

## Lesson 7-2

### Example 1 Solve Using Substitution

Use substitution to solve the system of equations.

$$2x - y = -3$$

$$x = 2y$$

Since  $x = 2y$ , substitute  $2y$  for  $x$  in the first equation.

$$2x - y = -3 \quad \text{First equation}$$

$$2(2y) - y = -3 \quad x = 2y$$

$$4y - y = -3 \quad \text{Simplify.}$$

$$3y = -3 \quad \text{Combine like terms.}$$

$$\frac{3y}{3} = \frac{-3}{3} \quad \text{Divide each side by 3.}$$

$$y = -1 \quad \text{Simplify.}$$

Use  $x = 2y$  to find the value of  $x$ .

$$x = 2y \quad \text{Second equation}$$

$$x = 2(-1) \quad y = -1$$

$$x = -2 \quad \text{Simplify.}$$

**Check** In each equation, replace  $x$  with  $-2$  and  $y$  with  $-1$ .

$$2x - y = -3 \quad x = 2y$$

$$2(-2) - (-1) = -3 \quad -2 = 2(-1)$$

$$-4 + 1 = -3 \quad -2 = -2 \quad \checkmark$$

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

The solution is  $(-2, -1)$ .

### Example 2 Solve for One Variable, Then Substitute

Use substitution to solve the system of equations.

$$y - x = -4$$

$$6x + y = 3$$

Solve the first equation for  $y$  since the coefficient of  $y$  is 1.

$$y - x = -4 \quad \text{First equation}$$

$$y - x + x = -4 + x \quad \text{Add } x \text{ to each side.}$$

$$y = -4 + x \quad \text{Simplify.}$$

Find the value of  $x$  by substituting  $-4 + x$  for  $y$  in the second equation.

$$6x + y = 3 \quad \text{Second equation}$$

$$6x + (-4 + x) = 3 \quad y = -4 + x$$

$$7x - 4 = 3 \quad \text{Combine like terms.}$$

$$7x - 4 + 4 = 3 + 4 \quad \text{Add 4 to each side.}$$

$$7x = 7 \quad \text{Simplify.}$$

$$\frac{7x}{7} = \frac{7}{7} \quad \text{Divide each side by 7.}$$

$$x = 1 \quad \text{Simplify.}$$

Substitute 1 for  $x$  in either equation to find the value of  $y$ .

Choose the equation that is easier to solve.

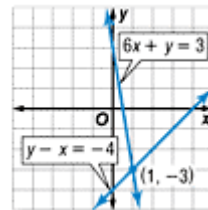
$$y - x = -4 \quad \text{First equation}$$

$$y - 1 = -4 \quad x = 1$$

$$y - 1 + 1 = -4 + 1 \quad \text{Add 1 to each side.}$$

$$y = -3 \quad \text{Simplify.}$$

The solution is  $(1, -3)$ . The graph at the right verifies the solution.



### Example 3 Dependent System

Use substitution to solve the system of equations.

$$y = -x + 3$$

$$2x + 2y = 6$$

Since  $y = -x + 3$ , substitute  $-x + 3$  for  $y$  in the second equation.

$$2x + 2y = 6 \quad \text{Second equation}$$

$$2x + 2(-x + 3) = 6 \quad y = -x + 3$$

$$2x + -2x + 6 = 6 \quad \text{Distributive Property}$$

$$6 = 6 \quad \text{Simplify.}$$

The statement  $6 = 6$  is true. This means that there are infinitely many solutions of the system of equations. This is true because the slope-intercept form of both equations is  $y = -x + 3$ . That is, the equations are equivalent, and they have the same graph.

### Example 4 Write and Solve a System of Equations

One type of punch served in the cafeteria contains 10% fruit juice. Another punch contains 20% fruit juice. How much of each punch should be used to make 10 gallons of a punch that is 16% fruit juice?

Let  $a$  = the number of gallons of the 10% fruit juice and  $b$  = the number of gallons of the 20% fruit juice. Use a table to organize the information.

	10% Fruit Juice	20% Fruit Juice	16% Fruit Juice
Total Gallons	$a$	$b$	10
Gallons of Fruit Juice	$0.10a$	$0.20b$	$0.16(10)$

The system of equations is  $a + b = 10$  and  $0.10a + 0.20b = 0.16(10)$ . Use substitution to solve this system.

$$a + b = 10$$

First equation

$$a + b - b = 10 - b$$

Subtract  $b$  from each side.

$$a = 10 - b$$

Simplify.

$$0.10a + 0.20b = 0.16(10)$$

Second equation

$$0.10(10 - b) + 0.20b = 0.16(10)$$

$a = 10 - b$

$$1 - 0.10b + 0.20b = 1.6$$

Distributive Property

$$1 + 0.10b = 1.6$$

Combine like terms.

$$1 + 0.10b - 1 = 1.6 - 1$$

Subtract 1 from each side.

$$0.10b = 0.6$$

Simplify.

$$\frac{0.10b}{0.10} = \frac{0.6}{0.10}$$

Divide each side by 0.10.

$$b = 6$$

Simplify.

$$a + b = 10$$

First equation

$$a + 6 = 10$$

$b = 6$

$$a + 6 - 6 = 10 - 6$$

Subtract 6 from each side.

$$a = 4$$

Simplify.

6 gallons of the 20% fruit juice punch and 4 gallons of the 10% fruit juice punch should be used.