2.4 Graphing Linear Equations in Standard Form

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.

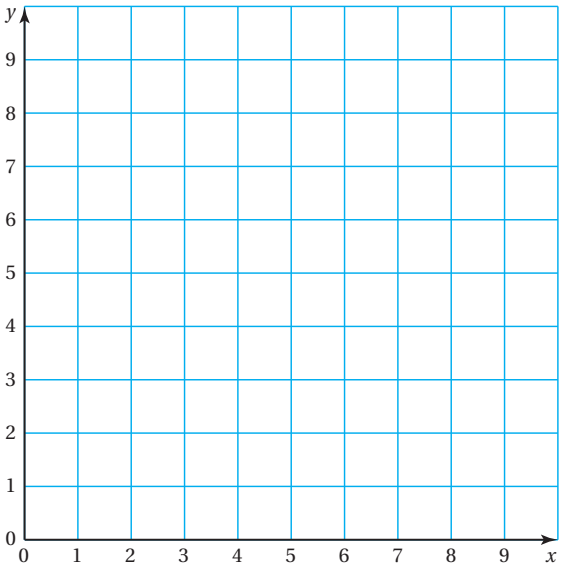
$$\frac{\$4}{\text{Adult}} \cdot \text{Number of Adult Tickets} + \frac{\$2}{\text{Child}} \cdot \text{Number of Child Tickets} = \$16$$

a. Let x represent the number of adult tickets.
Let y represent the number of child tickets.
Write an equation that relates x and y.

b. Copy and complete the table showing the different combinations of tickets you might have sold.

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

c. Plot the points from the table. Describe the pattern formed by the points.



d. If you remember how many adult tickets you sold, can you determine how many child tickets you sold? Explain your reasoning.

Common Core

Graphing Equations

In this lesson, you will
- graph linear equations written in standard form.

Learning Standards
A.CED.2
A.REI.10
F.IF.4

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.

Math Practice 2

Understand Quantities

What do the equation and the graph represent? How can you use this information to solve the problem?

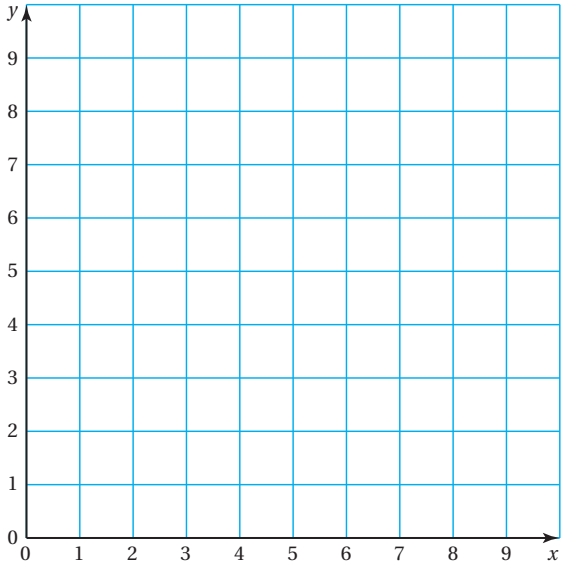
$$\frac{\$4}{\text{lb}} \cdot \text{Pounds of Swiss} + \frac{\$2}{\text{lb}} \cdot \text{Pounds of Cheddar} = \$16$$

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.



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?

Practice Use what you learned about graphing linear equations in standard form to complete Exercises 3 and 4 on page 68.

2.4 Lesson

Check It Out
Lesson Tutorials
BigIdeasMath.com

Key Vocabulary
standard form, *p. 66*

Study Tip
Any linear equation can be written in standard form.

Key Idea

Standard Form of a Linear Equation

The **standard form** of a linear equation is

$$ax + by = c$$

where a and b are not both zero.

EXAMPLE 1 Graphing a Linear Equation in Standard Form

Graph $-2x + 3y = -6$.

Step 1: Write the equation in slope-intercept form.

$-2x + 3y = -6$ Write the equation.

$3y = 2x - 6$ Add $2x$ to each side.

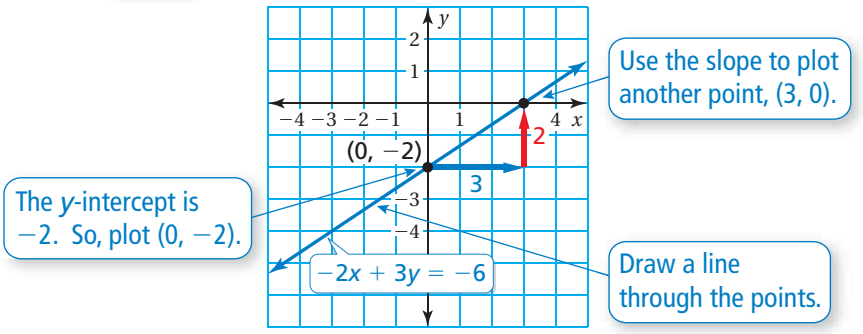
$y = \frac{2}{3}x - 2$ Divide each side by 3.

