

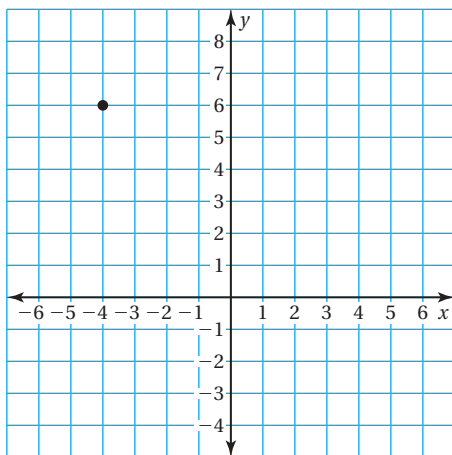
Essential Question How can you write an equation of a line when you are given the slope and a point on the line?

1 ACTIVITY: Writing Equations of Lines

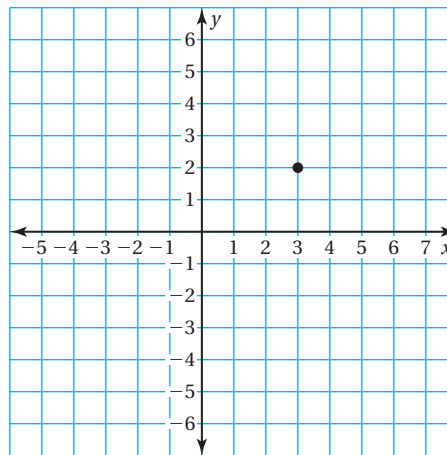
Work with a partner.

- Sketch the line that has the given slope and passes through the given point.
- Find the y -intercept of the line.
- Write an equation of the line.

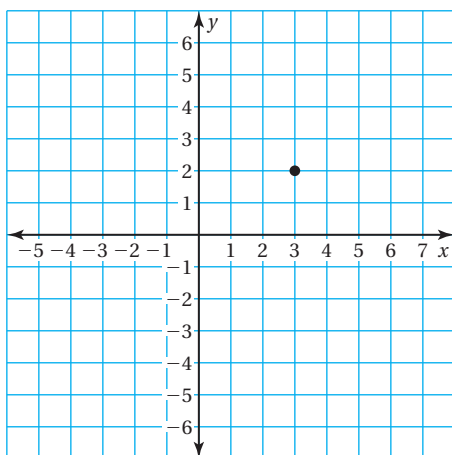
a. $m = -2$



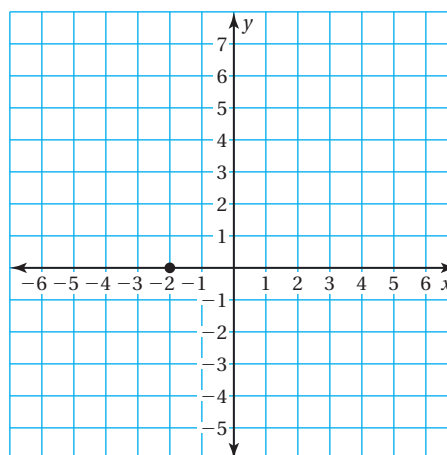
b. $m = \frac{1}{3}$



c. $m = -\frac{2}{3}$



d. $m = \frac{5}{2}$



Writing Equations

In this lesson, you will

- write equations of lines using a slope and a point.
- write equations of lines using two points.

Learning Standards

- A.CED.2
- A.REI.10
- F.IF.4
- F.IF.6

2 ACTIVITY: Developing a Formula

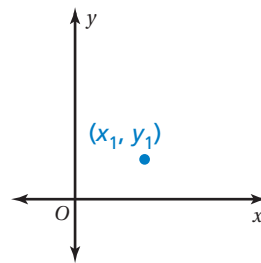
Math Practice 3

Construct Arguments

How does a graph help you develop a formula?

Work with a partner.

- Draw a nonvertical line that passes through the point (x_1, y_1) .
- Plot another point on your line. Label this point as (x, y) . This point represents any other point on the line.
- Label the rise and run of the line through the points (x_1, y_1) and (x, y) .
- The rise can be written as $y - y_1$. The run can be written as $x - x_1$. Explain why this is true.
- Write an equation for the slope m of the line using the expressions from part (d).
- Multiply each side of the equation by the expression in the denominator. Write your result. What does this result represent?

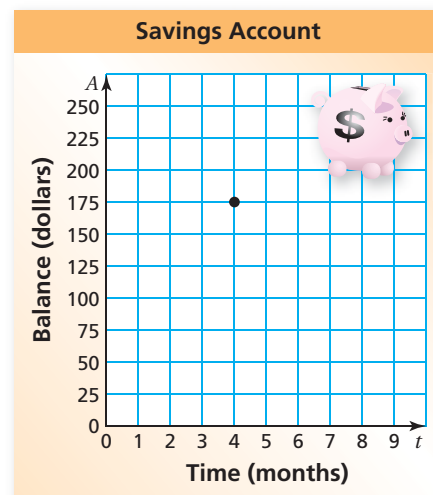


3 ACTIVITY: Writing an Equation

Work with a partner.

