. If such a system is not possible, tell why.

44. no solutions 45. all real numbers 46. the points of a line

Reasoning Write a system of inequalities to describe each graph.





Test Prep

Multiple Choice



Take It to the NET

Online lesson quiz at
www.PHSchool.com

Web Code: ada-0808

49. Which inequality has the same solutions as $y \geq -2x + 1$?
- A. $2x + y \leq 1$ B. $2x + y \geq 1$
C. $2x - y \leq 1$ D. $2x - y \geq 1$
50. Which describes the graph of $y \leq -x + 2$?
- F. shading above a solid boundary line
G. shading below a solid boundary line
H. shading above a dashed boundary line
I. shading below a dashed boundary line
51. You want to spend less than \$20 on asparagus and green beans. Asparagus costs \$3.00 per pound and green beans cost \$5.00 per pound. Let a represent the asparagus and g represent the green beans. Which inequality models what you can spend?
- A. $3a + 0.5g > 20$ B. $3a + 0.5g \geq 20$
C. $3a + 0.5g < 20$ D. $3a + 0.5g \leq 20$
52. Which inequality has a graph with shading below a dashed boundary line?
- F. $2x + y > -3$ G. $2x + y \geq -3$
H. $2x + y \leq -3$ I. $2x + y < -3$
53. Which point is a solution of the system $y \geq 0$; $x \leq 0$?
- A. (1, 1) B. (-1, 1) C. (1, -1) D. (-1, -1)
54. Explain how to graph $y \geq 2x + 3$. Then graph the inequality.

Short Response

Mixed Review

Lesson 8-7

Solve each system of equations by graphing. Check each solution.

55. $x + y = 8$
 $x - y = -2$

56. $y = 2x - 1$
 $2x - y = 3$

57. $3y = -2x - 3$
 $3y = x - 12$

Lesson 6-6

58. **Endangered Animals** In 1999, there were 162 California condors. Of these birds, 113 were in captivity, 29 were living free in California, and 20 were living free in Arizona.
- What percent of the condors were living free in Arizona? Round your answer to the nearest tenth of a percent.
 - What percent of the condors were living free in all? Round your answer to the nearest tenth of a percent.

Lessons 5-7 and 5-8

Solve each equation.

59. $m - \frac{2}{3} = \frac{1}{6}$

60. $\frac{5}{4}c = \frac{3}{2}$

61. $\frac{3}{4} + w = \frac{9}{10}$

Lesson 4-6

Evaluate each expression for $c = 4$ and $m = -3$.

62. $\frac{c + m}{5}$

63. $\frac{m - c}{2}$

64. $\frac{2c - m}{-4}$

65. $\frac{4m}{2 - c}$



Technology

Graphing Inequalities

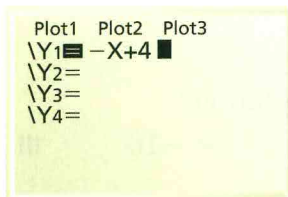
For Use With Lesson 8-8

Graphing an inequality on a calculator is similar to graphing an equation. If your calculator does not graph dashed lines, you have to remember the type of boundary line you need for the inequality.

EXAMPLE

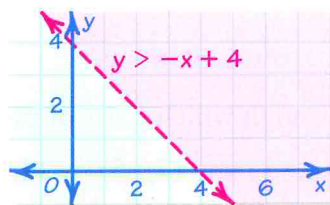
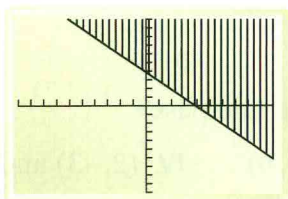
Graph $y > -x + 4$.

Step 1 Press the **Y=** key.
Enter $-x + 4$.



Step 2 Press **◀** to move to the left of Y1.
Press **ENTER** twice when y is greater than the right side of the equation.
Press **ENTER** three times when y is less than the right side of the equation.

Step 3 Press **ZOOM 6** to graph the inequality with the standard viewing window. Then sketch the inequality.



