2.5 Writing Equations in Slope-Intercept Form

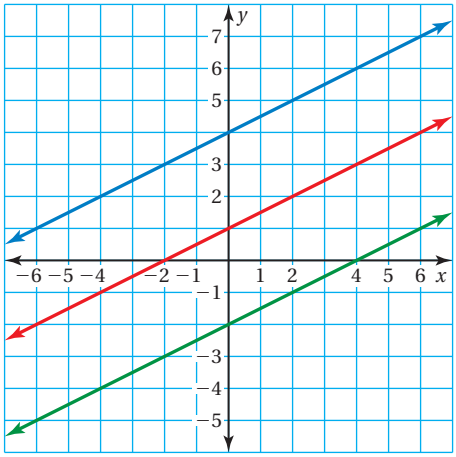
Essential Question How can you write an equation of a line when you are given the slope and y-intercept of the line?

1 ACTIVITY: Writing Equations of Lines

Work with a partner.

- **Find the slope of each line.**
- **Find the y-intercept of each line.**
- **Write an equation for each line.**
- **What do the three lines have in common?**

a.



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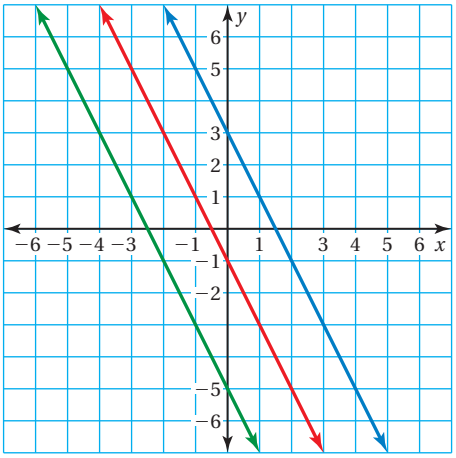

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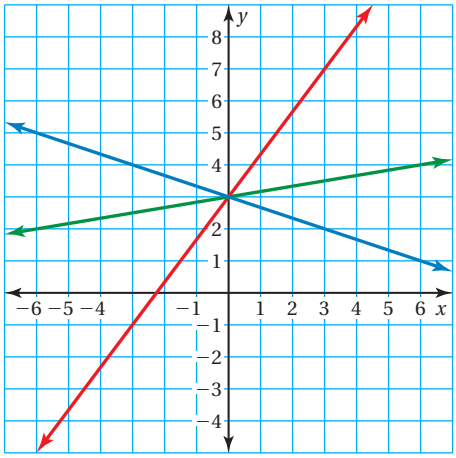

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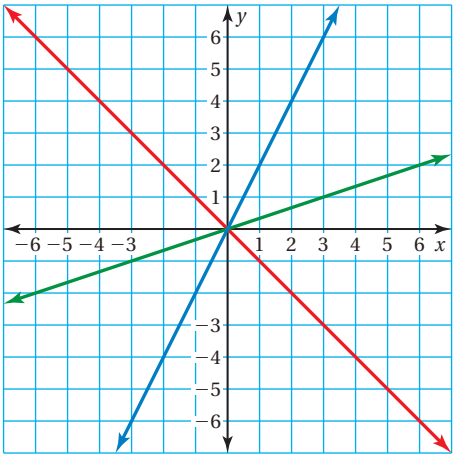


Common Core

Graphing Equations

In this lesson, you will

- write equations of lines in slope-intercept form.

Learning Standards
8.F.3
A.CED.2
A.CED.3

2 ACTIVITY: Describing a Parallelogram

Math Practice 1

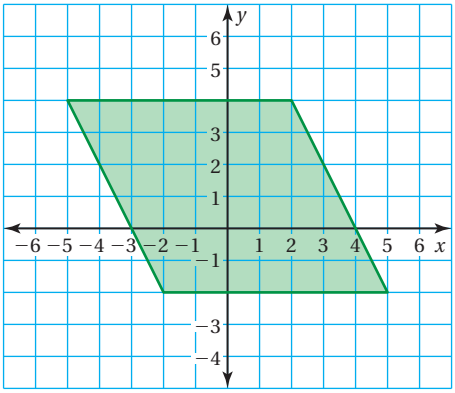
Analyze Givens

What do you need to know in order to write an equation?

