

# 5-1

# Solving Systems by Graphing

## Check Skills You'll Need

### 1. Vocabulary Review

A **function** is a rule that assigns to each input exactly one output.

### 2. Graph each linear function.

$$y = 3x - 2$$

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

$$y = \frac{2}{3}x + 1$$



## What You'll Learn

To solve systems of two linear equations in two variables by graphing the equations

**New Vocabulary** solution of a system, system of equations

## Why Learn This?

Graphing systems of equations can help you compare different rental options.

A **system of equations** is a set of two or more equations that have the same variables. The **solution of a system** is any ordered pair that satisfies all equations in the system.



One method of solving a system of linear equations is to graph each equation and find any intersection points.

## CONTENT STANDARDS

8.EE.8.a, 8.EE.8.b, 8.EE.8.c

## EXAMPLE Solving a System by Graphing

- 1 Solve the system by graphing.  $y = 2x - 1$   
 $y = -x + 5$

Graph both equations in the same coordinate plane.

$y = 2x - 1$  ← The slope is 2. The y-intercept is -1.

$y = -x + 5$  ← The slope is -1. The y-intercept is 5.

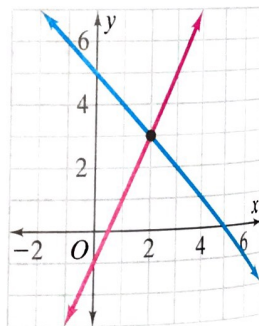
The lines appear to intersect at (2, 3). Check by replacing  $x$  with 2 and  $y$  with 3 in each equation.

$$y = 2x - 1 \quad y = -x + 5$$

$$3 \stackrel{?}{=} 2(2) - 1 \quad 3 \stackrel{?}{=} -(2) + 5$$

$$3 = 3 \checkmark \quad 3 = 3 \checkmark$$

The solution of the system is (2, 3).



## Vocabulary Tip

The lines intersect at one point. This means that the system of equations has one solution.

## Quick Check

1. Solve the system of equations by graphing.  $y = 2x - 4$   
Check the solution.  $y = -\frac{1}{2}x + 1$

You can also use tables when graphing systems of equations.

## EXAMPLE Solving a System by Graphing

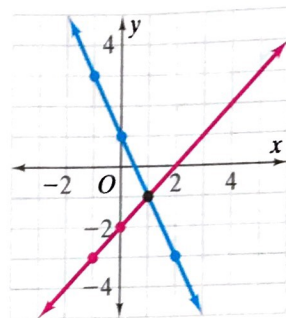
- 2 Solve the system by graphing.  $x - y = 2$

$$2x + y = 1$$

Make a table for each equation in the system.

$x - y = 2$	
$x$	$y$
-1	-3
0	-2
1	-1

$2x + y = 1$	
$x$	$y$
-1	3
0	1
1	-1



Notice that  $(1, -1)$  is an ordered pair in both tables.

Graph both equations in the same coordinate plane.

The lines intersect at  $(1, -1)$ .

So the solution of the system is  $(1, -1)$ .

### Quick Check

2. Solve the system by graphing.  $-x + y = -5$   
 $2x + y = 4$

## EXAMPLE Application: Comparison Shopping

- 3 You need to rent a video camera. Video Barn charges a \$30 rental fee plus \$35 per day. Allied Rental charges a \$45 rental fee plus \$30 per day. Which company should you choose? Justify your answer.

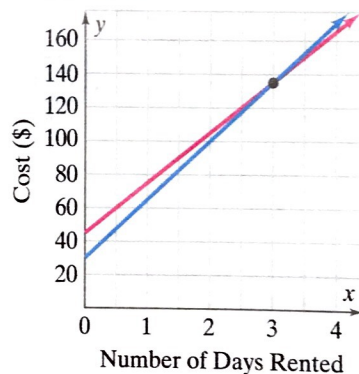
**Step 1** Write a system of equations to represent the situation. Let  $x$  = the number of days and  $y$  = the total cost.

$$y = 30 + 35x \quad \leftarrow \text{The slope is 35. The } y\text{-intercept is 30.}$$

$$y = 45 + 30x \quad \leftarrow \text{The slope is 30. The } y\text{-intercept is 45.}$$

**Step 2** Graph both equations in the same coordinate plane. The lines appear to intersect at  $(3, 135)$ .

**Step 3** Analyze the graph. For a rental of up to 3 days, Video Barn is less expensive. For a 3-day rental, both companies charge \$135. For rentals longer than 3 days, Allied Rental is less expensive.



### Quick Check

3. To rent scooters, Sam's charges a \$30 fee plus \$8 per hr. Rosie's charges a \$20 fee plus \$10 per hr. Which company should the Morris family choose?

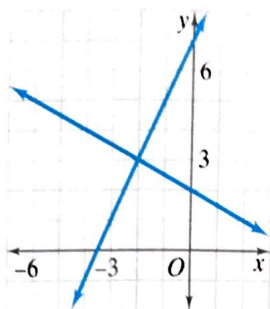
## GO for Help

For help graphing a line by making a table, go to Lesson 4-2.