EXERCISES

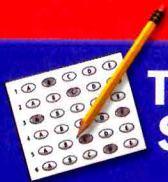
Graph each inequality. Be sure your boundary line is correct.

- | | | | |
|---------------------|----------------|------------------|-------------------------------|
| 1. $y > 3x + 1$ | 2. $y \leq 2x$ | 3. $y < -x - 5$ | 4. $y \geq 4x + 6$ |
| 5. $y \leq -2x - 4$ | 6. $y < x + 7$ | 7. $y > -3x + 4$ | 8. $y \geq -\frac{2}{5}x + 1$ |

Graph each system of inequalities. Sketch the solutions.

- | | | | |
|----------------------------|-----------------------------------|------------------------------|------------------------------------|
| 9. $y > -x$
$y < x + 6$ | 10. $y \leq x$
$y \geq -x - 4$ | 11. $y > -x$
$y > 2x + 3$ | 12. $y \leq -x + 1$
$y > x - 5$ |
|----------------------------|-----------------------------------|------------------------------|------------------------------------|

13. Find and graph a system of inequalities that has no solution.
14. Find and graph a system of inequalities whose solutions are the points of a line.



A multiple-correct-answer test item presents you with a question and several possible answers labeled with Roman numerals. You have to decide which of the answers are correct. Then you pick your list of correct answers from the lettered choices given.

A good strategy to follow is to test each answer and mark it if correct.

EXAMPLE

For which equation(s) is (4, 6) a solution?

I. $x - y = -2$ II. $-x - y = -10$ III. $x - y = 2$ IV. $y - x = 2$

A. I and II only B. I, II, and III only C. I, II, and IV only D. III only

Test each answer.

Substitute 4 for x and 6 for y .

I. $x - y = -2$ $4 - 6 = -2$ true	II. $-x - y = -10$ $-4 - 6 = -10$ true	III. $x - y = 2$ $4 - 6 = 2$ not true	IV. $y - x = 2$ $6 - 4 = 2$ true
---	--	---	--

- Statements I, II, and IV (only) are correct; choice C.

EXERCISES

1. The slope of a line is -2 . Through which pairs of points could the line pass?

I. (0, 3) and $(-2, 7)$ II. (0, -1) and $(2, -5)$ III. (0, 0) and $(3, 6)$ IV. $(2, -3)$ and $(-1, 3)$

A. I and II only B. I, II, and III only C. I, II, and IV only D. III only

2. For which system(s) of equations is (2, 3) the solution?

I. $y = x + 1$ and $y = -x + 5$ II. $y = 2x - 1$ and $y = \frac{1}{2}x + 2$

III. $y = 3x - 3$ and $y = -2x + 7$ IV. $y = \frac{1}{4}x + \frac{5}{2}$ and $y = -3x + 3$

F. I and III only G. I, II, and III only H. I, II, and IV only I. III and IV only

3. Which system(s) of equations has no solution?

I. $y = 3x - 1$ and $y = -3x + 1$ II. $y = 1.5x - 2$ and $y = \frac{3}{2}x + 2$

III. $x + y = 1$ and $y = -x + 3$ IV. $2x + y = 4$ and $2y = 4x + 2$

A. III only B. II and III only C. I, II, and III only D. I, II, III, and IV

Chapter Review

Vocabulary

domain (p. 400)
 function (p. 400)
 function notation (p. 418)
 function rule (p. 418)
 linear equation (p. 406)
 linear inequality (p. 441)
 negative correlation (p. 425)
 no correlation (p. 425)

positive correlation (p. 425)
 range (p. 400)
 relation (p. 400)
 scatter plot (p. 423)
 slope (p. 411)
 slope-intercept form (p. 413)
 solution (p. 405)

system of linear equations (p. 435)
 system of linear inequalities (p. 443)
 trend line (p. 430)
 vertical-line test (p. 401)
 y-intercept (p. 413)



Choose the vocabulary term that correctly completes the sentence.

