

**Chapter
2****Fair Game Review**

Evaluate the expression when $x = \frac{1}{2}$ and $y = -5$.

1. $-2xy$

2. $4x^2 - 3y$

3. $\frac{10y}{12x + 4}$

4. $11x - 8(x - y)$

Evaluate the expression when $a = -9$ and $b = -4$.

5. $3ab$

6. $a^2 - 2(b + 12)$

7. $\frac{4b^2}{3b - 7}$

8. $7b^2 + 5(ab - 6)$

9. You go to the movies with five friends. Two of you buy a ticket and a bag of popcorn. The rest of your friends buy just one ticket each. The expression $4x + 2(x + y)$ represents the situation. Evaluate the expression when tickets cost \$7.25 and a bag of popcorn costs \$3.25.

**Chapter
2****Fair Game Review** (continued)

Use the graph to answer the question.

10. Write the ordered pair that corresponds to Point D .

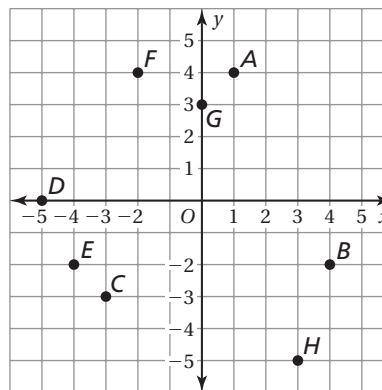
11. Write the ordered pair that corresponds to Point H .

12. Which point is located at $(-2, 4)$?

13. Which point is located at $(0, 3)$?

14. Which point(s) are located in Quadrant IV?

15. Which point(s) are located in Quadrant III?



Plot the point.

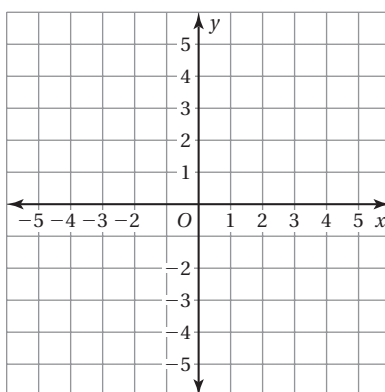
16. $(3, -1)$

17. $(0, 2)$

18. $(-5, -4)$

19. $(-1, 0)$

20. $(-2, 3)$



2.1

Graphing Linear Equations

For use with Activity 2.1

Essential Question How can you recognize a linear equation? How can you draw its graph?

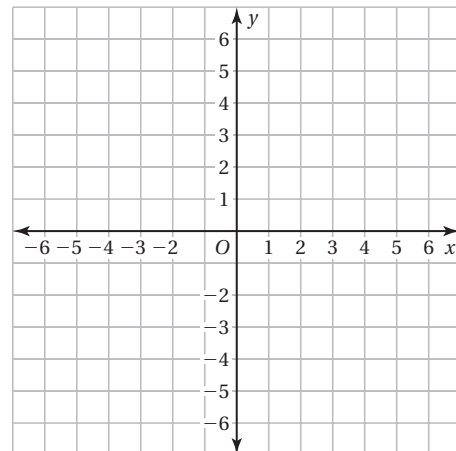
1 ACTIVITY: Graphing a Linear Equation

Work with a partner.

- Use the equation $y = \frac{1}{2}x + 1$ to complete the table. (Choose any two x -values and find the y -values).
- Write the two ordered pairs given by the table. These are called **solution points** of the equation.

Solution Points		
x		
$y = \frac{1}{2}x + 1$		

- PRECISION** Plot the two solution points. Draw a line *exactly* through the two points.
- Find a different point on the line. Check that this point is a solution point of the equation $y = \frac{1}{2}x + 1$.



- LOGIC** Do you think it is true that *any* point on the line is a solution point of the equation $y = \frac{1}{2}x + 1$? Explain.

2.1 Graphing Linear Equations (continued)

- f. Choose five additional x -values for the table. (Choose positive and negative x -values.) Plot the five corresponding solution points on the previous page. Does each point lie on the line?

	Solution Points				
x					
$y = \frac{1}{2}x + 1$					

- g. **LOGIC** Do you think it is true that *any* solution point of the equation

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

is a point on the line? Explain.

- h. **THE MEANING OF A WORD** Why is $y = ax + b$ called a *linear equation*?

2 ACTIVITY: Using a Graphing Calculator

Use a graphing calculator to graph $y = 2x + 5$.

- a. Enter the equation $y = 2x + 5$ into your calculator.
- b. Check the settings of the *viewing window*. The boundaries of the graph are set by the minimum and maximum x - and y -values. The number of units between the tick marks are set by the x - and y -scales.

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Plot1 Plot2 Plot3
Y1=2X+5
Y2=
Y3=
Y4=
Y5=
Y6=
Y7=