Step 2: Use the slope and y-intercept to graph the equation.

$y = \frac{2}{3}x + (-2)$

slope

y-intercept



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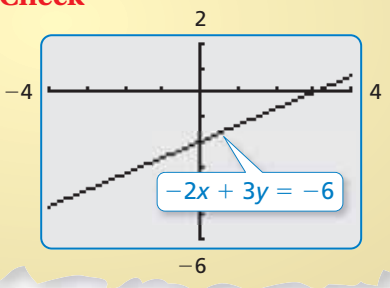


On Your Own

Now You're Ready
Exercises 5–10

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

1. $x + y = -2$
2. $-\frac{1}{2}x + 2y = 6$
3. $-\frac{2}{3}x + y = 0$
4. $2x + y = 5$

EXAMPLE 2 Graphing a Linear Equation in Standard Form

Graph $x + 3y = -3$ using intercepts.

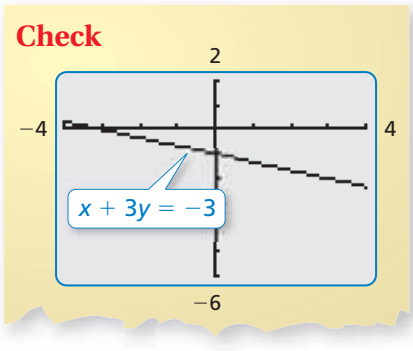
Step 1: To find the x-intercept, substitute 0 for y.

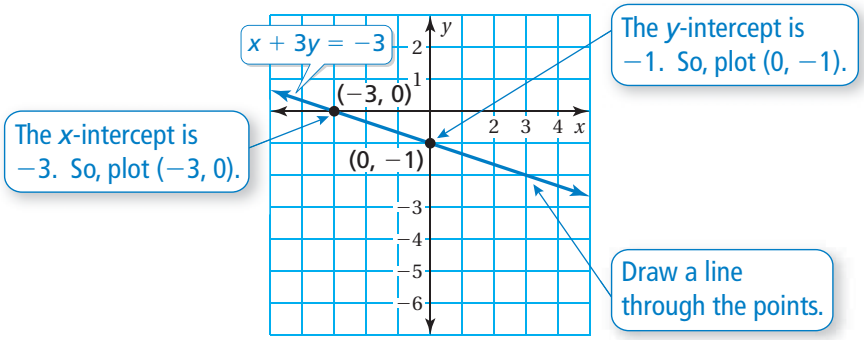
$$x + 3y = -3$$
$$x + 3(0) = -3$$
$$x = -3$$

To find the y-intercept, substitute 0 for x.

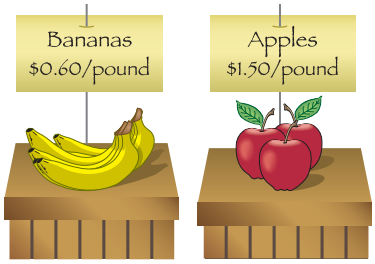
$$x + 3y = -3$$
$$0 + 3y = -3$$
$$y = -1$$

Step 2: Graph the equation.





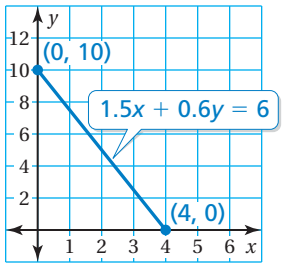
EXAMPLE 3 Real-Life Application



You have \$6 to spend on apples and bananas. (a) Graph the equation $1.5x + 0.6y = 6$, where x is the number of pounds of apples and y is the number of pounds of bananas. (b) Interpret the intercepts.

a. Find the intercepts and graph the equation.

x-intercept	y-intercept
$1.5x + 0.6y = 6$	$1.5x + 0.6y = 6$
$1.5x + 0.6(0) = 6$	$1.5(0) + 0.6y = 6$
$x = 4$	$y = 10$



b. The x-intercept shows that you can buy 4 pounds of apples if you don't buy any bananas. The y-intercept shows that you can buy 10 pounds of bananas if you don't buy any apples.

On Your Own

Now You're Ready
Exercises 16–18

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

5. $2x - y = 8$

6. $x + 3y = 6$

7. WHAT IF? In Example 3, you buy y pounds of oranges instead of bananas. Oranges cost \$1.20 per pound. Graph the equation $1.5x + 1.2y = 6$. Interpret the intercepts.