Work with a partner.

- **Find the area of each parallelogram.**
- **Write an equation for each side of each parallelogram.**
- **What do you notice about the slopes of the opposite sides of each parallelogram?**

a.



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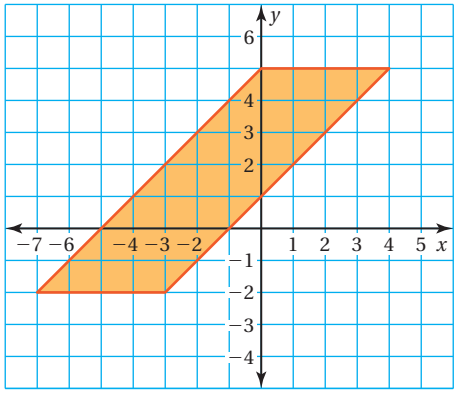


3 ACTIVITY: Interpreting the Slope and *y*-Intercept

Work with a partner. The graph shows a trip taken by a car where *t* is the time (in hours) and *y* is the distance (in miles) from Phoenix.

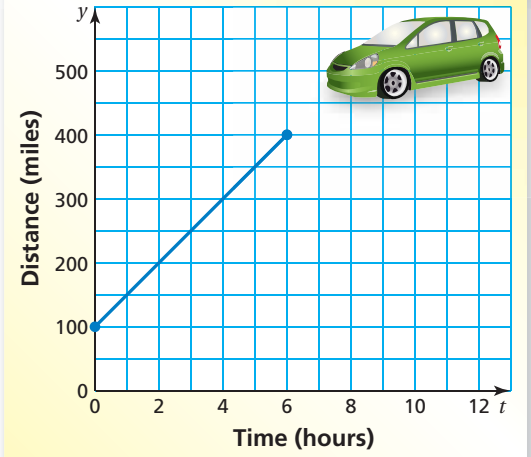
a. How far from Phoenix was the car at the beginning of the trip?

b. What was the car's speed?

c. How long did the trip last?

d. How far from Phoenix was the car at the end of the trip?

Car Trip



What Is Your Answer?

4. IN YOUR OWN WORDS How can you write an equation of a line when you are given the slope and *y*-intercept of the line? Give an example that is different from those in Activities 1, 2, and 3.

Practice Use what you learned about writing equations in slope-intercept form to complete Exercises 3 and 4 on page 76.

Check It Out
Lesson Tutorials
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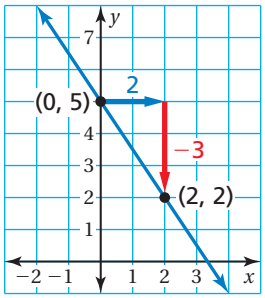
EXAMPLE 1 Writing Equations in Slope-Intercept Form

Write an equation of the line in slope-intercept form.

a.



Find the slope and y-intercept.

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 5}{2 - 0} = \frac{-3}{2}, \text{ or } -\frac{3}{2}$$

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

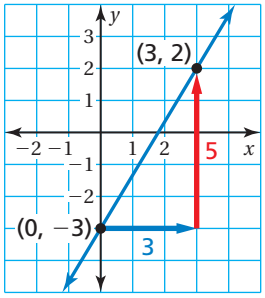
slope: $-\frac{3}{2}$ y-intercept: 5

∴ So, the equation is $y = -\frac{3}{2}x + 5$.

Study Tip

After writing an equation, check that the given points are solutions of the equation.

b.



Find the slope and y-intercept.

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-3 - 2}{0 - 3} = \frac{-5}{-3}, \text{ or } \frac{5}{3}$$

Because the line crosses the y-axis at $(0, -3)$, the y-intercept is -3.

slope: $\frac{5}{3}$ y-intercept: -3

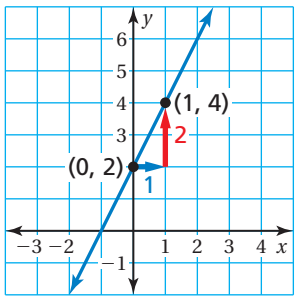
∴ So, the equation is $y = \frac{5}{3}x + (-3)$, or $y = \frac{5}{3}x - 3$.