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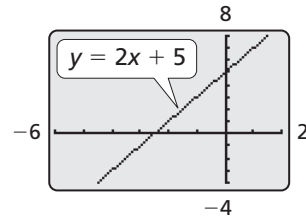
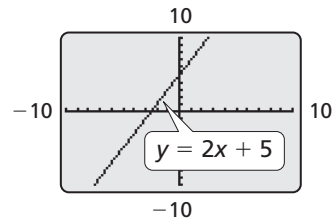
WINDOW
Xmin=-10
Xmax=10
Xscl=1
Ymin=-10
Ymax=10
Yscl=1
Xres=1

```

This is the
standard
viewing
window.

2.1 Graphing Linear Equations (continued)

- c. Graph $y = 2x + 5$ on your calculator.
- d. Change the settings of the viewing window to match those shown. Compare the two graphs.

**What Is Your Answer?**

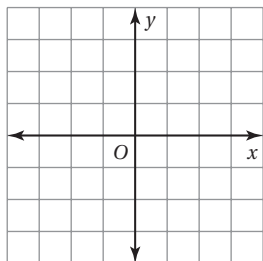
3. **IN YOUR OWN WORDS** How can you recognize a linear equation? How can you draw its graph? Write an equation that is linear. Write an equation that is *not* linear.
4. Use a graphing calculator to graph $y = 5x - 12$ in the standard viewing window.
- a. Can you tell where the line crosses the x -axis? Can you tell where the line crosses the y -axis?
- b. How can you adjust the viewing window so that you can determine where the line crosses the x - and y -axes?
5. **CHOOSE TOOLS** You want to graph $y = 2.5x - 3.8$. Would you graph it by hand or using a graphing calculator? Why?

2.1**Practice**

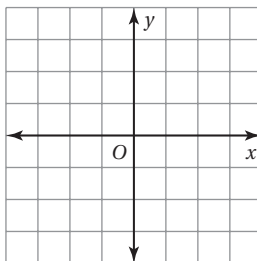
For use after Lesson 2.1

Graph the linear equation.

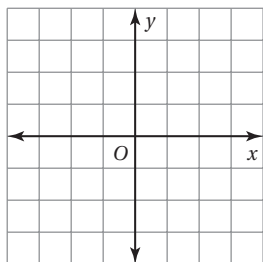
1. $y = 4$



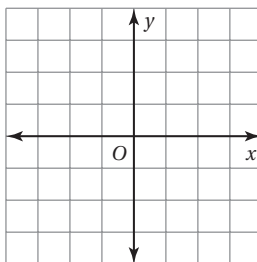
2. $y = -\frac{1}{3}x$

Solve for y . Then graph the equation.

3. $y + 2x = 3$

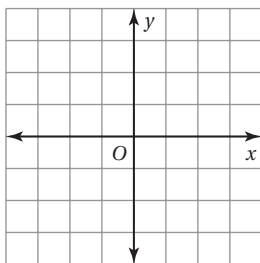


4. $2y - 3x = 1$



5. The equation $y = 2x + 4$ represents the cost y (in dollars) of renting a movie after x days of late charges.

a. Graph the equation.



b. Use the graph to determine how much it costs after 3 days of late charges.

2.2

Slope of a Line

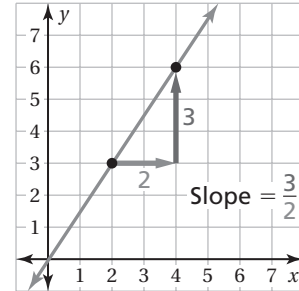
For use with Activity 2.2

Essential Question How can the slope of a line be used to describe the line?

Slope is the rate of change between any two points on a line. It is the measure of the *steepness* of the line.

To find the slope of a line, find the ratio of the change in y (vertical change) to the change in x (horizontal change).

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



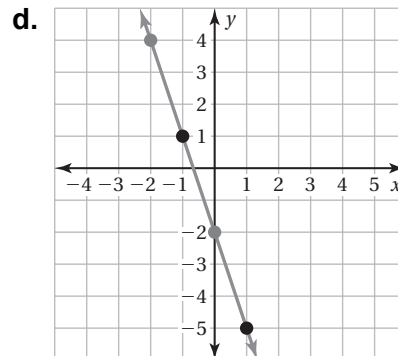
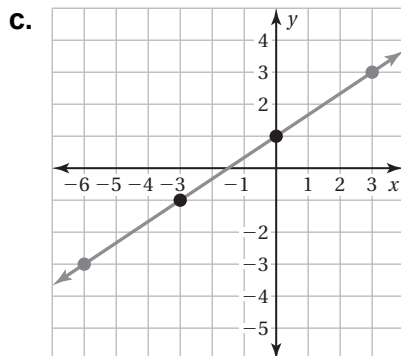
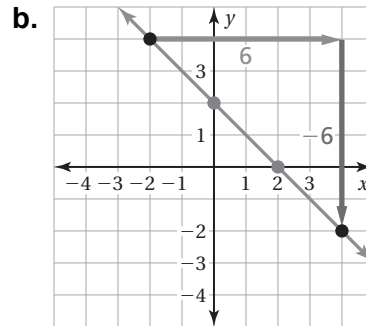
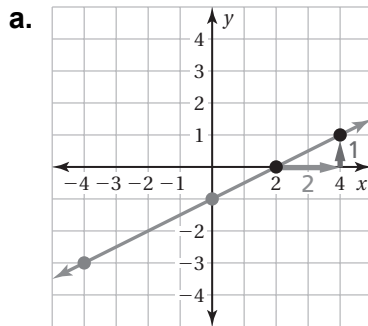
1 ACTIVITY: Finding the Slope of a Line

Work with a partner. Find the slope of each line using two methods.

Method 1: Use the two black points.

Method 2: Use the two gray points.

Do you get the same slope using each method? Why do you think this happens?



