**MAIN IDEA**

Graph linear equations using the slope and y-intercept.

**New Vocabulary**

- slope-intercept form
- y-intercept

**Math Online**

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- Extra Examples
- Personal Tutor
- Self-Check Quiz

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**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.

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**EXAMPLES**

Find Slopes and y-intercepts of Graphs

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

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

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

   $y = mx + b$

   $m = \frac{2}{3}, b = -4$

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

2. $x + y = 6$

   $x + y = 6$ Write the original equation.

   $x - x + y = 6 - x$ Subtract $x$ from each side.

   $y = 6 - x$ Simplify.

   $y = -1x + 6$ Write the equation in the form $y = mx + b$.

   Recall that $-x$ means $-1x$.

   $y = mx + b$

   $m = -1, b = 6$

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

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**Check Your Progress**

a. $y = -5x + 3$

b. $y = \frac{1}{4}x - 6$

c. $y - x = 5$
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.

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

**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.

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

**Step 4** Draw a line through the two points.

4. Graph each equation.

a. \( y = x + 3 \)

b. \( y = \frac{1}{2}x - 1 \)

c. \( y = \frac{4}{3}x + 2 \)

d. \( y = x + 3 \)

**Examples**

**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 $80.

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

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.

\[ \frac{25}{1} = $25 \text{ per T-shirt} \quad \frac{50}{6} \approx $8.33 \text{ per T-shirt} \]

The ratios are different. So, the total cost is not proportional to the number of T-shirts.

**CHECK Your Progress**

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

8. Graph the equation to find the cost of traveling 8 miles.

9. What do the slope and \( y \)-intercept represent?

10. Is the total fare proportional to the number of miles? Explain.
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. \( 2x + y = 3 \)

Graph each equation using the slope and the \( y \)-intercept.

4. \( y = \frac{2}{3}x - 2 \)  
5. \( y = -\frac{5}{2}x + 1 \)  
6. \( y = -2x + 5 \)

**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.

**HOMEWORK HELP**

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.

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.

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<table>
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<td>( y )</td>
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</tbody>
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**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. \( 4 - \frac{1}{5}x = 20 \)

**Lesson 9-6 Slope-Intercept Form**