For 4 months, you have saved \$25 a month. You now have \$175 in your savings account.

- Draw a graph that shows the balance in your account after t months.
- Use your result from Activity 2 to write an equation that represents the balance A after t months.



What Is Your Answer?

- Redo Activity 1 using the formula you found in Activity 2. Compare the results. What do you notice?
- The formula you found in Activity 2, $y - y_1 = m(x - x_1)$, is called the *point-slope form* of the equation of a line. Why is $y - y_1 = m(x - x_1)$ called the “point-slope” form? Why do you think it is important?
- IN YOUR OWN WORDS** How can you write an equation of a line when you are given the slope and a point on the line? Give an example that is different from those in Activity 1.

Practice

Use what you learned about writing equations using a slope and a point to complete Exercises 3–5 on page 82.

Key Vocabulary

 point-slope form,
p. 80

Key Idea
Point-Slope Form

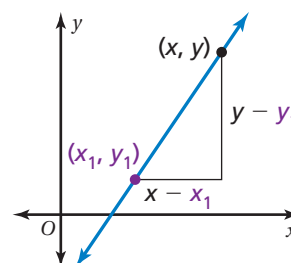
Words A linear equation written in the form $y - y_1 = m(x - x_1)$ is in **point-slope form**. The line passes through the point (x_1, y_1) and the slope of the line is m .

Algebra

$$y - y_1 = m(x - x_1)$$

passes through (x_1, y_1)

slope


EXAMPLE 1 Writing an Equation Using a Slope and a Point

Write in point-slope form an equation of the line that passes through the point $(-6, 1)$ with slope $\frac{2}{3}$.

$$y - y_1 = m(x - x_1) \quad \text{Write the point-slope form.}$$

$$y - 1 = \frac{2}{3}[x - (-6)] \quad \text{Substitute } \frac{2}{3} \text{ for } m, -6 \text{ for } x_1, \text{ and } 1 \text{ for } y_1.$$

$$y - 1 = \frac{2}{3}(x + 6) \quad \text{Simplify.}$$

∴ So, the equation is $y - 1 = \frac{2}{3}(x + 6)$.

Check Check that $(-6, 1)$ is a solution of the equation.

$$y - 1 = \frac{2}{3}(x + 6) \quad \text{Write the equation.}$$

$$1 - 1 \stackrel{?}{=} \frac{2}{3}(-6 + 6) \quad \text{Substitute.}$$

$$0 = 0 \quad \checkmark \quad \text{Simplify.}$$

On Your Own

Write in point-slope form an equation of the line that passes through the given point and has the given slope.

- $(1, 2); m = -4$
- $(7, 0); m = 1$
- $(-8, -5); m = -\frac{3}{4}$

Now You're Ready
Exercises 6–11

EXAMPLE 2 Writing an Equation Using Two Points

Study Tip

You can use either of the given points to write the equation of the line.

Use $m = -2$ and $(5, -2)$.

$$y - (-2) = -2(x - 5)$$

$$y + 2 = -2x + 10$$

$$y = -2x + 8 \quad \checkmark$$

Write in slope-intercept form an equation of the line that passes through the points $(2, 4)$ and $(5, -2)$.

$$\text{Find the slope: } m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - 4}{5 - 2} = \frac{-6}{3} = -2$$

Then use the slope $m = -2$ and the point $(2, 4)$ to write an equation of the line.

$$y - y_1 = m(x - x_1)$$

Write the point-slope form.

$$y - 4 = -2(x - 2)$$

Substitute -2 for m , 2 for x_1 , and 4 for y_1 .

$$y - 4 = -2x + 4$$

Use Distributive Property.

$$y = -2x + 8$$

Write in slope-intercept form.

EXAMPLE 3 Real-Life Application



You finish parasailing and are being pulled back to the boat. After 2 seconds, you are 25 feet above the boat. (a) Write and graph an equation that represents your height y (in feet) above the boat after x seconds. (b) At what height were you parasailing?

- a. You are being pulled down at the rate of 10 feet per second. So, the slope is -10 . You are 25 feet above the boat after 2 seconds. So, the line passes through $(2, 25)$. Use the point-slope form.

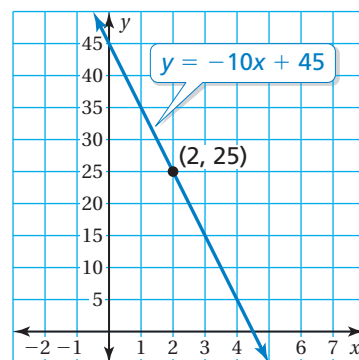
$$y - 25 = -10(x - 2) \quad \text{Substitute for } m, x_1, \text{ and } y_1.$$

$$y - 25 = -10x + 20 \quad \text{Use Distributive Property.}$$

$$y = -10x + 45 \quad \text{Write in slope-intercept form.}$$

∴ So, the equation is $y = -10x + 45$.