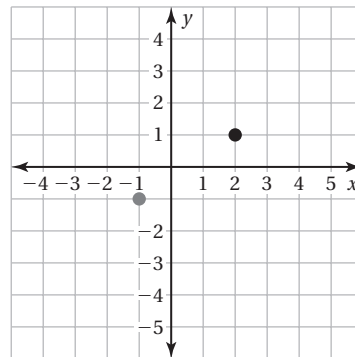
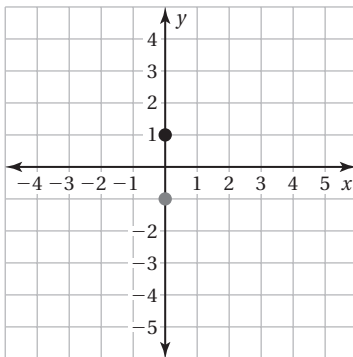
2.2 Slope of a Line (continued)**2 ACTIVITY:** Drawing Lines with Given Slopes

Work with a partner.

- Draw a line through the black point using the given slope.
- Draw a line through the gray point using the given slope.
- What do you notice about the two lines?

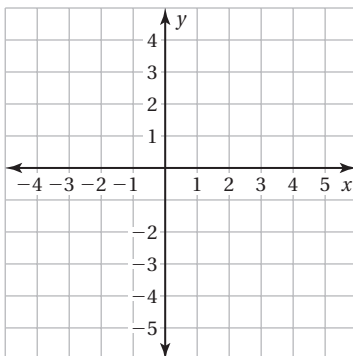
a. Slope = $\frac{3}{4}$

b. Slope = $-\frac{4}{3}$

**3 ACTIVITY:** Drawing Lines with Given Slopes

Work with a partner.

- Examine the lines drawn through the black points in parts (a) and (b) of Activity 2. Draw these two lines in the same coordinate plane.



- Describe the angle formed by the two lines. What do you notice about the product of the slopes of the two lines?

2.2 Slope of a Line (continued)**What Is Your Answer?**

4. **IN YOUR OWN WORDS** How can the slope of a line be used to describe the line?

5. Based on your results in Activity 2, make a conjecture about two different nonvertical lines in the same plane that have the same slope.

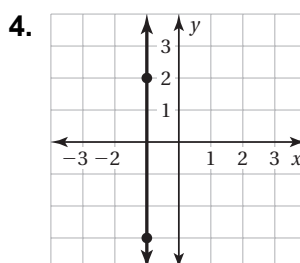
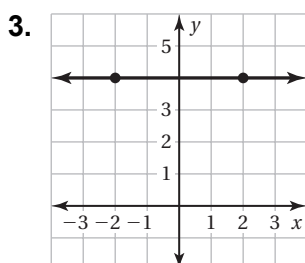
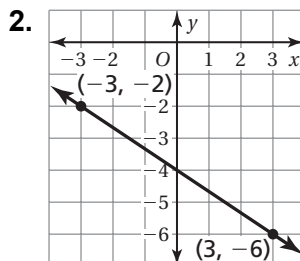
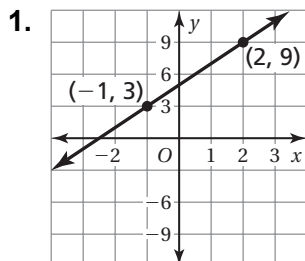
6. **REPEATED REASONING** Repeat Activity 3 for lines drawn through the gray points in Activity 2. Based on your results, make a conjecture about two lines in the same plane whose slopes have a product of -1 .

2.2

Practice

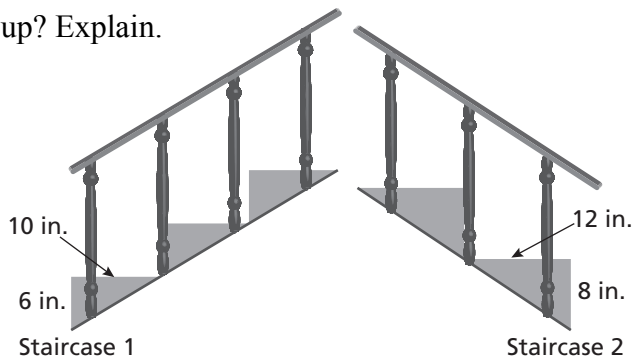
For use after Lesson 2.2

Find the slope of the line.



5. The back of a moving truck is 4 feet above the ground. A ramp extending from the back of the truck meets the ground 10 feet from the truck. What is the slope of the ramp?

6. Which set of stairs is more difficult to walk up? Explain.

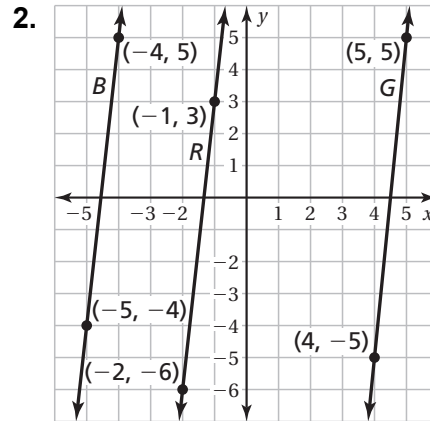
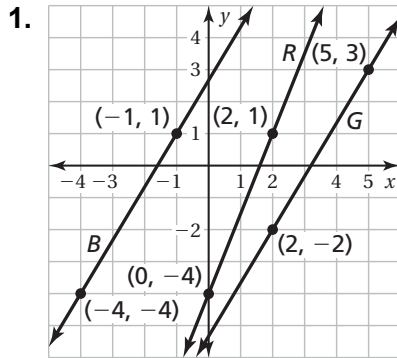


Extension 2.2

Practice

For use after Extension 2.2

Which lines are parallel? How do you know?

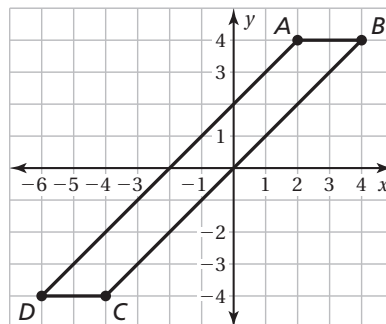


Are the given lines parallel? Explain your reasoning.

3. $y = 2$, $y = -4$

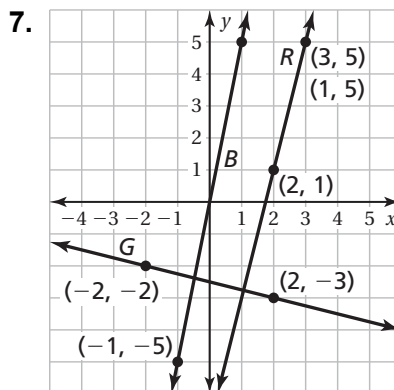
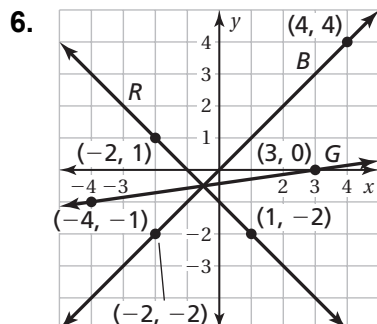
4. $x = 3$, $y = -3$

5. Is the quadrilateral a parallelogram? Justify your answer.



**Extension
2.2**
Practice (continued)

Which lines are perpendicular? How do you know?

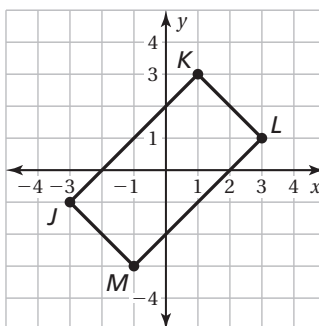


Are the given lines perpendicular? Explain your reasoning.

8. $x = 0, y = 3$

9. $y = 2, y = -\frac{1}{2}$

10. Is the parallelogram a rectangle?
Justify your answer.



