

Graphing Linear Equations in Slope-Intercept Form

Essential Question

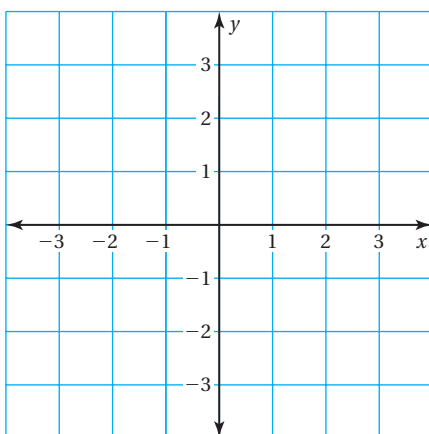
How can you describe the graph of the equation $y = mx + b$?

1 ACTIVITY: Finding Slopes and y-Intercepts

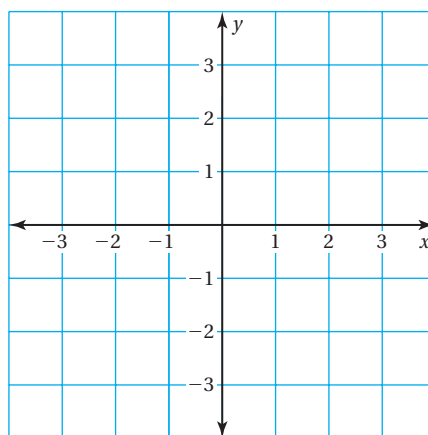
Work with a partner.

- Graph the equation.
- Find the slope of the line.
- Find the point where the line crosses the y -axis.

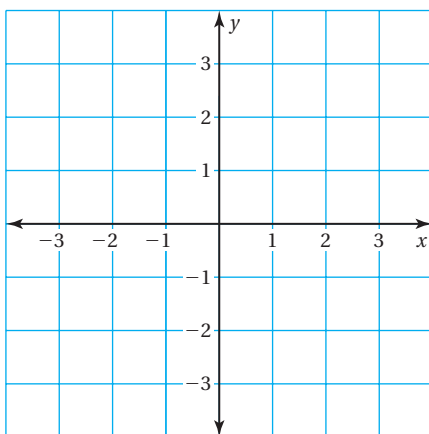
a. $y = -\frac{1}{2}x + 1$



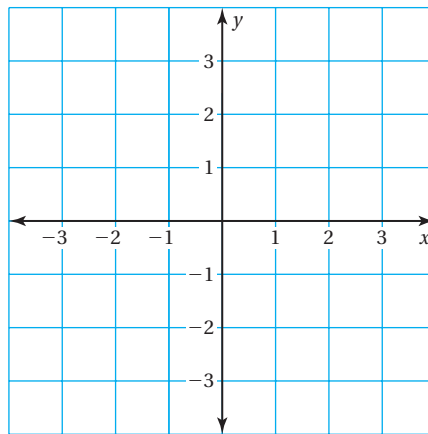
b. $y = -x + 2$



c. $y = -x - 2$



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



Inductive Reasoning

Work with a partner. Graph each equation. Then copy and complete the table.

	Equation	Description of Graph	Slope of Graph	Point of Intersection with y-axis
1a	2. $y = -\frac{1}{2}x + 1$	Line	$-\frac{1}{2}$	(0, 1)
1b	3. $y = -x + 2$			
1c	4. $y = -x - 2$			
1d	5. $y = \frac{1}{2}x + 1$			
	6. $y = x + 2$			
	7. $y = x - 2$			
	8. $y = \frac{1}{2}x - 1$			
	9. $y = -\frac{1}{2}x - 1$			
	10. $y = 3x + 2$			
	11. $y = 3x - 2$			
	12. $y = -2x + 3$			

What Is Your Answer?

13. **IN YOUR OWN WORDS** How can you describe the graph of the equation $y = mx + b$?
- How does the value of m affect the graph of the equation?
 - How does the value of b affect the graph of the equation?
 - Check your answers to parts (a) and (b) with three equations that are not in the table.
14. Why is $y = mx + b$ called the “slope-intercept” form of the equation of a line?

