

9-6

Slope-Intercept Form

MAIN IDEA

Graph linear equations using the slope and y -intercept.

New Vocabulary

slope-intercept form
 y -intercept

Math Online

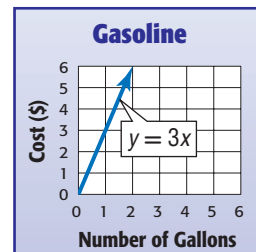
glencoe.com

- Extra Examples
- Personal Tutor
- Self-Check Quiz

▶ GET READY for the Lesson

GASOLINE The graph represents the cost of gasoline at \$3 per gallon.

1. Write an equation that represents the cost of gasoline at \$3 per gallon and a drink that costs \$2.
2. Graph the equation from Exercise 1.



Proportional linear functions can be written in the form $y = kx$, where k is the constant of variation, or slope of the line. Nonproportional linear functions can be written in the form $y = mx + b$. This is called the **slope-intercept form**. When an equation is written in this form, m is the slope and b is the y -intercept. The **y -intercept** of a line is the y -coordinate of the point where the line crosses the y -axis.

EXAMPLES Find Slopes and y -intercepts of Graphs

State the slope and the y -intercept of the graph of each equation.

1 $y = \frac{2}{3}x - 4$

$$y = \frac{2}{3}x + (-4) \quad \text{Write the equation in the form } y = mx + b.$$

$$y = mx + b \quad m = \frac{2}{3}, b = -4$$

The slope of the graph is $\frac{2}{3}$, and the y -intercept is -4 .

2 $x + y = 6$

$$x + y = 6 \quad \text{Write the original equation.}$$

$$x - x + y = 6 - x \quad \text{Subtract } x \text{ from each side.}$$

$$y = 6 - x \quad \text{Simplify.}$$

$$y = -1x + 6 \quad \text{Write the equation in the form } y = mx + b. \text{ Recall that } -x \text{ means } -1x.$$

$$y = mx + b \quad m = -1, b = 6$$

The slope of the graph is -1 , and the y -intercept is 6 .

✓ CHECK Your Progress

- a. $y = -5x + 3$ b. $y = \frac{1}{4}x - 6$ c. $y - x = 5$

EXAMPLE Graph Using Slope-Intercept Form

- 3 Graph $y = -\frac{3}{2}x - 1$ using the slope and y -intercept.

Step 1 Find the slope and y -intercept.

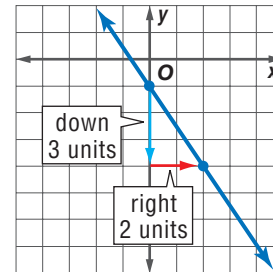
$$y = -\frac{3}{2}x - 1 \quad \text{slope} = -\frac{3}{2}, \text{ } y\text{-intercept} = -1$$

Step 2 Graph the y -intercept -1 .

Step 3 Write the slope $-\frac{3}{2}$ as $\frac{-3}{2}$. Use it to locate a second point on the line.

$$m = \frac{-3}{2} \quad \leftarrow \text{change in } y: \text{down 3 units} \\ \leftarrow \text{change in } x: \text{right 2 units}$$

Step 4 Draw a line through the two points.



CHECK Your Progress Graph each equation.

d. $y = x + 3$

e. $y = \frac{1}{2}x - 1$

f. $y = -\frac{4}{3}x + 2$

Study Tip

Check for Accuracy
To check your graph, substitute the x - and y -values of another point on your graph into the equation. For Example 3, test the point $(2, -4)$.

$$y = -\frac{3}{2}x - 1 \\ -4 = -\frac{3}{2}(2) - 1 \\ -4 = -3 - 1 \\ -4 = -4 \quad \checkmark$$

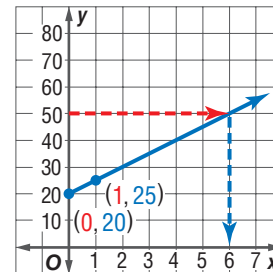
EXAMPLES Graph an Equation to Solve Problems

ACTIVITIES The Student Council is selling spirit T-shirts during spirit week. It costs \$20 for the design and \$5 to print each shirt. The cost y to print x shirts is given by $y = 5x + 20$.