2.3**Graphing Linear Equations in Slope-Intercept Form**

For use with Activity 2.3

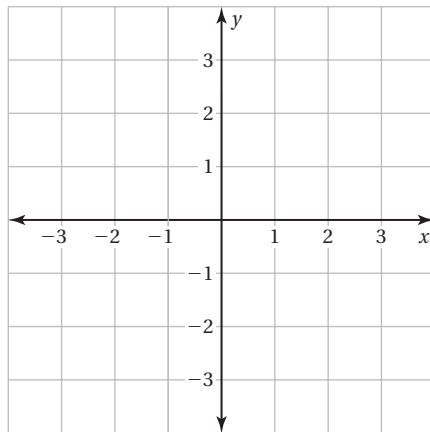
Essential Question How can you describe the graph of the equation $y = mx + b$?

1 ACTIVITY: Finding Slopes and y -Intercepts

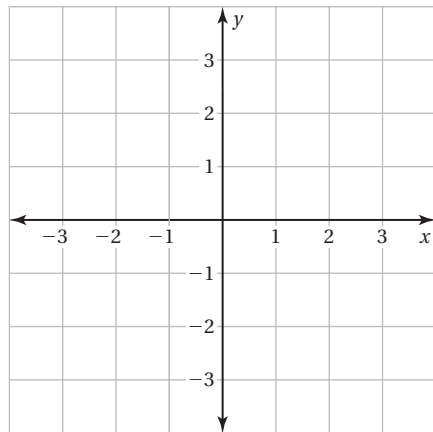
Work with a partner.

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

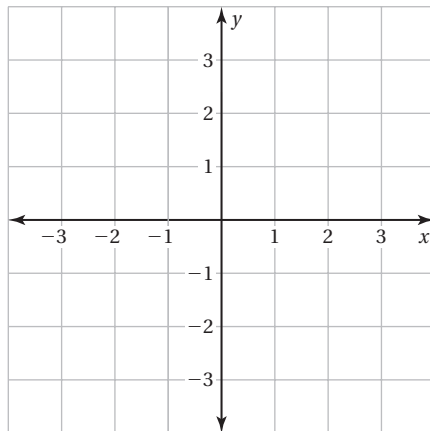
a. $y = -\frac{1}{2}x + 1$



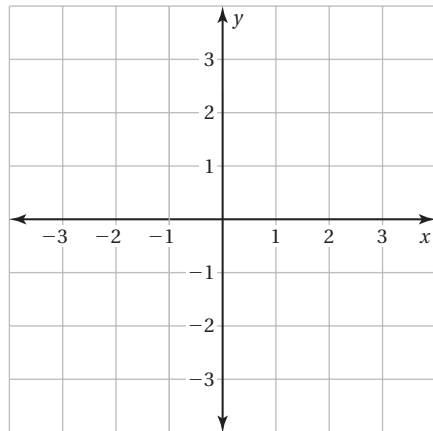
b. $y = -x + 2$



c. $y = -x - 2$



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



2.3 Graphing Linear Equations in Slope-Intercept Form (continued)**Inductive Reasoning**

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

	Equation	Description of Graph	Slope of Graph	Point of Intersection with y-axis
1a	2. $y = -\frac{1}{2}x + 1$			
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. $y = -2x + 3$			

2.3 Graphing Linear Equations in Slope-Intercept Form (continued)**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 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.

2.3**Practice**

For use after Lesson 2.3

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

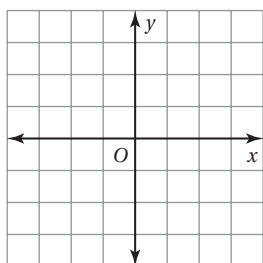
1. $y = -3x + 9$

2. $y = 4 - \frac{2}{5}x$

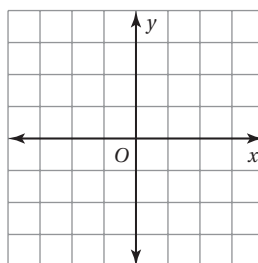
3. $6 + y = 8x$

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

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

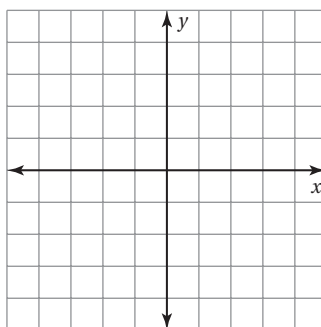


5. $y - 10 = -5x$



6. The equation $y = -90x + 1440$ represents the time (in minutes) left after x games of a tournament.

a. Graph the equation.



b. Interpret the x-intercept and slope.

2.4

Graphing Linear Equations in Standard Form

For use with Activity 2.4

Essential Question How can you describe the graph of the equation $ax + by = c$?

1 ACTIVITY: Using a Table to Plot Points

Work with a partner. You sold a total of \$16 worth of tickets to a school concert. You lost track of how many of each type of ticket you sold.

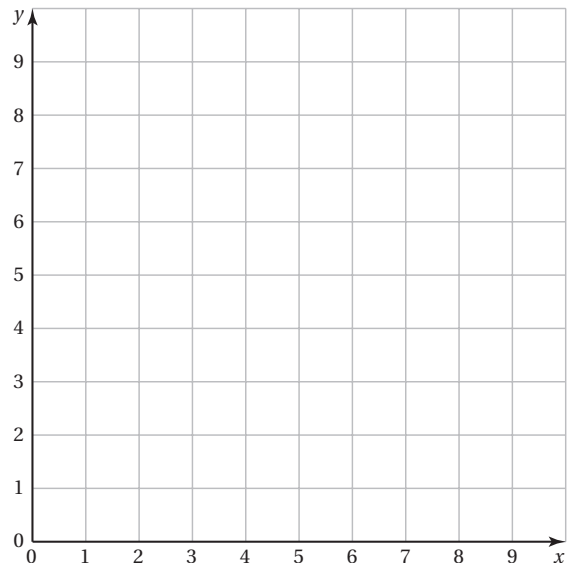


$$\frac{\$4}{\text{Adult}} \cdot \text{Number of Adult Tickets} + \frac{\$2}{\text{Child}} \cdot \text{Number of Child Tickets} = \$16$$

- Let x represent the number of adult tickets.
Let y represent the number of child tickets.
Write an equation that relates x and y .
- Complete the table showing the different combinations of tickets you might have sold.

Number of Adult Tickets, x					
Number of Child Tickets, y					

- Plot the points from the table. Describe the pattern formed by the points.