- The tilt or slant of a line is its ?.
- To determine whether the graph shows a function, use the ?.
- On a scatter plot, when one set of values increases while the other decreases, the data is said to have a ?.
- When each member of a relation's domain is paired with exactly one member of the range, the relation is a ?.
- Any equation whose graph is a line is a ?.
- The first coordinates in a set of ordered pairs is the ? of the relation.
- The second coordinates in a set of ordered pairs is the ? of the relation.
- An ordered pair that makes an equation a true statement is a ? of the equation.



Skills and Concepts

8-1 Objectives

- ▼ To determine whether a relation is a function (p. 400)
- ▼ To graph relations and functions (p. 401)

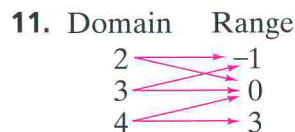
Any set of ordered pairs is a **relation**. The **domain** of a relation is the set of first coordinates of the ordered pairs. The **range** is the set of second coordinates. A **function** is a relation in which no two ordered pairs have the same first coordinate.

Is each relation a function? Explain.

9. $\{(2, 3), (4, 3), (0, 1), (-2, 3)\}$

10.

x	-3	4	-1	-4
y	0	2	0	1



12. Is the amount of a long-distance telephone bill a function of time spent talking on the telephone? Explain.

8-2 Objectives

- ▼ To find solutions of equations with two variables (p. 405)
- ▼ To graph linear equations with two variables (p. 406)

A solution of an equation with two variables is any ordered pair that makes the equation true. The graph of a **linear equation** is a line.

Find the solutions of each equation for $x = -3, 0,$ and 2 .

13. $y = x + 5$ 14. $y = -4x$ 15. $y = \frac{1}{2}x + 3$ 16. $y = 6 - 2x$

8-3 Objectives

- ▼ To find the slope of a line (p. 411)
- ▼ To use slope-intercept form in graphing a linear equation (p. 413)

Slope is a measure describing the tilt of a line, which you can calculate using the ratio $\frac{\text{vertical change}}{\text{horizontal change}}$, OR $\frac{\text{difference in } y\text{-coordinates}}{\text{difference in } x\text{-coordinates}}$.

One form of a linear equation is the slope-intercept form, $y = mx + b$, where m is the slope and b is the y -intercept.

Identify the slope and y -intercept of each equation. Then graph each equation.

17. $x + y = 7$

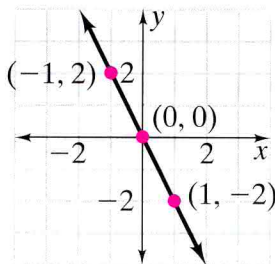
18. $x - y = -2$

19. $2x + 5y = 10$

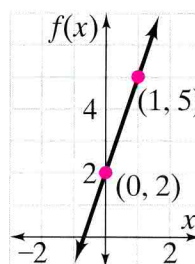
20. $3x - 2y = 12$

Find the slope of each line.

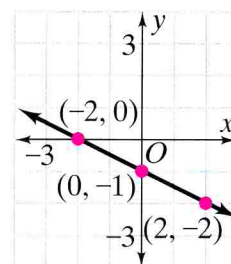
21.



22.



23.



8-4 Objectives

- ▼ To write a function rule for a word relationship (p. 418)
- ▼ To write a function rule by analyzing a table or graph (p. 419)

You can write a **function rule** from a verbal description, from a table of values, or from a graph.

Write a rule for each function.

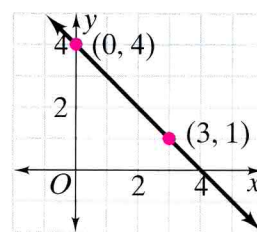
24.

x	$f(x)$
-2	2
-1	1
0	0
1	-1

25.

x	y
-3	-5
-2	-3
-1	-1
0	1

26.



27. Tickets to a play cost \$14 each by mail, plus a \$2 processing fee for each order of one or more tickets. Write a rule to describe total cost $c(t)$ as a function of the number of tickets t .