On Your Own

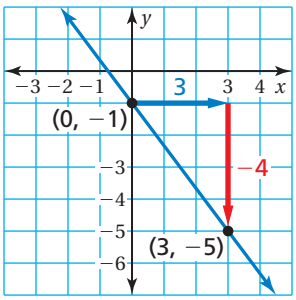
Write an equation of the line in slope-intercept form.

Now You're Ready
Exercises 5–10

1.



2.

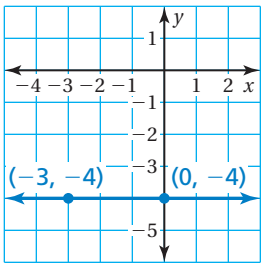


EXAMPLE 2 Writing an Equation

Which equation is shown in the graph?

Ⓐ $y = -4$ Ⓑ $y = -3$

Ⓒ $y = 0$ Ⓓ $y = -3x$



Remember

The graph of $y = a$ is a horizontal line that passes through $(0, a)$.

Find the slope and y-intercept.

The line is horizontal, so the change in y is 0.

$$\text{slope} = \frac{\text{change in } y}{\text{change in } x} = \frac{0}{3} = 0$$

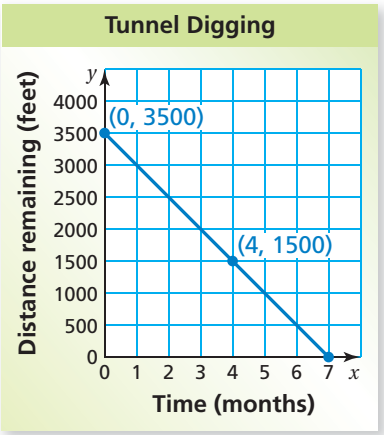
Because the line crosses the y-axis at $(0, -4)$, the y-intercept is -4.

∴ So, the equation is $y = 0x + (-4)$, or $y = -4$. The correct answer is Ⓐ.

EXAMPLE 3 Real-Life Application

Engineers used tunnel boring machines like the ones shown above to dig an extension of the Metro Gold Line in Los Angeles. The new tunnels are 1.7 miles long and 21 feet wide.

The graph shows the distance remaining to complete a tunnel. (a) Write an equation that represents the distance y (in feet) remaining after x months. (b) How much time does it take to complete the tunnel?



a. Find the slope and y-intercept.

$$\text{slope} = \frac{\text{change in } y}{\text{change in } x} = \frac{-2000}{4} = -500$$

Because the line crosses the y-axis at $(0, 3500)$, the y-intercept is 3500.

∴ So, the equation is $y = -500x + 3500$.

b. The tunnel is complete when the distance remaining is 0 feet. So, find the value of x when $y = 0$.

$y = -500x + 3500$	Write the equation.
$0 = -500x + 3500$	Substitute 0 for y.
$-3500 = -500x$	Subtract 3500 from each side.
$7 = x$	Solve for x.

∴ It takes 7 months to complete the tunnel.

On Your Own

Now You're Ready
Exercises 13–15

3. Write an equation of the line that passes through $(0, 5)$ and $(4, 5)$.
4. **WHAT IF?** In Example 3, the points are $(0, 3500)$ and $(5, 1500)$. How long does it take to complete the tunnel?

2.5 Exercises

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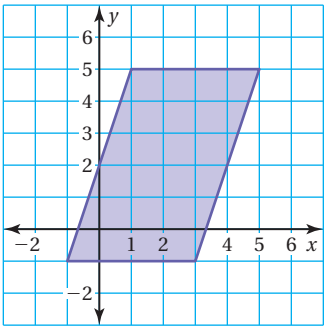
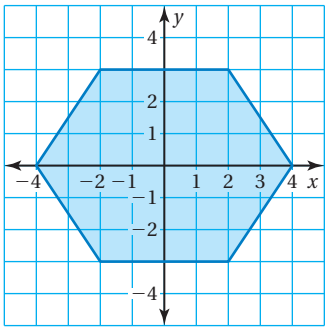
Vocabulary and Concept Check

1. **PRECISION** Explain how to find the slope of a line given the intercepts of the line.
2. **WRITING** Explain how to write an equation of a line using its graph.

