SOLVING MATRIX EQUATIONS You can use what you know about matrix operations and matrix equality to solve an equation involving matrices.

EXAMPLE 4 Solve a matrix equation

Solve the matrix equation for x and y.

$$3\left(\begin{bmatrix} 5x & -2 \\ 6 & -4 \end{bmatrix} + \begin{bmatrix} 3 & 7 \\ -5 & -y \end{bmatrix}\right) = \begin{bmatrix} -21 & 15 \\ 3 & -24 \end{bmatrix}$$

Solution

Simplify the left side of the equation.

$$3\left(\begin{bmatrix} 5x & -2 \\ 6 & -4 \end{bmatrix} + \begin{bmatrix} 3 & 7 \\ -5 & -y \end{bmatrix}\right) = \begin{bmatrix} -21 & 15 \\ 3 & -24 \end{bmatrix}$$ Write original equation.

$$3\begin{bmatrix} 5x + 3 & 5 \\ 1 & -4 - y \end{bmatrix} = \begin{bmatrix} -21 & 15 \\ 3 & -24 \end{bmatrix}$$ Add matrices inside parentheses.

$$\begin{bmatrix} 15x + 9 & 15 \\ 3 & -12 - 3y \end{bmatrix} = \begin{bmatrix} -21 & 15 \\ 3 & -24 \end{bmatrix}$$ Perform scalar multiplication.

Equate corresponding elements and solve the two resulting equations.

$$15x + 9 = -21 \qquad -12 - 3y = -24$$
$$x = -2 \qquad y = 4$$

▶ The solution is $x = -2$ and $y = 4$.

GUIDED PRACTICE for Examples 3 and 4

5. In Example 3, find $B - A$ and explain what information this matrix gives.

6. Solve $-2\left(\begin{bmatrix} -3x & -1 \\ 4 & y \end{bmatrix} + \begin{bmatrix} 9 & -4 \\ -5 & 3 \end{bmatrix}\right) = \begin{bmatrix} 12 & 10 \\ 2 & -18 \end{bmatrix}$ for x and y.

3.5 EXERCISES

HOMEWORK KEY

○ = **WORKED-OUT SOLUTIONS** on p. WS1 for Exs. 5, 21, and 33

= **TAKS PRACTICE AND REASONING** Exs. 28, 29, 33, 34, 36, and 37

SKILL PRACTICE

1. VOCABULARY Copy and complete: The __?__ of a matrix with 3 rows and 4 columns are 3×4.

2. WRITING *Describe* how to determine whether two matrices are equal.

EXAMPLE 1 on p. 187 for Exs. 3–9

3. ERROR ANALYSIS *Describe* and correct the error in adding the matrices.

$$\begin{bmatrix} 9 \\ -5 \end{bmatrix} + \begin{bmatrix} 4.1 \\ 3.8 \end{bmatrix} = \begin{bmatrix} 9 & 4.1 \\ -5 & 3.8 \end{bmatrix}$$ ✗