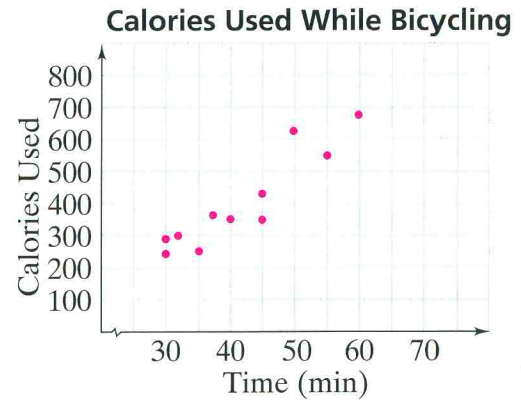
8-5 and 8-6 Objectives

- ▼ To interpret and draw scatter plots (p. 423)
- ▼ To use scatter plots to find trends (p. 425)
- ▼ To solve problems by graphing (p. 430)

A **scatter plot** is a graph that shows the relationship between two sets of data. A scatter plot can help you find trends between sets of data.

Use the scatter plot at the right.

28. How long did the person who used 240 calories ride a bicycle?
29. How many calories did the person who bicycled 50 minutes use?
30. **Data Analysis** Is there a positive correlation, a negative correlation, or no correlation between the time spent bicycling and the calories used? Explain.
31. **Data Analysis** Carefully place a straightedge (preferably transparent) on the scatter plot to serve as a trend line. Use the trend line to predict the number of calories a person uses on a 70-min bicycle ride.



8-7 and 8-8 Objectives

- ▼ To solve systems of linear equations by graphing (p. 435)
- ▼ To use systems of linear equations to solve problems (p. 436)
- ▼ To graph linear inequalities (p. 441)
- ▼ To graph systems of linear inequalities (p. 443)

Two or more linear equations with the same variables form a **system of linear equations**. A solution of a system of equations is any ordered pair that makes each equation true.

Two or more linear inequalities with the same variables form a **system of linear inequalities**. A solution of a system of inequalities is any ordered pair that makes both inequalities true. You can solve a system by graphing.

Graph each inequality.

32. $y > 2x + 5$
33. $y \leq -x + 1$
34. $y \geq \frac{1}{2}x - 3$
35. $y < 3x - 2$

Solve each system by graphing.

36. $y = \frac{1}{2}x - 3$
 $y = -\frac{1}{2}x + 1$
37. $3x + 2y = 6$
 $x + 4y = -8$
38. $y = x - 5$
 $y = -2x + 1$
39. $y < 3x + 2$
 $y > 3x - 1$

40. Explain why it is possible for a system of linear equations to have no solutions.



Chapter Test



Is each relation a function? Explain.

- $\{(-2, -12), (-2, 0), (-2, 4), (-2, 11)\}$
- $\{(8, 1), (4, 1), (0, 1), (-15, 1)\}$
- $\{(-4, -6), (-3, -2), (1, -2), (1, 0), (1, 3)\}$
- $\{(0, 1), (0, 2), (1, 2), (1, 3), (3, 1), (4, 2)\}$

Graph each equation.

- $y = 2x$
- $y = -x - 2$
- $2x - y = 4$
- $3y = x - 6$

Find the slope of the line through each pair of points.

- $C(0, 1)$ and $D(-5, 1)$
- $M(-4, 1)$ and $N(6, 3)$
- $J(-1, -2)$ and $K(2, 7)$
- $P(4, 9)$ and $Q(-6, 12)$

Write a rule for each function.

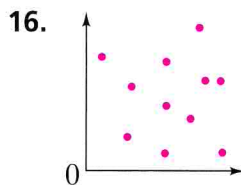
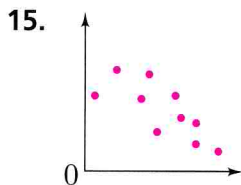
13.

x	$f(x)$
-2	-3
-1	-5
0	-7
1	-9

14.

x	$f(x)$
-3	4
0	1
3	-2
6	-5

Is there a *positive correlation*, a *negative correlation*, or *no correlation* between the sets of data in each scatter plot? Explain.



Graph each inequality.

- $y \geq 3x - 1$
- $y < -x + 5$

Solve each system by graphing.