Practice

Use what you learned about graphing linear equations in slope-intercept form to complete Exercises 4–6 on page 66.

Key Vocabulary

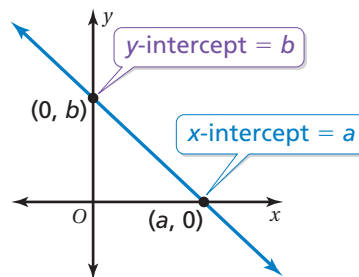
x-intercept, p. 64
y-intercept, p. 64
slope-intercept form,
p. 64

Key Ideas

Intercepts

The **x-intercept** of a line is the x-coordinate of the point where the line crosses the x-axis. It occurs when $y = 0$.

The **y-intercept** of a line is the y-coordinate of the point where the line crosses the y-axis. It occurs when $x = 0$.



Slope-Intercept Form

Words An equation written in the form $y = mx + b$ is in **slope-intercept form**. The slope of the line is m and the y-intercept of the line is b .

Algebra

$$y = mx + b$$

↑
slope
↑
y-intercept

EXAMPLE 1 Identifying Slopes and y-Intercepts

Find the slope and y-intercept of the graph of each linear equation.

a. $y = -4x - 2$

$y = -4x + (-2)$ Write in slope-intercept form.

∴ The slope is -4 and the y-intercept is -2 .

b. $y - 5 = \frac{3}{2}x$

$y = \frac{3}{2}x + 5$ Add 5 to each side.

∴ The slope is $\frac{3}{2}$ and the y-intercept is 5.

On Your Own

Find the slope and y-intercept of the graph of the linear equation.

1. $y = 3x - 7$

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

Now You're Ready
Exercises 7–15

EXAMPLE 2 Graphing a Linear Equation in Slope-Intercept Form

Graph $y = -3x + 3$. Identify the x -intercept.

Step 1: Find the slope and y -intercept.

$$y = -3x + 3$$

slope
y-intercept

Study Tip

You can check the x -intercept by substituting $y = 0$ in the equation and solving for x .

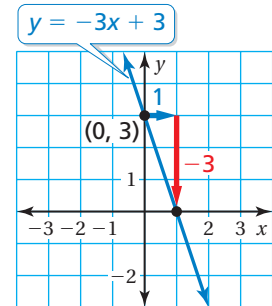
$$\begin{aligned}
 y &= -3x + 3 \\
 0 &= -3x + 3 \\
 -3 &= -3x \\
 1 &= x
 \end{aligned}$$

Step 2: The y -intercept is 3. So, plot $(0, 3)$.

Step 3: Use the slope to find another point and draw the line.

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{-3}{1}$$

Plot the point that is **1 unit right** and **3 units down** from $(0, 3)$. Draw a line through the two points.



••• The line crosses the x -axis at $(1, 0)$. So, the x -intercept is 1.

EXAMPLE 3 Real-Life Application

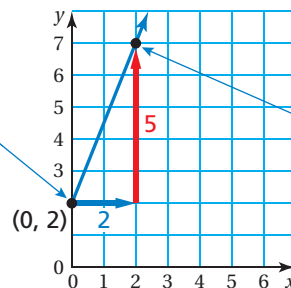
The cost y (in dollars) of taking a taxi x miles is $y = 2.5x + 2$.

(a) Graph the equation. (b) Interpret the y -intercept and slope.

- a. The slope of the line is $2.5 = \frac{5}{2}$. Use the slope and y -intercept to graph the equation.



The y -intercept is 2. So, plot $(0, 2)$.



Use the slope to plot another point, $(2, 7)$. Draw a line through the points.

- b. The slope is 2.5. So, the cost per mile is \$2.50. The y -intercept is 2. So, there is an initial fee of \$2 to take the taxi.

On Your Own

Graph the linear equation. Identify the x -intercept.

3. $y = x - 4$

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

5. In Example 3, the cost y (in dollars) of taking a different taxi x miles is $y = 2x + 1.5$. Interpret the y -intercept and slope.

