2.3 Graphing Linear Equations in Slope-Intercept Form

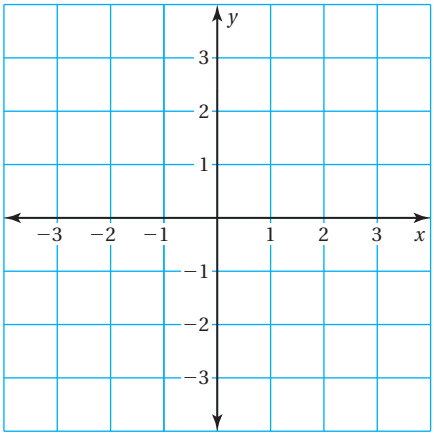
Essential Question How can you describe the graph of the equation $y = mx + b$?

1 ACTIVITY: Finding Slopes and y-Intercepts

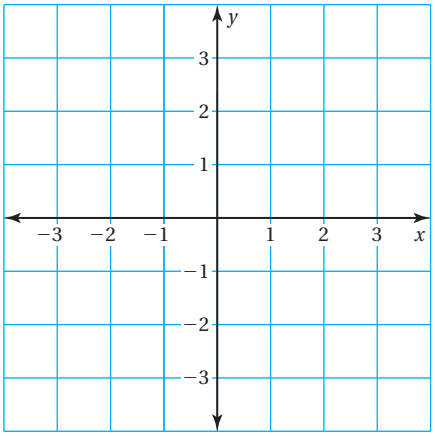
Work with a partner.

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

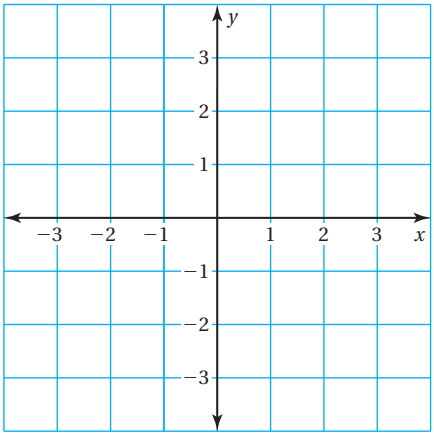
a. $y = -\frac{1}{2}x + 1$



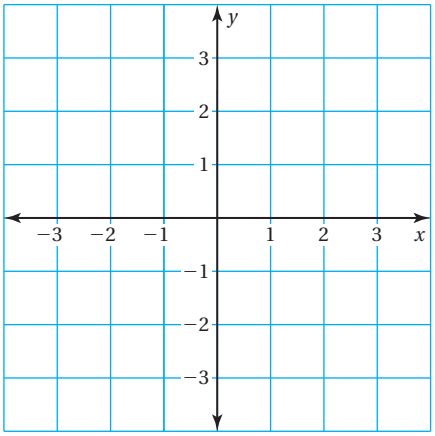
b. $y = -x + 2$



c. $y = -x - 2$



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



Common Core

Graphing Equations

In this lesson, you will

- find slopes and y-intercepts of graphs of linear equations.
- graph linear equations written in slope-intercept form.

Learning Standards
A.CED.2
A.REI.10
F.IF.4

Inductive Reasoning

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

Math Practice 7

Look for Patterns

What patterns do you notice in the table? What does this tell you about the graph of the equation?

	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 $y = mx + b$?

a. How does the value of m affect the graph of the equation?

b. How does the value of b affect the graph of the equation?

c. Check your answers to parts (a) and (b) with three equations that are not in the table.

14. **LOGIC** Why do you think $y = mx + b$ is called the "slope-intercept" form of the equation of a line? Use drawings or diagrams to support your answer.

Practice Use what you learned about graphing linear equations in slope-intercept form to complete Exercises 4–6 on page 62.

2.3 Lesson

Check It Out
Lesson Tutorials
BigIdeasMath.com

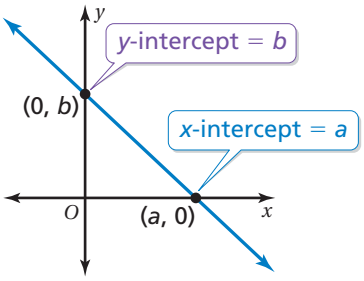
Key Vocabulary
x-intercept, *p. 60*
y-intercept, *p. 60*
slope-intercept form, *p. 60*

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 A linear 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: m — *y*-intercept: b

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

Now You're Ready
Exercises 7–15

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

1. $y = 3x - 7$

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

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.