- $$\begin{cases} y = x - 1 \\ x = 2y \end{cases}$$
- $$\begin{cases} x + y = 4 \\ 2x + 2y = 8 \end{cases}$$
- $$\begin{cases} x + y = 3 \\ y = x - 5 \end{cases}$$
- $$\begin{cases} y \leq 3x - 2 \\ y > x + 4 \end{cases}$$

- Writing in Math** Is the amount of sales tax paid a function of the labeled price of a taxable item? Explain.
- Writing in Math** Is a person's age a function of his or her height? Explain.
- Use the data in the table below.

New York Thruway Tolls

Distance (miles)	Toll (dollars)	Distance (miles)	Toll (dollars)
112	3.50	125	3.90
137	3.75	100	3.10
112	3.40	22	0.70
69	1.65	58	1.80
69	2.15	137	4.25
169	5.70	43	1.80
90	2.80	84	3.05
188	5.85	164	5.10

- Make a (distance, toll) scatter plot.
 - Draw a trend line. Predict the toll if a car travels 200 mi on the toll road.
 - Use your trend line to predict how far a car traveled on the toll road if there was a \$4.50 toll.
 - Write an equation of your trend line.
26. **Open-Ended** The slope of a line through the origin is $-\frac{2}{3}$. Find the coordinates of two points on the line.



Test Prep

CUMULATIVE REVIEW CHAPTERS 1-8

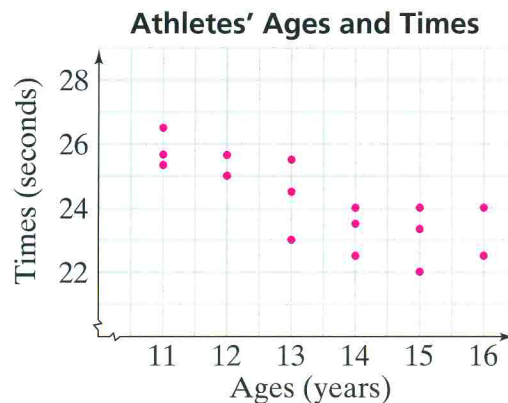
Multiple Choice

- An empty pot weighs 1 lb 11 oz. With oatmeal in it, the pot weighs 3 lb 7 oz. How much does the oatmeal weigh?
A. 5 lb 2 oz B. 2 lb 3 oz
C. 1 lb 12 oz D. 1 lb 4 oz
- Which equation has a solution of 8?
F. $8x + 8 = 64$ G. $\frac{b}{2} + 7 = 10$
H. $2z + 5 = 11$ I. $5n - 13 = 27$
- Four friends split the cost of renting a car for a snorkeling trip. Each person also rents a snorkel for \$2. Each person pays a total of \$15. Which equation will help find the cost c of renting the car?
A. $\frac{c}{4} + 2 = 15$ B. $15 - 2^4 = c$
C. $15 - 4c = 2$ D. $\frac{c}{2} + 4 = 15$
- Sara and Juan collect soccer cards. Sara has 6 fewer than three times the number of cards Juan has. Together they have 42 cards. Solve $c + (3c - 6) = 42$ to answer: How many cards does each have?
F. Sara has 9 cards; Juan has 33 cards.
G. Sara has 33 cards; Juan has 9 cards.
H. Sara has 12 cards; Juan has 30 cards.
I. Sara has 30 cards; Juan has 12 cards.
- Which ordered pair is *not* a solution of $4x + 2y = 16$?
A. $(-2, 12)$ B. $(5, -2)$
C. $(2, 5)$ D. $(1, 6)$
- Which function represents the number of kilograms $k(n)$ as a function of the number of grams n ?
F. $k(n) = 100n$ G. $k(n) = 0.01n$
H. $k(n) = 1,000n$ I. $k(n) = 0.001n$
- Which point is a solution of the system?
 $y = x + 2$; $y = 2x - 2$
A. $(6, 4)$ B. $(1, 3)$
C. $(4, 6)$ D. no solution

- What is the solution of $-2(x - 1) \leq -6$?
F. $x \leq 4$ G. $x \leq -4$
H. $x \geq 4$ I. $x \geq -4$

Gridded Response

- The probability that a couple will give birth to a pair of twins is 1 in 90. About how many pairs of twins would you expect to find in 250,000 births?
- Find the slope of the line through $(3, 2)$ and $(1, -2)$.
- In the scatter plot below, each point represents an athlete who ran in the 100-m race. Greg won the race in the least amount of time. What is Greg's age in years?