- If you remember how many adult tickets you sold, can you determine how many child tickets you sold? Explain your reasoning.



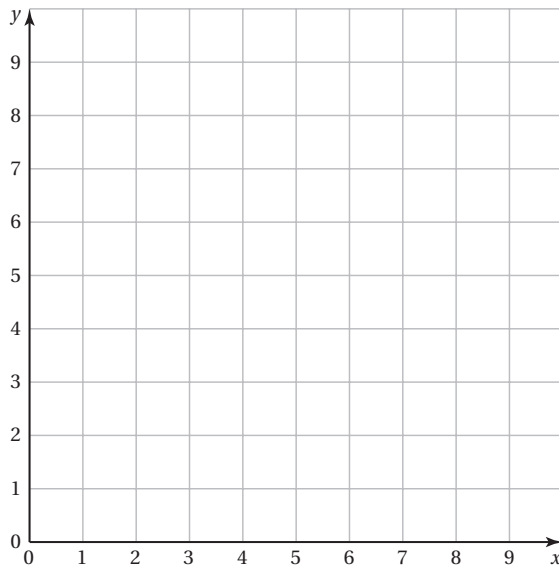
2.4 Graphing Linear Equations in Standard Form (continued)**2** **ACTIVITY:** Rewriting an Equation

Work with a partner. You sold a total of \$16 worth of cheese. You forgot how many pounds of each type of cheese you sold.



$$\boxed{\frac{\$4}{\text{lb}}} \cdot \boxed{\text{Pounds of Swiss}} + \boxed{\frac{\$2}{\text{lb}}} \cdot \boxed{\text{Pounds of Cheddar}} = \boxed{\$16}$$

- a. Let x represent the number of pounds of Swiss cheese.
Let y represent the number of pounds of Cheddar cheese.
Write an equation that relates x and y .
- b. Rewrite the equation in slope-intercept form. Then graph the equation.



2.4 Graphing Linear Equations in Standard Form (continued)**What Is Your Answer?**

3. **IN YOUR OWN WORDS** How can you describe the graph of the equation

$$ax + by = c?$$

4. Activities 1 and 2 show two different methods for graphing $ax + by = c$. Describe the two methods. Which method do you prefer? Explain.

5. Write a real-life problem that is similar to those shown in Activities 1 and 2.

6. Why do you think it might be easier to graph $x + y = 10$ using standard form instead of rewriting it in slope-intercept form and then graphing?

2.4**Practice**

For use after Lesson 2.4

Write the linear equation in slope-intercept form.

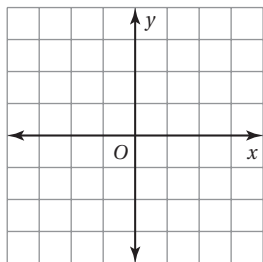
1. $2x - y = 7$

2. $\frac{1}{4}x + y = -\frac{2}{7}$

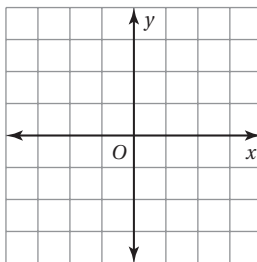
3. $3x - 5y = -20$

Graph the linear equation using intercepts. Use a graphing calculator to check your graph.

4. $2x - 3y = 12$



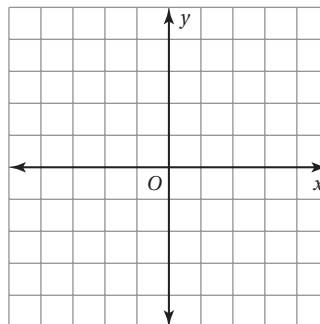
5. $x + 9y = -27$



6. You go shopping and buy x shirts for \$12 and y jeans for \$28. The total spent is \$84.

a. Write an equation in standard form that models how much money you spent.

b. Graph the equation and interpret the intercepts.



2.5

Writing Equations in Slope-Intercept Form

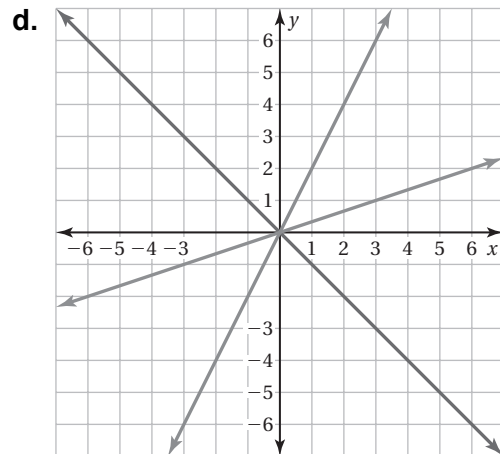
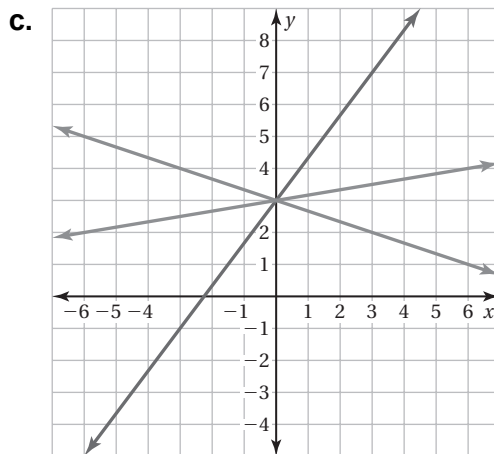
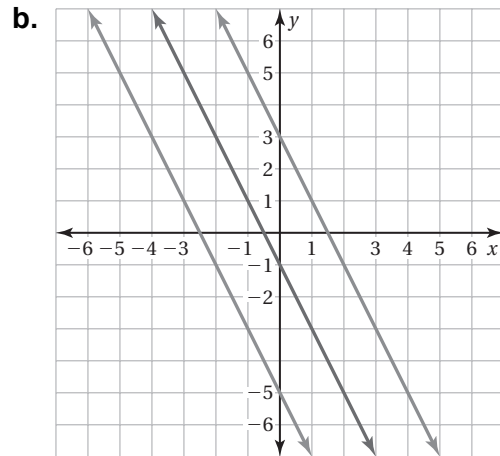
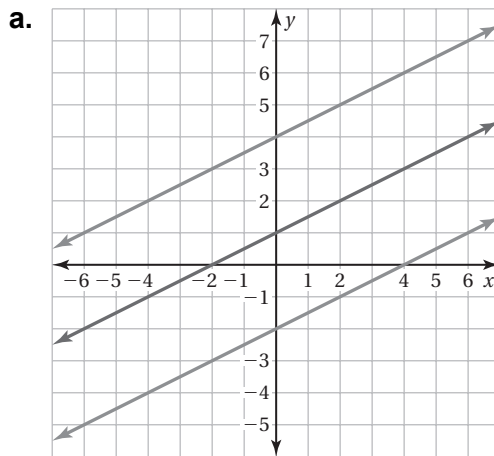
For use with Activity 2.5

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?

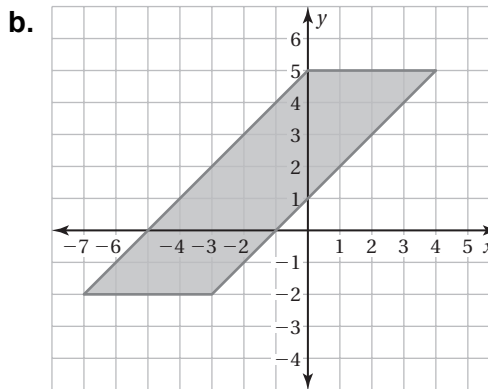
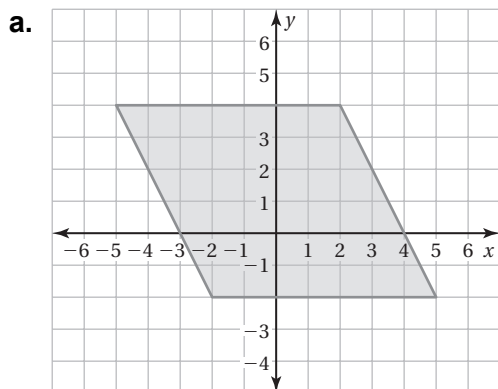


2.5 Writing Equations in Slope-Intercept Form (continued)

2 ACTIVITY: Describing a Parallelogram

Work with a partner.

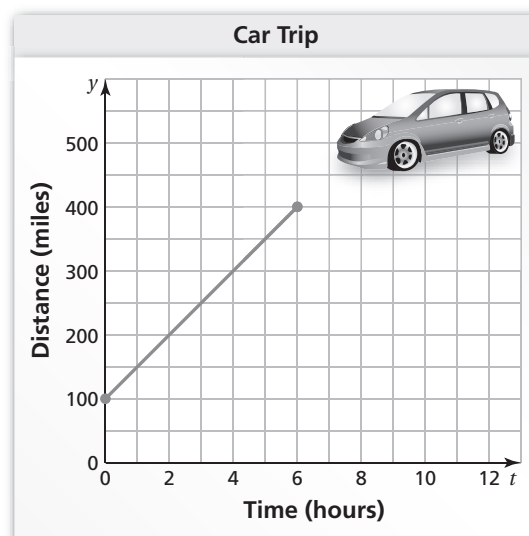
