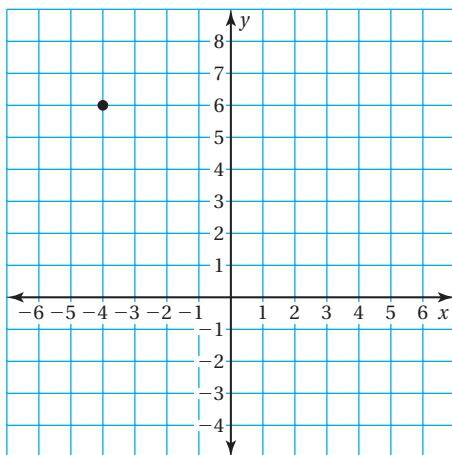## 3.2 Writing Equations Using a Slope and a Point

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

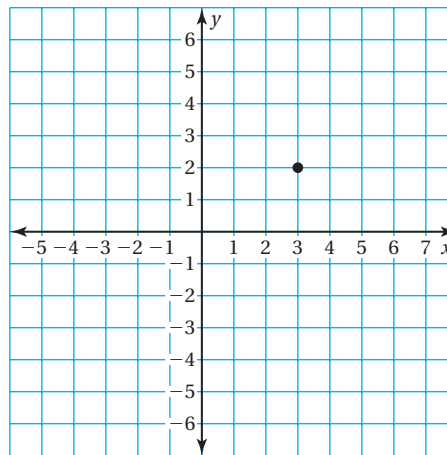### 1 ACTIVITY: Writing Equations of Lines

Work with a partner.

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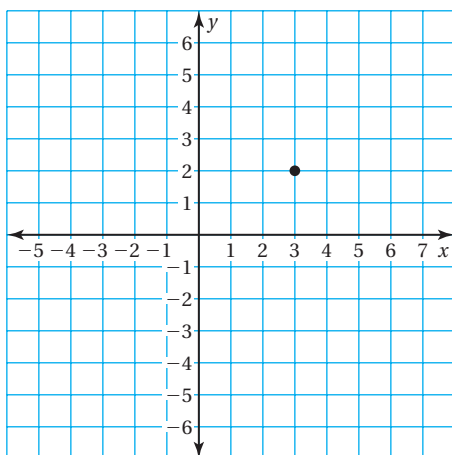- Find the y-intercept of the line.
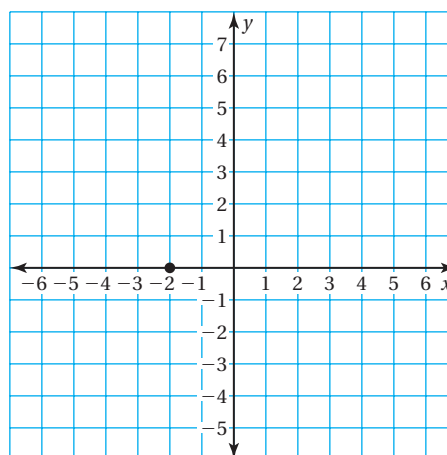- Write an equation of the line.

a. $m = -2$

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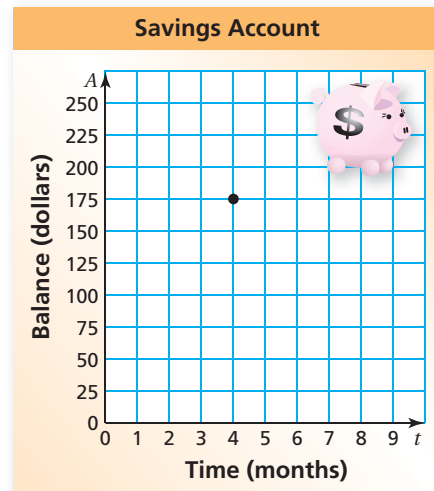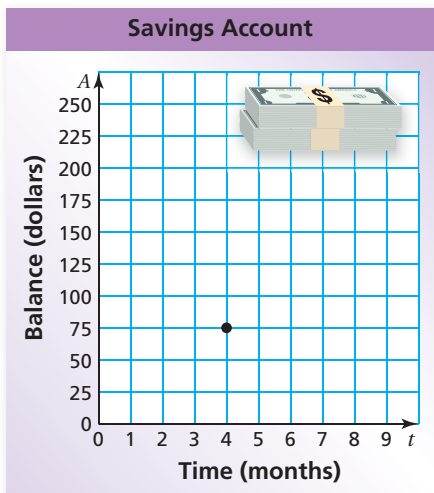

c. $m = -\dfrac{2}{3}$

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

ACTIVITY: Writing Linear Equations

Work with a partner.

a. 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.

- Write an equation that represents the balance A after t months.

Savings Account

Savings Account

b. For 4 months, you have withdrawn $25 a month from your savings account. Your account balance is now $75.