Short Response

Find the solutions of each equation for the given values of x . Show your work.

- $y = x + 12$; $x = -3, 0$, and 2
- $4x - 4y = 8$; $x = 0, 2$, and 4

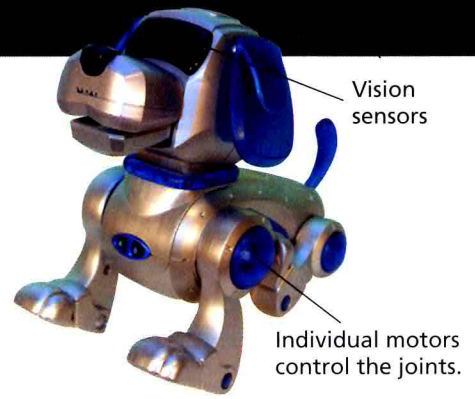
Extended Response

- Write the equation $x + \frac{1}{2}y = 4$ in slope-intercept form.
 - Find the slope and the y -intercept of the line in part (a).
 - Graph the equation in part (a).



Virtual Progress

Applying Graphs Technology changes every day. When your grandparents were kids, they watched black-and-white TVs, listened to records, and used typewriters. Today, people watch color TVs, listen to compact discs, and use computers. Tired of walking your dog? Robotic pets hit the market in 2000. Interested in becoming an astronaut? Pilots and astronauts train with virtual reality gear.

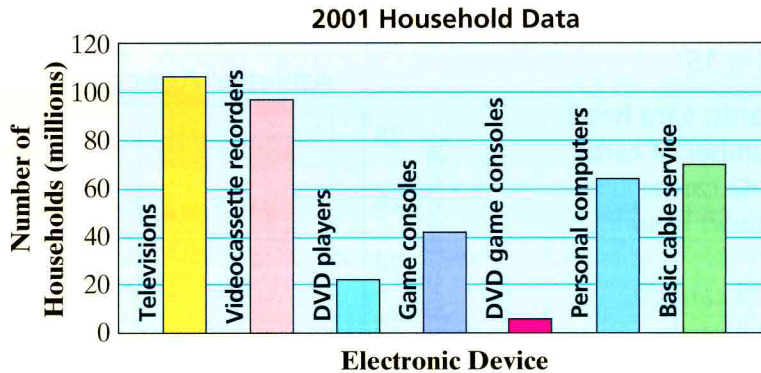


New and Different Pets

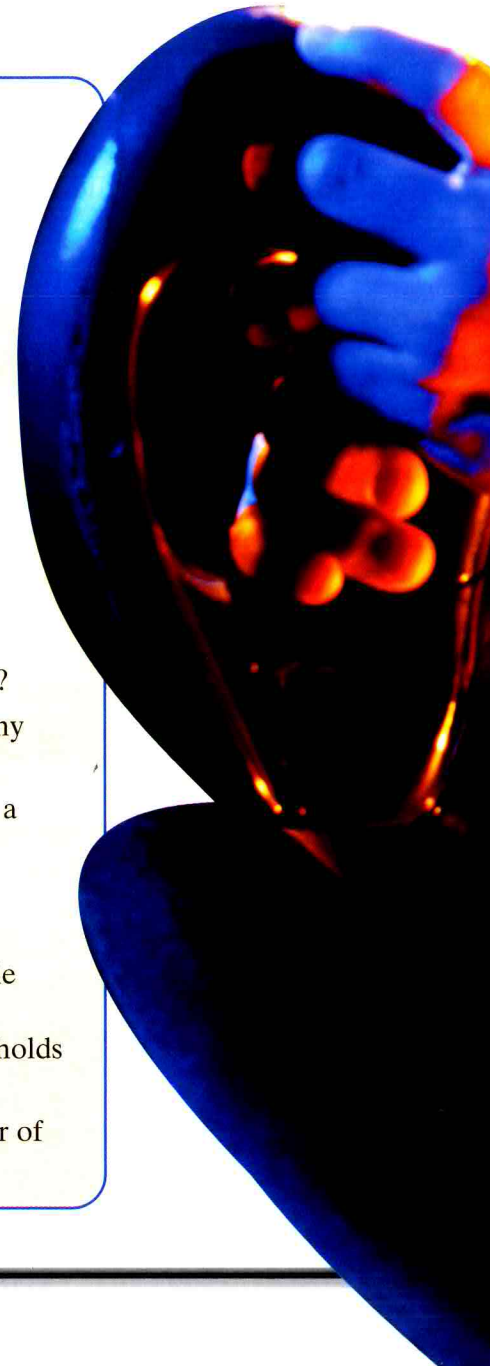
Robotic pets use computers and artificial intelligence to interact with their environments.