- 4 Graph the equation to find the number of shirts that can be printed for \$50.

$$y = 5x + 20 \quad \text{slope} = 5, \text{ } y\text{-intercept} = 20$$

Plot the point $(0, 20)$. Locate another point up 5 and right 1. Draw the line. The x -coordinate is 6 when the y -coordinate is 50, so the number of T-shirts is 6.



- 5 Describe what the slope and y -intercept represent.

The slope 5 represents the cost in dollars per T-shirt, and the y -intercept 20 is the one-time charge in dollars for preparing the design.

- 6 Is the total cost proportional to the number of T-shirts? Explain.

Compare the ratio of total cost to number of T-shirts for two points.
 $\frac{25}{1} = \$25$ per T-shirt $\frac{50}{6} \approx \$8.33$ per T-shirt **The ratios are different.**
So, the total cost is not proportional to the number of T-shirts.

CHECK Your Progress

TRANSPORTATION A taxi fare y can be determined by the equation $y = 0.50x + 3.50$, where x is the number of miles traveled.

- g. Graph the equation to find the cost of traveling 8 miles.
h. What do the slope and y -intercept represent?
i. Is the total fare proportional to the number of miles? Explain.



Real-World Link

Shirt designs can be created on a computer then sent to a company to screen print the shirts. Each color requires a separate screen for the ink to pass through.

CHECK Your Understanding

Examples 1, 2
(p. 495)

State the slope and the y -intercept for the graph of each equation.

1. $y = x + 2$

2. $y = -\frac{1}{6}x - \frac{1}{2}$

3. $2x + y = 3$

Example 3
(p. 496)

Graph each equation using the slope and the y -intercept.

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

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

6. $y = -2x + 5$

Examples 4–6
(p. 496)

SCHOOL For Exercises 7–9, use the following information.

Liam is reading a 254-page book for school. He can read 40 pages in one hour. The equation for the number of pages he has left to read is $y = 254 - 40x$, where x is the number of hours he reads.

7. Graph the equation to find how many pages Liam has left to read after 3 hours.
8. What do the slope and y -intercept represent?
9. Is the number of pages left to read proportional to the time read? Explain.

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
10–15	1, 2
16–21	3
22–27	4–6

State the slope and the y -intercept for the graph of each equation.

10. $y = 3x + 4$

11. $y = -5x + 2$

12. $y = \frac{1}{2}x - 6$

13. $y = -\frac{3}{7}x - \frac{1}{7}$

14. $y - 2x = 8$

15. $3x + y = -4$

Graph each equation using the slope and the y -intercept.

16. $y = \frac{1}{3}x - 5$

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

18. $y = -\frac{4}{3}x + 1$

19. $y = \frac{3}{2}x - 4$

20. $y + 2x = -3.5$

21. $1.5 = y - 3x$

BOATING For Exercises 22–24, use the following information.

The Lakeside Marina charges a \$35 rental fee for a boat, in addition to charging \$15 an hour for usage. The total cost y of renting a boat for x hours can be represented by the equation $y = 15x + 35$.

22. Graph the equation to find the total cost for a 3-hour rental.
23. What do the slope and the y -intercept represent?
24. Is the total cost proportional to the number of hours? Explain.

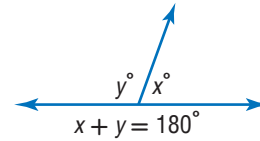
TRAVEL For Exercises 25–27, use the following information.

The Viera family is traveling from Philadelphia, Pennsylvania, to Orlando, Florida, for vacation. The equation $y = 1,000 - 65x$ represents the distance remaining in their trip after x hours.

25. Graph the equation to find the distance remaining after 6 hours.
26. What do the slope and y -intercept represent?
27. Is the distance remaining proportional to the hours driven? Explain.

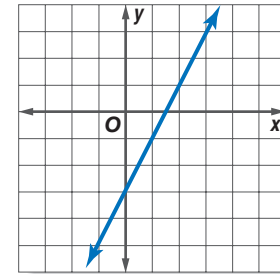
28. **INSECTS** The equation $y = 15x + 37$ can be used to approximate the temperature y in degrees Fahrenheit based on the number of chirps x a cricket makes in 15 seconds. Graph the equation to estimate the number of chirps a cricket will make in 15 seconds if the temperature is 80°F .

GEOMETRY For Exercises 29–31, use the supplementary angles at the right.



29. Write the equation in slope-intercept form.
 30. Graph the equation.
 31. Is the relationship between supplementary angles proportional? Explain your reasoning.

