English Spanish

2.3 Graphing Linear Equations in Slope-Intercept Form

STATE STANDARDS
MA.8.A.1.1
MA.8.A.1.2

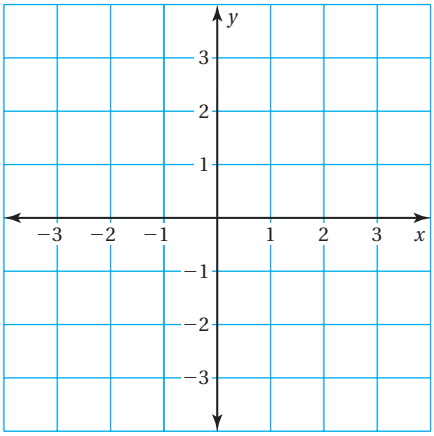
Essential Question How can you describe the graph of the equation $y = mx + b$?

1 ACTIVITY: Finding Slopes and y-Intercepts

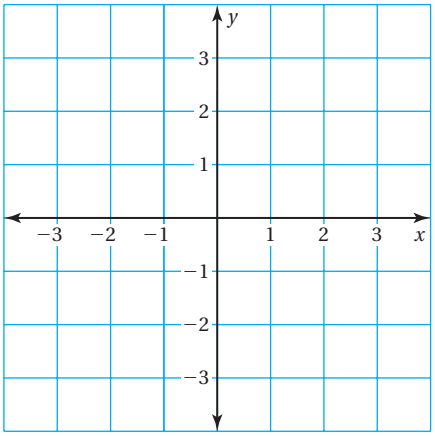
Work with a partner.

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

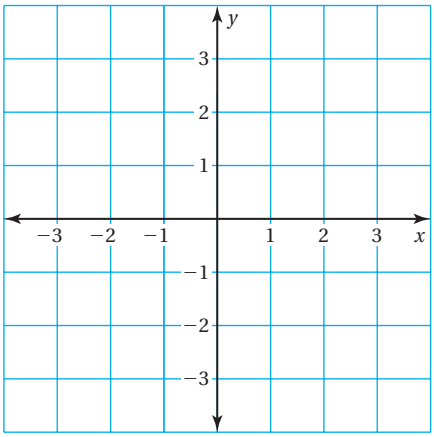
a. $y = -\frac{1}{2}x + 1$



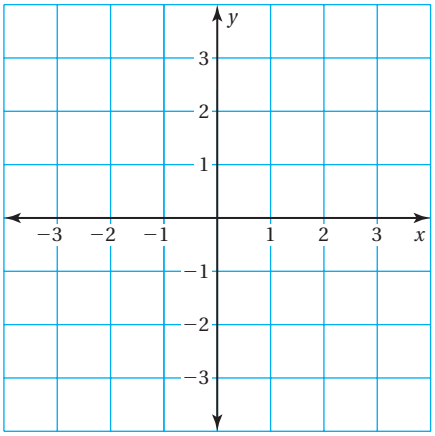
b. $y = -x + 2$



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 $y = mx + b$?

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. 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.

English Spanish

2.3 Lesson

Check It Out
Lesson Tutorials
BigIdeasMath.com

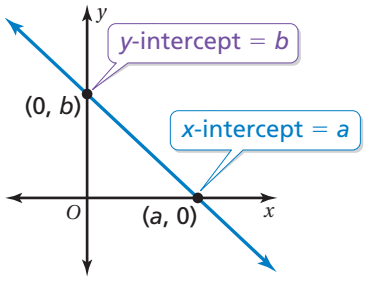
Key Vocabulary
x-intercept, *p. 64*
y-intercept, *p. 64*
slope-intercept form, *p. 64*

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

English Spanish

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 (the coefficient of x)

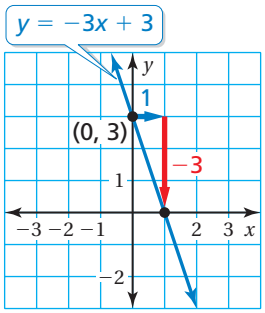
y-intercept: 3 (the constant term)

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.



Study Tip

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

$y = -3x + 3$

$0 = -3x + 3$

$-3 = -3x$

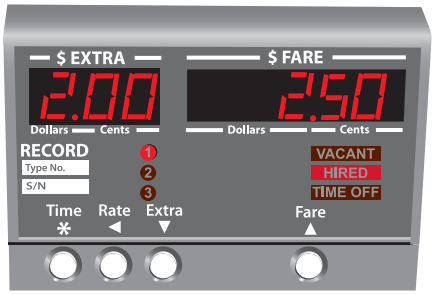
$1 = x$

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

EXAMPLE 3 Real-Life Application

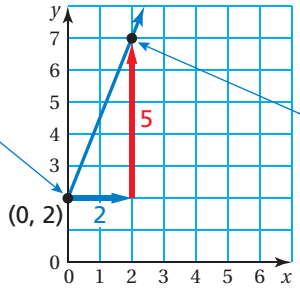
The cost y (in dollars) of taking a taxi x miles is $y = 2.5x + 2$. (a) Graph the equation. (b) Interpret the y-intercept and slope.

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.

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.

English Spanish

2.3 Exercises

Check It Out
Help with Homework
BigIdeasMath.com

Vocabulary and Concept Check

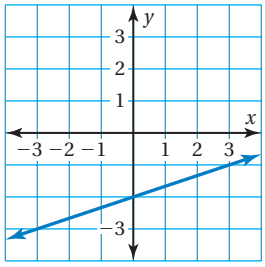
1. **VOCABULARY** How can you find the x-intercept of the graph of $2x + 3y = 6$?
2. **CRITICAL THINKING** Is the equation $y = 3x$ in slope-intercept form? Explain.
3. **OPEN-ENDED** Describe a real-life situation that can be modeled by a linear equation. Write the equation. Interpret the y-intercept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

Practice and Problem Solving

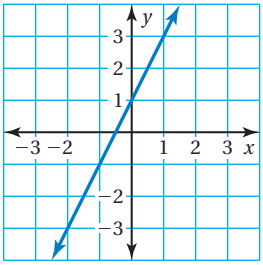
Match the equation with its graph. Identify the slope and y-intercept.

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

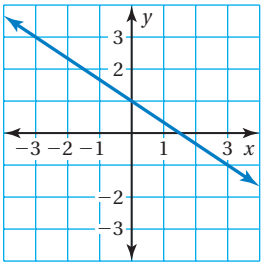
A.



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.

English Spanish

Graph the linear equation. Identify the x-intercept.

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. 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. 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) $(-1, -1)$