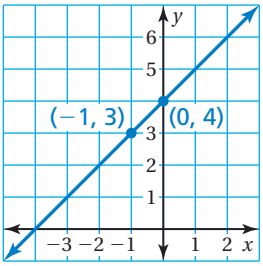
Practice and Problem Solving

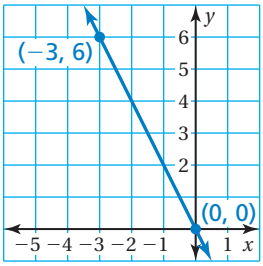
Write an equation for each side of the figure.

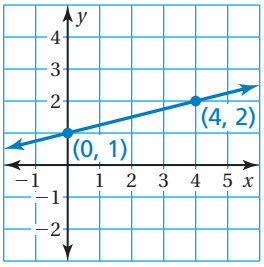
3. 

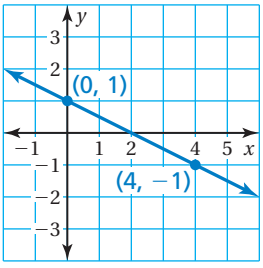
4. 

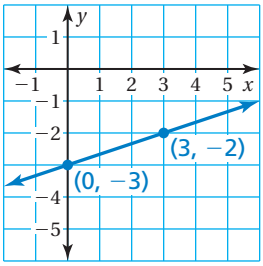
Write an equation of the line in slope-intercept form.

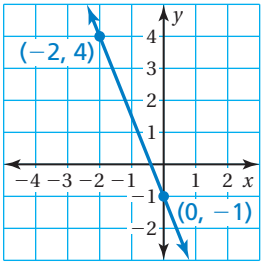
5. 

6. 

7. 

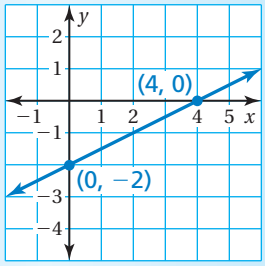
8. 

9. 

10. 

11. **ERROR ANALYSIS** Describe and correct the error in writing the equation of the line.

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



12. **BOA** A boa constrictor is 18 inches long at birth and grows 8 inches per year. Write an equation that represents the length y (in feet) of a boa constrictor that is x years old.

Write an equation of the line that passes through the points.

2 **13.** (2, 5), (0, 5) **14.** (−3, 0), (0, 0) **15.** (0, −2), (4, −2)

16. WALKATHON One of your friends gives you $10 for a charity walkathon. Another friend gives you an amount per mile. After 5 miles, you have raised $13.50 total. Write an equation that represents the amount y of money you have raised after x miles.

17. BRAKING TIME During each second of braking, an automobile slows by about 10 miles per hour.

a. Plot the points (0, 60) and (6, 0). What do the points represent?

b. Draw a line through the points. What does the line represent?

c. Write an equation of the line.

18. PAPER You have 500 sheets of notebook paper. After 1 week, you have 72% of the sheets left. You use the same number of sheets each week. Write an equation that represents the number y of pages remaining after x weeks.

19. Critical Thinking The palm tree on the left is 10 years old. The palm tree on the right is 8 years old. The trees grow at the same rate.

a. Estimate the height y (in feet) of each tree.

b. Plot the two points (x, y), where x is the age of each tree and y is the height of each tree.

c. What is the rate of growth of the trees?

d. Write an equation that represents the height of a palm tree in terms of its age.

Fair Game Review What you learned in previous grades & lessons

Plot the ordered pair in a coordinate plane. *(Skills Review Handbook)*

20. (1, 4) **21.** (−1, −2) **22.** (0, 1) **23.** (2, 7)

24. MULTIPLE CHOICE Which of the following statements is true? *(Section 2.3)*

Ⓐ The x-intercept is 5.

Ⓑ The x-intercept is −2.

Ⓒ The y-intercept is 5.

Ⓓ The y-intercept is −2.