For Exercises 32–35, use the graph at the right.



32. What is the slope and y -intercept of the line?
 33. Describe how the slope and y -intercept appear on the graph.
 34. Use the slope and y -intercept to write the equation of the line in slope-intercept form.
 35. The x -intercept of a line is the x -coordinate of the point where the line crosses the x -axis. What are the coordinates of the x - and y -intercepts?

WEATHER For Exercises 36–38, use the following information.

The equation $y = 1.5x + 2$ can be used to find the total rainfall in y inches x hours after 12:00 P.M. during a tropical storm.

36. What is the slope and y -intercept of the line?
 37. Describe how the slope and y -intercept appear on the graph of the equation. Then explain their meaning.
 38. What are the coordinates of the x - and y -intercepts?

For Exercises 39 and 40, complete parts a–d for each table. The points given in the table lie on a line.

- a. Find the slope and y -intercept of the line.
 b. Describe how the slope and y -intercept appear on the graph of the line.
 c. Use the slope and y -intercept to find the equation of the line in slope-intercept form.
 d. Find the coordinates of the x - and y -intercepts.

EXTRA PRACTICE

See pages 692, 708.

39.

x	0	1	2	3
y	1	5	9	13

40.

x	2	4	6	8
y	-4	-8	-12	-16

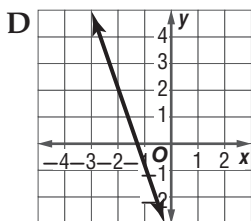
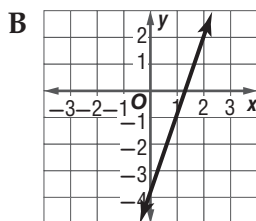
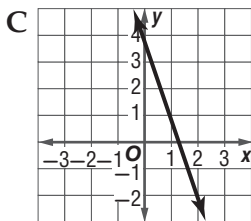
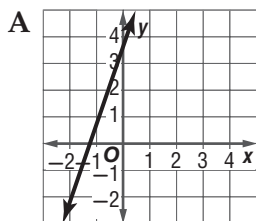
H.O.T. Problems

41. **OPEN ENDED** Draw the graph of a line that has a y -intercept but no x -intercept. What is the slope of the line?

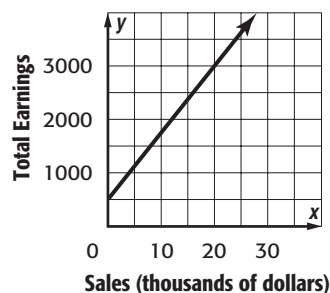
42. **CHALLENGE** A triangle's original vertices are located at $(3, 0)$, $(4, -3)$, and $(1, -4)$. The triangle is translated 1 unit to the right and 3 units up. It is then reflected across the graph of $y = x + 1$. Determine the new vertices of the triangle.
43. **REASONING** What is the slope and y -intercept of a vertical line?
44. **WRITING IN MATH** Write a real-world problem that involves a linear relationship. Describe how the slope and y -intercept would appear in these three different representations of the problem: table, equation, and graph.

TEST PRACTICE

45. Which *best* represents the graph of $y = 3x + 4$?



46. Which statement could be true for the graph below?



- F Mr. Blackwell will earn \$1,750 if his sales are \$10,000.
- G Ms. Chu will not earn any money if she has no sales.
- H Mr. Montoya earns \$250 for every \$1,000 he sells.
- J Ms. James earns \$2,500 if she sells \$2,500 worth of merchandise.

Spiral Review

47. **BICYCLING** Angel rides her bike 25 miles in $2\frac{1}{2}$ hours. How long will it take her to ride 60 miles? (Lesson 9-5)

Find the slope of the line that passes through each pair of points. (Lesson 9-4)

48. $M(4, 3), N(-2, 1)$

49. $S(-5, 4), T(-7, 1)$

50. $X(-9, 5), Y(-2, 5)$

51. **MEASUREMENT** The function $y = 0.39x$ approximates the number of centimeters y in x inches. Make a function table. Then graph the function. (Lesson 9-3)

GET READY for the Next Lesson

PREREQUISITE SKILL Solve each equation. Check your solution. (Lesson 8-2)

52. $3a - 12 = -3$

53. $-2 = -n + 4$

54. $-\frac{1}{3}p - 7 = -3$

55. $4 - \frac{1}{5}x = 20$