Activity

Use the information on these two pages to answer the questions.



- How many households have a television and not a VCR?
- How many households with televisions do not have basic cable?
- The number of households with personal computers is how many times the number with DVD game consoles?
- How many times as many households have a television as have a DVD player?
- How many households will get their first DVD player between 2001 and 2006?
- About 70% of DVD households rent at least one DVD movie per month. How many households is this?
 - Suppose this percent stays constant. About how many households will rent at least one DVD movie in December 2006?
- Reasoning** What do you think is likely to happen to the number of households with VCRs by 2006? Explain.





Intelligent Modeling

3-D glasses help this researcher "touch" carbon atoms from a microscopic world in a virtual reality room.



At Home Viewing

In 1997, most people watched movies at home on VCRs. Then DVDs hit the market. About 69 million households will have DVD players by the year 2006.



Take It to the NET For more information about DVDs, go to www.PHSchool.com.

Web Code: ade-0853





Where You've Been

- In Chapter 3, you learned how to solve equations by multiplying or dividing decimals, and how to use formulas.
- In Chapter 5, you learned how to solve equations by multiplying fractions.
- In Chapter 7, you learned how to solve multi-step equations by using inverse operations.



Diagnosing Readiness

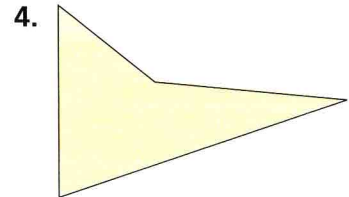
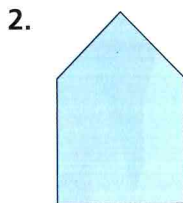
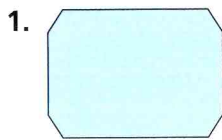


Instant self-check
online and on CD-ROM

(For help, go to the lesson in green.)

Naming Polygons (Previous Course)

Match each polygon to its name.



A. quadrilateral

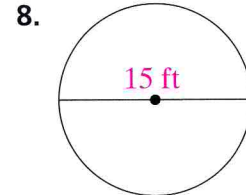
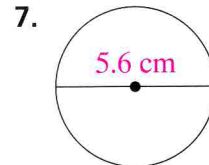
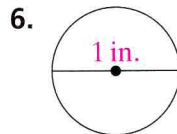
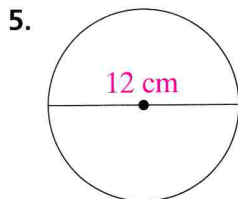
B. pentagon

C. octagon

D. hexagon

Identifying Radius (Previous Course)

Give the radius of each circle.



Graphing on the Coordinate Plane (Lesson 1-10)

Graph each point on the same coordinate plane.

9. $A(0, 7)$ 10. $B(-2, 5)$ 11. $E(4, 0)$ 12. $D(2, -4)$ 13. $C(-3, -1)$
14. $F(1\frac{1}{2}, -3)$ 15. $G(0, 0)$ 16. $J(0, -1)$ 17. $I(-4, -5)$ 18. $H(-5, -5)$