- b. You start descending when $x = 0$. The y -intercept is 45. So, you were parasailing at a height of 45 feet.



On Your Own

Now You're Ready
Exercises 12–17

Write in slope-intercept form an equation of the line that passes through the given points.

4. $(-2, 1), (3, -4)$ 5. $(-5, -5), (-3, 3)$ 6. $(-8, 6), (-2, 9)$

7. **WHAT IF?** In Example 3, you are 35 feet above the boat after 2 seconds. Write and graph an equation that represents your height y (in feet) above the boat after x seconds.

2.6 Exercises

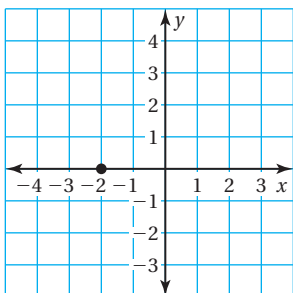
Vocabulary and Concept Check

- VOCABULARY** From the equation $y - 3 = -2(x + 1)$, identify the slope and a point on the line.
- WRITING** Describe how to write an equation of a line using (a) its slope and a point on the line, and (b) two points on the line.

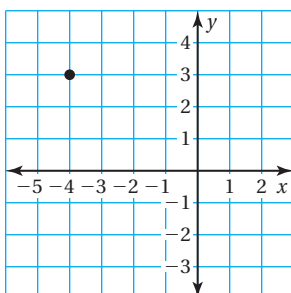
Practice and Problem Solving

Use the point-slope form to write an equation of the line with the given slope that passes through the given point.

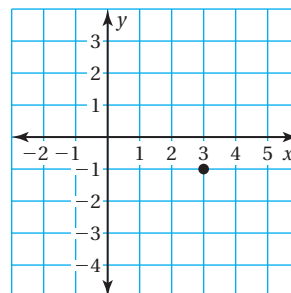
3. $m = \frac{1}{2}$



4. $m = -\frac{3}{4}$



5. $m = -3$



Write in point-slope form an equation of the line that passes through the given point and has the given slope.

1 6. $(3, 0); m = -\frac{2}{3}$

7. $(4, 8); m = \frac{3}{4}$

8. $(1, -3); m = 4$

9. $(7, -5); m = -\frac{1}{7}$

10. $(3, 3); m = \frac{5}{3}$

11. $(-1, -4); m = -2$

Write in slope-intercept form an equation of the line that passes through the given points.

2 12. $(-1, -1), (1, 5)$

13. $(2, 4), (3, 6)$

14. $(-2, 3), (2, 7)$

15. $(4, 1), (8, 2)$

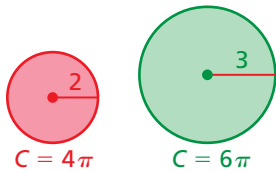
16. $(-9, 5), (-3, 3)$

17. $(1, 2), (-2, -1)$

18. **CHEMISTRY** At 0°C , the volume of a gas is 22 liters. For each degree the temperature T (in degrees Celsius) increases, the volume V (in liters) of the gas increases by $\frac{2}{25}$. Write an equation that represents the volume of the gas in terms of the temperature.



19. **CARS** After it is purchased, the value of a new car decreases \$4000 each year. After 3 years, the car is worth \$18,000.
- Write an equation that represents the value V (in dollars) of the car x years after it is purchased.
 - What was the original value of the car?



20. **CIRCUMFERENCE** Consider the circles shown.

- Plot the points $(2, 4\pi)$ and $(3, 6\pi)$.
- Write an equation of the line that passes through the two points.

21. **CRICKETS** According to Dolbear's Law, you can predict the temperature T (in degrees Fahrenheit) by counting the number x of chirps made by a snowy tree cricket in 1 minute. For each rise in temperature of 0.25°F , the cricket makes an additional chirp each minute.



- A cricket chirps 40 times in 1 minute when the temperature is 50°F . Write an equation that represents the temperature in terms of the number of chirps in 1 minute.
- You count 100 chirps in 1 minute. What is the temperature?
- The temperature is 96°F . How many chirps would you expect the cricket to make?

Leaning Tower of Pisa



22. **WATERING CAN** You water the plants in your classroom at a constant rate. After 5 seconds, your watering can contains 58 ounces of water. Fifteen seconds later, the can contains 28 ounces of water.

- Write an equation that represents the amount y (in ounces) of water in the can after x seconds.
- How much water was in the can when you started watering the plants?
- When is the watering can empty?

23. **Problem Solving** The Leaning Tower of Pisa in Italy was built between 1173 and 1350.

- Write an equation for the yellow line.
- The tower is 56 meters tall. How far off center is the top of the tower?



Fair Game Review What you learned in previous grades & lessons

Find the percent of the number. (*Skills Review Handbook*)

24. 15% of 300 25. 140% of 125 26. 6% of -75

27. **MULTIPLE CHOICE** What is the x -intercept of the equation $3x + 5y = 30$? (*Section 2.4*)

- (A) -10 (B) -6 (C) 6 (D) 10