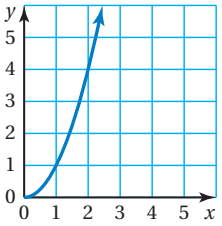
2.4 Exercises

Check It Out
Help with Homework
BigIdeasMath.com

Vocabulary and Concept Check

1. **VOCABULARY** Is the equation $y = -2x + 5$ in standard form? Explain.

2. **REASONING** Does the graph represent a linear equation? Explain.



Practice and Problem Solving

Define two variables for the verbal model. Write an equation in slope-intercept form that relates the variables. Graph the equation.

3. $\frac{\$2.00}{\text{pound}}$ • Pounds of peaches + $\frac{\$1.50}{\text{pound}}$ • Pounds of apples = \$15

4. $\frac{16 \text{ miles}}{\text{hour}}$ • Hours biked + $\frac{2 \text{ miles}}{\text{hour}}$ • Hours walked = 32 miles

Write the linear equation in slope-intercept form.

1 5. $2x + y = 17$

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

7. $-\frac{1}{2}x + y = 10$

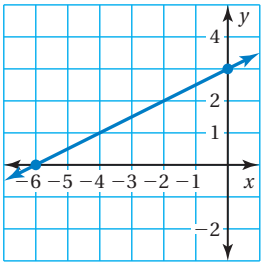
Graph the linear equation. Use a graphing calculator to check your graph.

8. $-18x + 9y = 72$

9. $16x - 4y = 2$

10. $\frac{1}{4}x + \frac{3}{4}y = 1$

Use the graph to find the x- and y-intercepts.

11.


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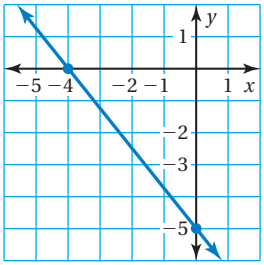

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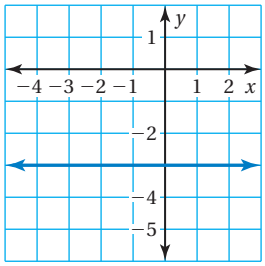


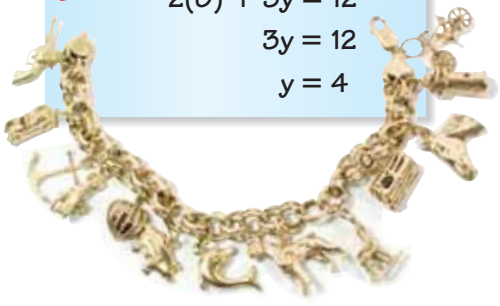
14. **ERROR ANALYSIS** Describe and correct the error in finding the x-intercept.

$$-2x + 3y = 12$$
$$-2(0) + 3y = 12$$
$$3y = 12$$
$$y = 4$$

15. **BRACELET** A charm bracelet costs \$65, plus \$25 for each charm.

   a. Write an equation in standard form that represents the total cost of the bracelet.

   b. How much does the bracelet shown cost?



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

16. $3x - 4y = -12$ **17.** $2x + y = 8$ **18.** $\frac{1}{3}x - \frac{1}{6}y = -\frac{2}{3}$

19. SHOPPING The amount of money you spend on x CDs and y DVDs is given by the equation $14x + 18y = 126$. Find the intercepts and graph the equation.

20. SCUBA Five friends go scuba diving. They rent a boat for x days and scuba gear for y days. The total spent is $1000.

a. Write an equation in standard form that represents the situation.

b. Graph the equation and interpret the intercepts.

21. MODELING You work at a restaurant as a host and a server. You earn $9.45 for each hour you work as a host and $7.65 for each hour you work as a server.

a. Write an equation in standard form that models your earnings.

b. Graph the equation.

Basic Information
Pay to the Order of:
..... John Doe
# of hours worked as
..... host: x
# of hours worked as
..... server: y
Earnings for this pay
..... period: $160.65

22. LOGIC Does the graph of every linear equation have an x-intercept? Explain your reasoning. Include an example.

23. Critical Thinking For a house call, a veterinarian charges $70, plus $40 an hour.

a. Write an equation that represents the total fee y charged by the veterinarian for a visit lasting x hours.

b. Find the x-intercept. Will this point appear on the graph of the equation? Explain your reasoning.

c. Graph the equation.

Fair Game Review What you learned in previous grades & lessons

Copy and complete the table of values. *(Skills Review Handbook)*

24.

x	-2	-1	0	1	2
$2x + 5$					

25.

x	-2	-1	0	1	2
$-5 - 3x$					

26. MULTIPLE CHOICE Which value of x makes the equation $4x - 12 = 3x - 9$ true? *(Section 1.3)*

(A) -1 (B) 0 (C) 1 (D) 3