- Draw a graph that shows the balance in your account after t months.

- Write an equation that represents the balance A after t months.

Population

c. For 6 years, the population of a town has grown by 5000 people per year. The population is now 70,000.

- Draw a graph that shows the population after t years.

- Write an equation that represents the population P after t years.
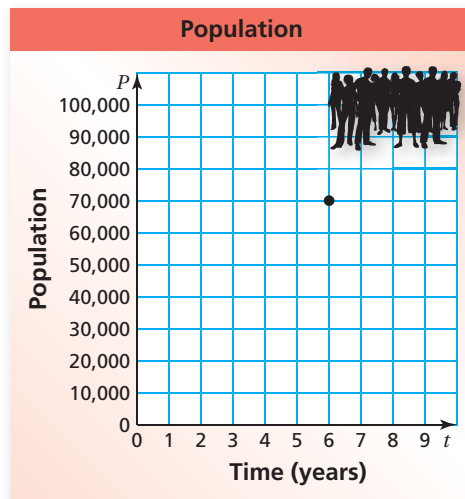
What Is Your Answer?

3. **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 Activities 1 and 2.
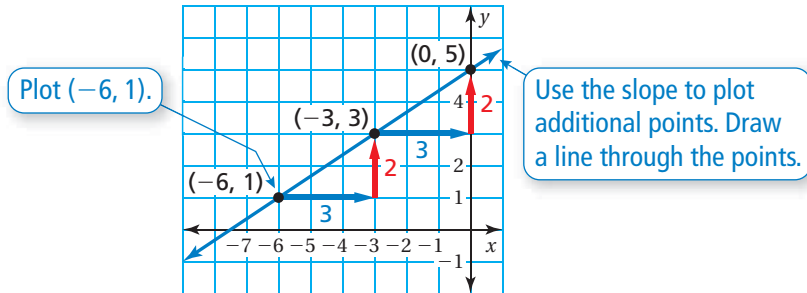
Practice

Use what you learned about writing equations using a slope and a point to complete Exercises 3–5 on page 116.

EXAMPLE 1   Writing Equations Using a Slope and a Point

Write an equation of the line with the given slope that passes through the given point.

a. $m = \dfrac{2}{3};\ (-6, 1)$
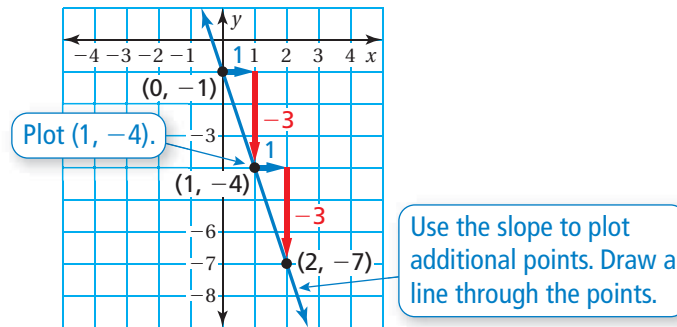
Use a graph to find the y-intercept.

Check

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

$y = \dfrac{2}{3}x + 5$

$1 \overset{?}{=} \dfrac{2}{3}(-6) + 5$

$1 = 1$ ✓

Plot $(-6, 1)$.

$(-3, 3)$

$(-6, 1)$

$(0, 5)$

Use the slope to plot additional points. Draw a line through the points.

Because the line crosses the y-axis at $(0, 5)$, the y-intercept is 5.

⠿ So, the equation is $y = \dfrac{2}{3}x + 5$.

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

Use a graph to find the y-intercept.

Check

Check that $(1, -4)$ is a solution of the equation.

$y = -3x - 1$

$-4 \overset{?}{=} -3(1) - 1$

$-4 = -4$ ✓

$(0, -1)$

Plot $(1, -4)$.

$(1, -4)$

$(2, -7)$

Use the slope to plot additional points. Draw a line through the points.

Because the line crosses the y-axis at $(0, -1)$, the y-intercept is -1.

⠿ So, the equation is $y = -3x + (-1)$, or $y = -3x - 1$.

On Your Own

Now You're Ready
Exercises 6–11

Write an equation of the line with the given slope that passes through the given point.

1. $m = 1;\ (2, 0)$

2. $m = -\dfrac{1}{2};\ (2, 3)$

EXAMPLE **2** **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 an equation that represents the height y (in feet) above the boat after x seconds. (b) At what height were you parasailing? (c) When do you reach the boat?