- Find the area of each parallelogram.
- Write an equation for each side of each parallelogram.
- What do you notice about the slopes of the opposite sides of each parallelogram?



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?



2.5 Writing Equations in Slope-Intercept Form (continued)

- 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?

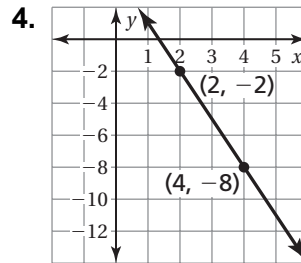
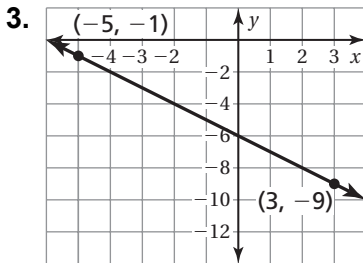
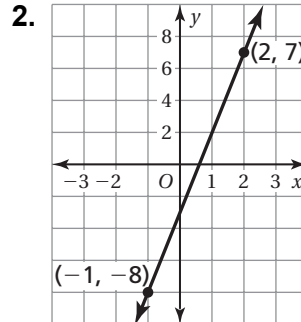
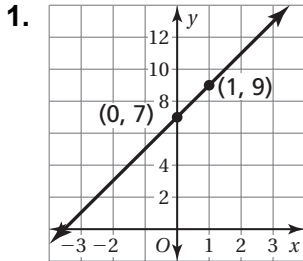
What Is Your Answer?

- 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.

2.5**Practice**

For use after Lesson 2.5

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



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

5. $(3, 8), (-2, 8)$

6. $(4, 3), (6, -3)$

7. $(-1, 0), (-5, 0)$

8. You organize a garage sale. You have \$30 at the beginning of the sale. You earn an average of \$20 per hour. Write an equation that represents the amount of money y you have after x hours.

2.6**Writing Equations in Point-Slope Form**

For use with Activity 2.6

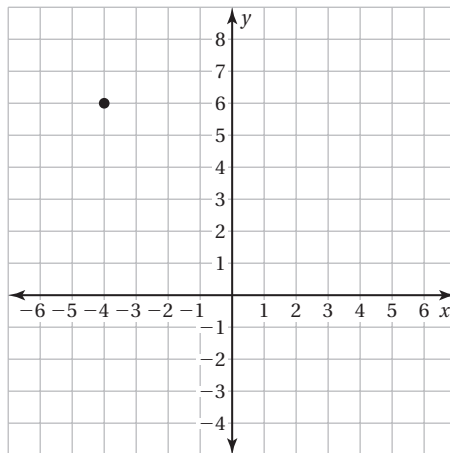
Essential Question How can you write an equation of a line when you are given the slope and a point on the line?

1 ACTIVITY: Writing Equations of Lines

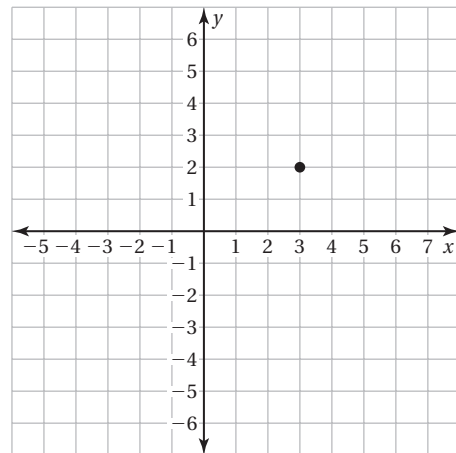
Work with a partner.

- 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.

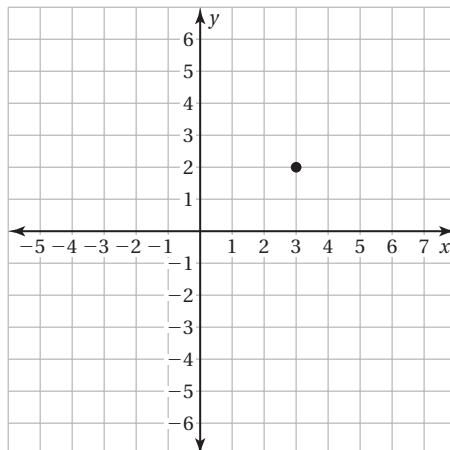
a. $m = -2$



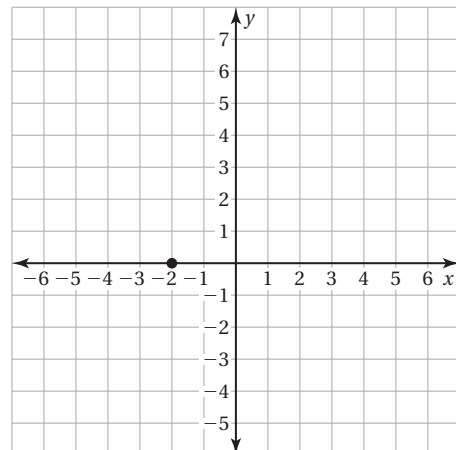
b. $m = \frac{1}{3}$



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



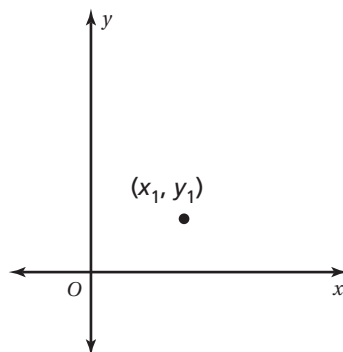
d. $m = \frac{5}{2}$



2.6 Writing Equations in Point-Slope Form (continued)**2 ACTIVITY:** Developing a Formula

Work with a partner.

- a. Draw a nonvertical line that passes through the point (x_1, y_1) .
- b. Plot another point on your line. Label this point as (x, y) . This point represents any other point on the line.
- c. Label the rise and run of the line through the points (x_1, y_1) and (x, y) .
- d. The rise can be written as $y - y_1$. The run can be written as $x - x_1$. Explain why this is true.



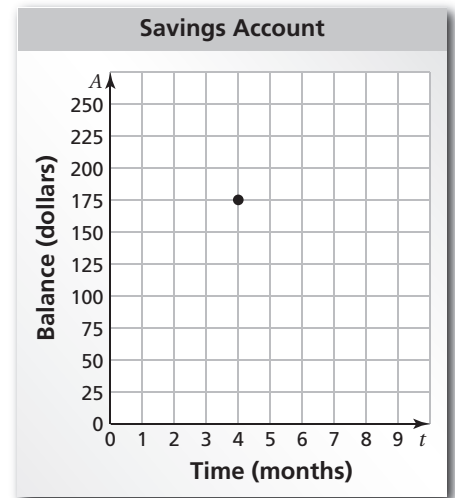
- e. Write an equation for the slope m of the line using the expressions from part (d).
- f. Multiply each side of the equation by the expression in the denominator. Write your result. What does this result represent?

2.6 Writing Equations in Point-Slope Form (continued)**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?**

