

# 2.31

## Solving a System of Linear Equations

### • Example 1

Solve the system.

$$3x - 5y = 19 \quad (1)$$

$$5x + 2y = 11 \quad (2)$$

Multiplying the first equation by 2 and the second by 5, we get

$$6x - 10y = 38$$

$$25x + 10y = 55$$

Adding these two equations eliminates  $y$  and yields

$$31x = 93$$

That is,  $x = 3$ .

To find the value of  $y$ , we set  $x = 3$  in equation (1). This gives

$$3 \cdot 3 - 5y = 19$$

$$9 - 5y = 19$$

$$-5y = 10$$

$$y = -2$$

The solution for the system is  $x = 3$  and  $y = -2$ .

### ● ● ● CHECK YOURSELF 1

Solve the system.

$$2x + 3y = -18$$

$$3x - 5y = 11$$

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### • Example 2

Suppose that the two equations below have a common solution; that is, there is a value of  $x$  and a value of  $y$  satisfying both equations.

$$(a) \quad 4x + 5y = 20 \quad (1)$$

$$8x + 10y = 19 \quad (2)$$

Multiplying equation (1) by  $-2$  and adding equation (2), we get

$$-8x - 10y = -40 \quad \text{We add the two left sides to get 0 and the two right sides to get } -21.$$

$$\underline{8x + 10y = 19}$$

$$0 = -21$$

The result  $0 = -21$  is a *false* statement. This implies that our initial hypothesis that equations (1) and (2) have a common solution is false.

(b) The system

$$5x - 7y = 9 \quad (1)$$

$$15x - 21y = 27 \quad (2)$$

has an infinite number of solutions. Indeed the two equations are equivalent. To see this we multiply equation (1) by 3, to get

$$3 \times (5x - 7y) = 3 \times 9$$

$$15x - 21y = 27$$

Thus, we have only a single equation. All the points  $(x, y)$  on the line representing the equation  $5x - 7y = 9$  are solutions

### ● ● ● CHECK YOURSELF 2

Solve each system, if possible.

a.  $3x + 2y = 8$   
 $9x + 6y = 11$

b.  $x - 2y = 8$   
 $3x - 6y = 24$

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### ● ● ● CHECK YOURSELF ANSWERS

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

2. (a) No solution; (b) an infinite number of solutions.

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# 2.31 Exercises

Name \_\_\_\_\_

Section \_\_\_\_\_

Date \_\_\_\_\_

## A N S W E R S

1.  $2x - y = 1$   
 $-2x + 3y = 5$

2.  $x + 3y = 12$   
 $2x - 3y = 6$

3.  $x + 2y = -2$   
 $3x + 2y = -12$

4.  $2x + 3y = 1$   
 $5x + 3y = 16$

5.  $x + y = 3$   
 $3x - 2y = 4$

6.  $x - y = -2$   
 $2x + 3y = 21$

7.  $3x - 4y = 2$   
 $4x - y = 20$

8.  $5x - 2y = 31$   
 $4x + 3y = 11$

9.  $2x + 4y = -8$   
 $-6x - 12y = -24$

10.  $3x - 8y = 6$   
 $-9x + 24y = -18$

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

6. \_\_\_\_\_

7. \_\_\_\_\_

8. \_\_\_\_\_

9. \_\_\_\_\_

10. \_\_\_\_\_