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).
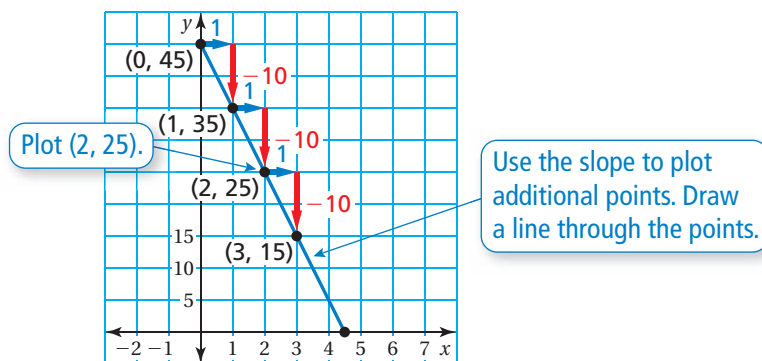
Because the line crosses the y-axis at (0, 45), the y-intercept is 45.

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

Check

Check that (2, 25) is a solution of the equation.

$$y = -10x + 45 \qquad \text{Write the equation.}$$
$$25 \overset{?}{=} -10(2) + 45 \qquad \text{Substitute.}$$
$$25 = 25 \;\checkmark \qquad \text{Simplify.}$$

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

c. You reach the boat when $y = 0$.

$$y = -10x + 45 \qquad \text{Write the equation.}$$
$$0 = -10x + 45 \qquad \text{Substitute 0 for } y.$$
$$-45 = -10x \qquad \text{Subtract 45 from each side.}$$
$$4.5 = x \qquad \text{Solve for } x.$$

You reach the boat after 4.5 seconds.

On Your Own

3. WHAT IF? In Example 2, you are 35 feet above the boat after 2 seconds. When do you reach the boat?
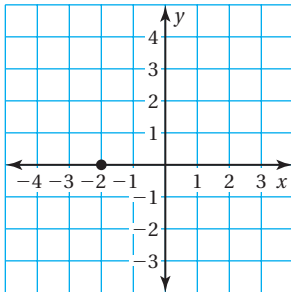
✓ Vocabulary and Concept Check

1. **WRITING** What information do you need to write an equation of a line?

2. **WRITING** Describe how to write an equation of a line using its slope and a point on the line.
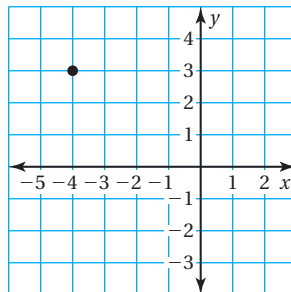
Practice and Problem Solving

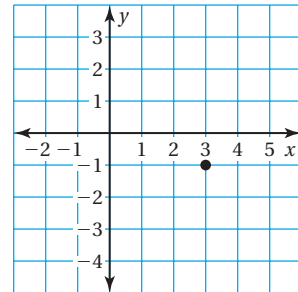**Write an equation of the line with the given slope that passes through the given point.**

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

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

5. $m = -3$

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

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

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

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

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

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

12. **ERROR ANALYSIS** Describe and correct the error in writing an equation of the line with a slope of $\dfrac{1}{3}$ that passes through the point (6, 4).

✗ $y = \dfrac{1}{3}x + 4$

13. **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 $\dfrac{2}{25}$. Write an equation that represents the volume of the gas in terms of the temperature.

14. CARS After it is purchased, the value of a new car decreases $4000 each year. After 3 years, the car is worth $18,000.

   a. Write an equation that represents the value V (in dollars) of the car x years after it is purchased.

   b. What was the original value of the car?

15. 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 chirp the cricket makes in 1 minute, the temperature rises 0.25 degree.

   a. 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.

   b. You count 100 chirps in 1 minute. What is the temperature?

   c. The temperature is 96°F. How many chirps would you expect the cricket to make?

Airboat
$30/hr

16. AIRBOATS You rent an airboat. The total cost includes a flat fee plus an hourly fee.

   a. After 4 hours the total cost is $140. Write an equation that represents the total cost y after x hours.

   b. Interpret the y-intercept.

17. **Critical Thinking** Bone mineral density is a measure of the strength of bones. The average bone mineral density of a female astronaut who has never been in space is 2.9 grams per square centimeter. For the first three years she spends in space, her bone density decreases by 0.03 grams per square centimeter per month.

   a. Write an equation that represents the bone mineral density y of a female astronaut in terms of the number x of months she spends in space.

   b. What is her bone mineral density after 2 years and 6 months in space?

   c. Explain why the amount of time an astronaut can spend in space is limited.

Fair Game Review *What you learned in previous grades & lessons*

18. Plot the ordered pairs in the same coordinate plane.

   $(2, 5), (-3, -6), (0, 7), (-5, 0), (-8, 9)$

19. MULTIPLE CHOICE What is the y-intercept of the equation $5x - 2y = 28$?

   Ⓐ $-\dfrac{5}{2}$ Ⓑ -14 Ⓒ $\dfrac{5}{2}$ Ⓓ 5.6