4. Redo Activity 1 using the formula you found in Activity 2. Compare the results. What do you notice?
5. 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 this is important?
6. **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.

2.6**Practice**

For use after Lesson 2.6

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

1. $m = -3; (-4, 6)$

2. $m = -\frac{4}{3}; (3, -1)$

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

3. $(-3, 0), (-2, 3)$

4. $(-6, 10), (6, -10)$

5. The total cost for bowling includes the fee for shoe rental plus a fee per game. The cost of each game increases the price by \$4. After 3 games, the total cost with shoe rental is \$14.

a. Write an equation to represent the total cost y to rent shoes and bowl x games.

b. How much is shoe rental? How is this represented in the equation?

**Extension
2.6****Practice**

For use after Extension 2.6

Write an equation of the line that passes through the given point and is parallel to the given line. Use a graphing calculator to check your answer.

1. $(1, 3); y = 2x + 6$

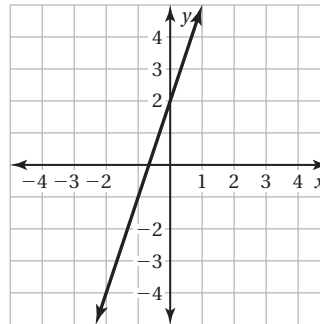
2. $(-2, -2); y = -3x + 7$

3. $(5, 7); y = \frac{3}{5}x + 6$

4. $(2, -5); y = -\frac{7}{2}x - 2$

Write an equation of the line that passes through the given point and is parallel to the line shown in the graph.

5. $(1, 2)$



6. $(4, 7)$

7. $(0, -9)$

8. $(-6, -15)$

Extension
2.6**Practice (continued)**

Write an equation of the line that passes through the given point and is perpendicular to the given line.

9. $(1, 1); y = \frac{1}{2}x + 4$

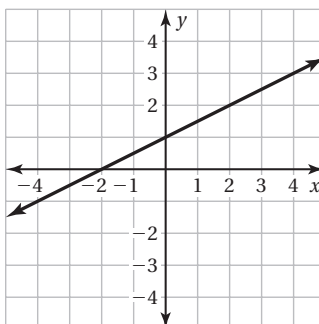
10. $(-3, 7); y = 3x - 4$

11. $(-2, -8); y = -2x - 7$

12. $(-8, 10); y = -\frac{4}{7}x + 2$

Write an equation of the line that passes through the given point and is perpendicular to the line shown in the graph.

13. $(4, -4)$



14. $(-5, 2)$

15. $(0, 0)$

16. $(0, 6)$

2.7

Solving Real-Life Problems

For use with Activity 2.7

Essential Question How can you use a linear equation in two variables to model and solve a real-life problem?

1 EXAMPLE: Writing a Story

Write a story that uses the graph at the right.

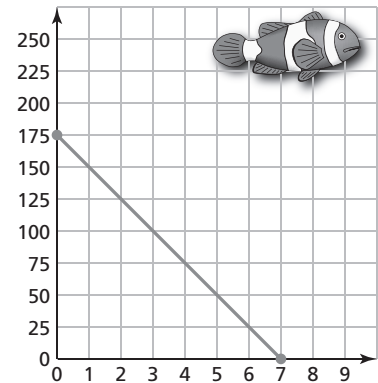
- In your story, interpret the slope of the line, the y -intercept, and the x -intercept.
- Make a table that shows data from the graph.
- Label the axes of the graph with units.
- Draw pictures for your story.

There are many possible stories. Here is one about a reef tank.

Tom works at an aquarium shop on Saturdays. One Saturday, when Tom gets to work, he is asked to clean a 175-gallon reef tank.