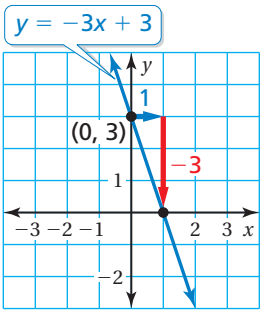
$y = -3x + 3$ (slope: -3; y-intercept: 3)

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

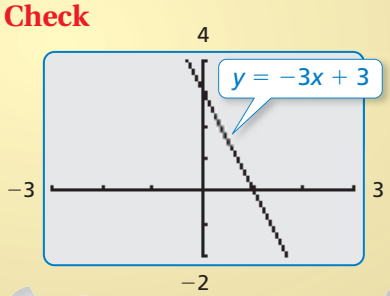
Step 3: Use the slope to find another point and draw the line.

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

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



Check

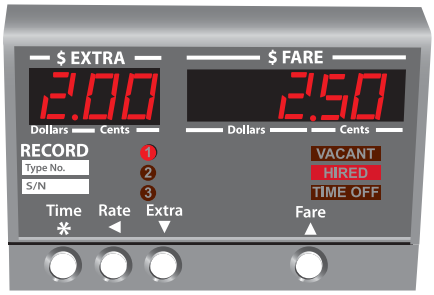


∴ The line crosses the x-axis at (1, 0). So, the x-intercept is 1.

EXAMPLE 3 Real-Life Application

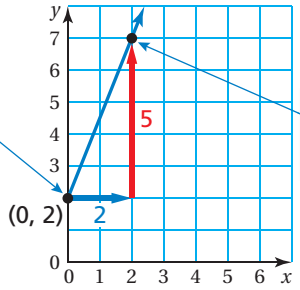
The cost y (in dollars) of taking a taxi x miles is $y = 2.5x + 2$.
(a) Graph the equation. (b) Interpret the y-intercept and slope.

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

Now You're Ready
Exercises 18–23

Graph the linear equation. Identify the x-intercept. Use a graphing calculator to check your answer.

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.

2.3 Exercises

Check It Out
Help with Homework
BigIdeasMath.com

Vocabulary and Concept Check

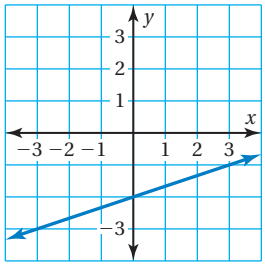
1. **VOCABULARY** How can you find the x-intercept of the graph of $2x + 3y = 6$?
2. **CRITICAL THINKING** Is the equation $y = 3x$ in slope-intercept form? Explain.
3. **OPEN-ENDED** Describe a real-life situation that can be modeled by a linear equation. Write the equation. Interpret the y-intercept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

Practice and Problem Solving

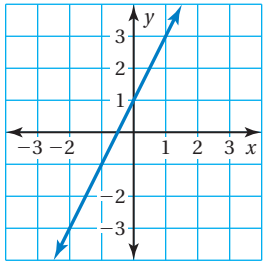
Match the equation with its graph. Identify the slope and y-intercept.

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

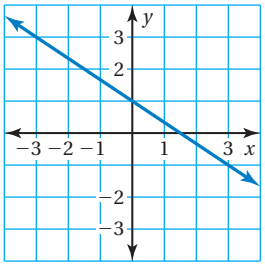
A.



B.



C.



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

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 $y = -10x + 3000$.
    a. Graph the equation.
    b. Interpret the x-intercept and slope.

Graph the linear equation. Identify the x-intercept. Use a graphing calculator to check your answer.

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 $y = 0.25x + 2$.

a. Graph the equation.

b. 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. REASONING 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. A banner ad earns \$0.005 per click. Write a linear equation that represents the monthly income y (in dollars) for x clicks.

b. 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. *(Section 1.4)*

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 $3x - 8y = 11$? *(Section 2.1)*

A $(1, 1)$ **B** $(1, -1)$ **C** $(-1, 1)$ **D** $(-1, -1)$