## Check Your Understanding



- Vocabulary** When graphing a system of linear equations, the point where the lines intersect is the ? of the system.
- What is the solution of the linear system at the left?
- Reasoning** Can a system of two linear equations have exactly two solutions? Explain.
- Determine if  $(1, 4)$  is a solution of the system.
 
$$y = 2x + 2$$

$$y = 4x - 6$$

## Homework Exercises

For more exercises, see **Extra Skills and Word Problems**.

### GO for Help

For Exercises	See Examples
5–10	1
11–13	2
14, 15	3

Solve each system of equations by graphing. Check your solution.

5.  $y = x + 2$

6.  $y = -x + 8$

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

$y = 3x$

$y = \frac{1}{3}x$

$y = 2x - 6$

8.  $y = 3x - 4$

9.  $y = x + 4$

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

$y = -3x + 2$

$y = -2x - 2$

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

11.  $x - y = 1$

12.  $y = 3x - 4$

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

$5x - 4y = 0$

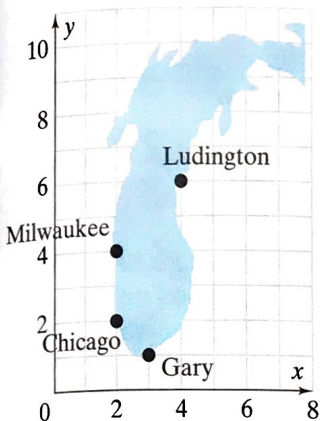
$x + 2y = 6$

$x + y = -2$

- The community theater is selling tickets for their fall play. On the first day of ticket sales, the theater sold 9 adult tickets and 3 student tickets for a total of \$75. The theater collected \$67 on the second day by selling 5 adult tickets and 8 student tickets. What are the prices of one adult ticket and one student ticket?
- The sum of two numbers is 13. Their difference is 3. Write a system of equations to model this situation. Use graphing to solve the system.

### GPS

- Guided Problem Solving** A system is made up of two lines,  $a$  and  $b$ . Line  $a$  passes through points  $(2, 3)$  and  $(6, 5)$ . Line  $b$  passes through points  $(2, 5)$  and  $(4, 2)$ . What is the solution of the system?
  - How can you use a graph to estimate the solution of the system?
  - How will an equation of each line help you check your answer?
- A system is made up of two lines,  $c$  and  $d$ . Line  $c$  passes through points  $(1, 1)$  and  $(4, 3)$ . Line  $d$  passes through points  $(2, 3)$  and  $(3, 1)$ . What is the solution of the system?



18. **Writing in Math** Explain how graphing a system of equations can help you estimate the solution of the system.
19. **Geography** Use the graph at the left. Boat A travels in a straight line from Milwaukee to Gary. Boat B travels in a straight line from Ludington to Chicago. Do the paths of the boats intersect? If so, at what point? Justify your answer.
20. **Open Ended** One equation in a linear system is  $y = x - 4$ .
- Graph  $y = x - 4$  and a second linear equation so that the solution of the system is  $(4, 0)$ .
  - Write an equation of the second linear equation in the system.
21. **Challenge** Solve the linear system.
- $$y = x + 2$$
- $$y = 4x + 11$$
- $$y = -2x - 7$$

**Test Prep and Mixed Review**

**Practice**

**Multiple Choice**

22. Which ordered pair is the solution of the system?

$$y = x + 4$$

$$y = 4x + 1$$

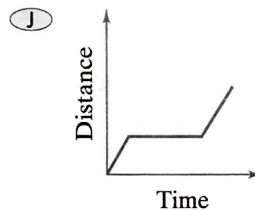
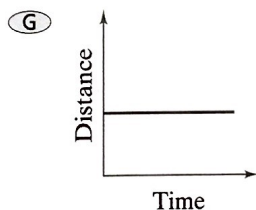
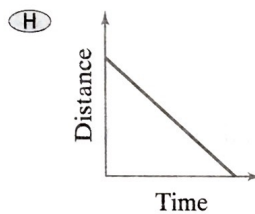
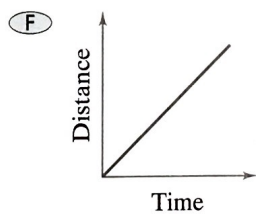
(A)  $(0, 1)$

(C)  $(1, 4)$

(B)  $(1, 5)$

(D)  $(0, 4)$

23. Mia took her dog for a walk, stopping to talk to a friend along the way. Which graph could represent Mia's distance from home over time?



24. **Algebra** Martin has \$165 in his bank account. He wants to buy some video games. Each game costs \$45. Write a function rule that represents Martin's account balance as a function of the number of games he buys.

<b>GO for Help</b>	
<b>For Exercise</b>	<b>See Lesson</b>
24	4-3