His first job is to drain the tank. He puts a hose into the tank and starts a siphon. Tom wonders if the tank will finish draining before he leaves work.

He measures the amount of water that is draining out and finds that 12.5 gallons drain out in 30 minutes. So, he figures that the rate is 25 gallons per hour. To see when the tank will be empty, Tom makes a table and draws a graph.



x -intercept: number of hours to empty the tank

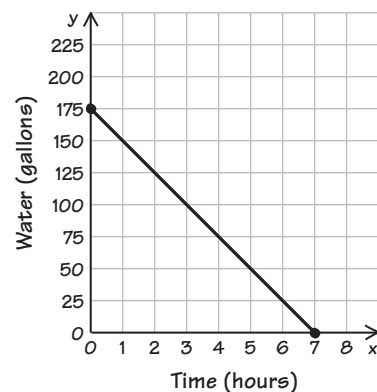
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x	0	1	2	3	4	5	6	7
y	175	150	125	100	75	50	25	0

↑

y -intercept: amount of water in full tank

From the table and also from the graph, Tom sees that the tank will be empty after 7 hours. This will give him 1 hour to wash the tank before going home.



2.7 Solving Real-Life Problems (continued)**2 ACTIVITY:** Writing a Story

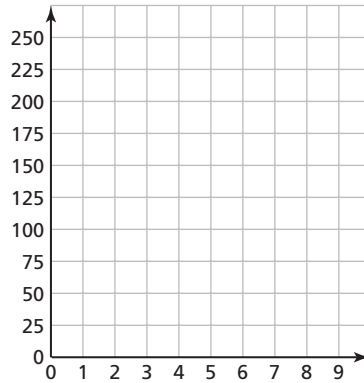
Work with a partner. Write a story that uses the graph of a line.

- In your story, interpret the slope of the line, the y -intercept, and the x -intercept.
- Make a table that shows data from the graph.
- Label the axes of the graph with units.
- Draw pictures for your story.

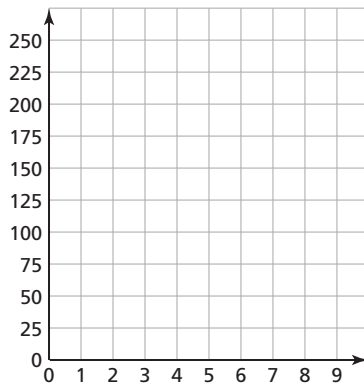
2.7 Solving Real-Life Problems (continued)**3 ACTIVITY:** Drawing Graphs

Work with a partner. Describe a real-life problem that has the given rate and intercepts. Draw a line that represents the problem.

- a.** Rate: -30 feet per second
y-intercept: 150 feet
x-intercept: 5 seconds



- b.** Rate: -25 dollars per month
y-intercept: \$200
x-intercept: 8 months

**What Is Your Answer?**

- 4. IN YOUR OWN WORDS** How can you use a linear equation in two variables to model and solve a real-life problem? List three different rates that can be represented by slopes in real-life problems.

2.7

Practice

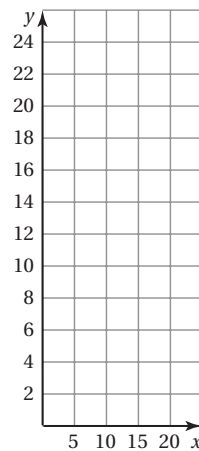
For use after Lesson 2.7

Describe a real-life problem that has the given rate and intercepts. Draw a line that represents the problem.

- Rate: -6 feet per year
y-intercept: 24 feet
x-intercept: 4 years
- Rate: -2 pages per minute
y-intercept: 280 pages
x-intercept: 140 minutes
- You are buying shirts for an organization. You have \$120 to spend. The number of short-sleeved shirts y you buy after buying x long-sleeved shirts is $y = -1.2x + 24$.

a. Graph the equation.

b. Interpret the x- and y-intercepts.



- The graph relates the percent of battery life y left in an MP3 player to the amount of playing time it has left. Write an equation of the line.

