

### Skill Check:

Tell whether the solution is an order pair to the system

$(-4, -2)$

$$y = 2x + 6$$

$$y = -3x - 14$$

### 5-2 Solving systems by substitution

What does  
substitute mean?

## Example 1

$$y = -2x - 9$$

$$6x - 5y = -19$$

### SOLUTION

Step 1 Equation 1 is already solved for  $y$ .

Step 2 Substitute  $-2x - 9$  for  $y$  in Equation 2 and solve for  $x$ .

$$6x - 5y = -19 \quad \text{Equation 2}$$

$$6x - 5(-2x - 9) = -19 \quad \text{Substitute } -2x - 9 \text{ for } y.$$

$$6x + 10x + 45 = -19 \quad \text{Distributive Property}$$

$$16x + 45 = -19 \quad \text{Combine like terms.}$$

$$16x = -64 \quad \text{Subtract 45 from each side.}$$

$$x = -4 \quad \text{Divide each side by 16.}$$

Step 3 Substitute  $-4$  for  $x$  in Equation 1 and solve for  $y$ .

$$y = -2x - 9 \quad \text{Equation 1}$$

$$= -2(-4) - 9 \quad \text{Substitute } -4 \text{ for } x.$$

$$= 8 - 9 \quad \text{Multiply.}$$

$$= -1 \quad \text{Subtract.}$$

► The solution is  $(-4, -1)$ .

Solve the system of linear equations by substitution. Check your solution.

1.  $y = 3x + 14$

$y = -4x$

2.  $3x + 2y = 0$

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

3.  $x = 6y - 7$

$4x + y = -3$

### **ANSWERS**

1.  $(-2, 8)$

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

3.  $(-1, 1)$

## Example 2

$$-x + y = 3$$

$$3x + y = -1$$

Solve the system of linear equations by substitution. Check your solution.

4.  $x + y = -2$

$$-3x + y = 6$$

6.  $2x - y = -5$

$$3x - y = 1$$

5.  $-x + y = -4$

$$4x - y = 10$$

7.  $x - 2y = 7$

$$3x - 2y = 3$$

## ANSWERS

4.  $(-2, 0)$

5.  $(2, -2)$

6.  $(6, 17)$

7.  $(-2, -\frac{9}{2})$

## Solving Real-Life Problems

### EXAMPLE 3 Modeling with Mathematics

A drama club earns \$1040 from a production. A total of 64 adult tickets and 132 student tickets are sold. An adult ticket costs twice as much as a student ticket.

Write a system of linear equations that represents this situation. What is the price of each type of ticket?

$x = \text{adult}$   
 $y = \text{child}$

$$x = 2y$$
$$64x + 132y = 1040$$

1.  $x = 5 - y$   
 $2x + 5y = 4$  (7, -2)

2.  $x - y = -2$   
 $3x - y = 2$  (2, 4)

3. There are a total of 124 students in the band. There are 12 more boys than girls in the band. Write a system of linear equations that represents this situation. How many boys and how many girls are in the band?

$$x + y = 124$$

$$x = y + 12$$

The solution is (68, 56). So, there are 68 boys and 56 girls in the band.

17. **ERROR ANALYSIS** Describe and correct the error in solving for one of the variables in the linear system  $8x + 2y = -12$  and  $5x - y = 4$ .



Step 1  $5x - y = 4$   
 $-y = -5x + 4$   
 $y = 5x - 4$

Step 2  $5x - (5x - 4) = 4$   
 $5x - 5x + 4 = 4$   
 $4 = 4$