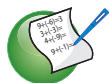
Now You're Ready
Exercises 18–23

2.3 Exercises



Vocabulary and Concept Check

- VOCABULARY** How can you find the x -intercept of the graph of $2x + 3y = 6$?
- CRITICAL THINKING** Is the equation $y = 3x$ in slope-intercept form? Explain.
- OPEN-ENDED** Describe a real-life situation that can be modeled by a linear equation. Write the equation. Interpret the y -intercept and slope.



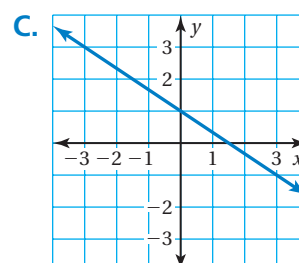
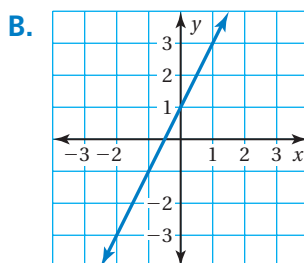
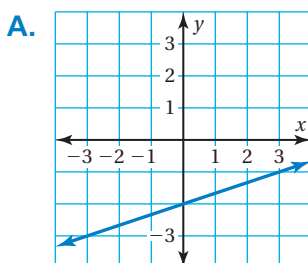
Practice and Problem Solving

Match the equation with its graph. Identify the slope and y -intercept.

4. $y = 2x + 1$

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

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



Find the slope and y -intercept of the graph of the linear equation.

1 7. $y = 4x - 5$

8. $y = -7x + 12$

9. $y = -\frac{4}{5}x - 2$

10. $y = 2.25x + 3$

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

12. $y - 6 = \frac{3}{8}x$

13. $y - 3.5 = -2x$

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

15. $y = 1.5x + 11$

16. **ERROR ANALYSIS** Describe and correct the error in finding the slope and y -intercept of the graph of the linear equation.



$y = 4x - 3$

The slope is 4 and the y -intercept is 3.



17. **SKYDIVING** A skydiver parachutes to the ground. The height y (in feet) of the skydiver after x seconds is $y = -10x + 3000$.
- Graph the equation.
 - Interpret the x -intercept and slope.

Graph the linear equation. Identify the x -intercept.

2 18. $y = \frac{1}{5}x + 3$

19. $y = 6x - 7$

20. $y = -\frac{8}{3}x + 9$

21. $y = -1.4x - 1$

22. $y + 9 = -3x$

23. $y - 4 = -\frac{3}{5}x$

24. **PHONES** The cost y (in dollars) of making a long distance phone call for x minutes is $y = 0.25x + 2$.

- Graph the equation.
- Interpret the slope and y -intercept.

25. **APPLES** Write a linear equation that models the cost y of picking x pounds of apples. Graph the equation.



26. **ELEVATOR** The basement of a building is 40 feet below ground level. The elevator rises at a rate of 5 feet per second. You enter the elevator in the basement. Write an equation that represents the height y (in feet) of the elevator after x seconds. Graph the equation.

27. **BONUS** You work in an electronics store. You earn a fixed amount of \$35 per day, plus a 15% bonus on the merchandise you sell. Write an equation that models the amount y (in dollars) you earn for selling x dollars of merchandise in one day. Graph the equation.



28. **Critical Thinking** Six friends create a website. The website earns money by selling banner ads. The site has five banner ads. It costs \$120 a month to operate the website.

- A banner ad earns \$0.005 per click. Write a linear equation that represents the monthly income y (in dollars) for x clicks.
- Draw a graph of the equation in part (a). On the graph, label the number of clicks needed for the friends to start making a profit.



Fair Game Review What you learned in previous grades & lessons

Solve the equation for y .

29. $y - 2x = 3$

30. $4x + 5y = 13$

31. $2x - 3y = 6$

32. $7x + 4y = 8$

33. **MULTIPLE CHOICE** Which point is a solution of the equation $3x - 8y = 11$?

(A) (1, 1)

(B) (1, -1)

(C) (-1, 1)

(D) (-1, -1)