

7.4

Solve Linear Systems by Multiplying First

Goal • Solve linear systems by multiplying first.

Your Notes

Example 1 Multiply one equation, then add

$$\begin{array}{r} \text{Solve the linear system: } 3x - 3y = 21 \quad \text{Equation 1} \\ 8x + 6y = -14 \quad \text{Equation 2} \end{array}$$

Solution

1. Multiply Equation 1 by 2 so that the coefficients of y are opposites.

$$\begin{array}{r} 3x - 3y = 21 \quad \times 2 \rightarrow \underline{6x - 6y = 42} \\ 8x + 6y = -14 \quad \underline{8x + 6y = -14} \end{array}$$

2. Add the equations.

$$\underline{14x} = \underline{28}$$

3. Solve for x .

$$x = \underline{2}$$

4. Substitute 2 for x in either of the original equations and solve for y .

$$3x - 3y = 21 \quad \text{Write Equation 1.}$$

$$3(\underline{2}) - 3y = 21 \quad \text{Substitute } \underline{2} \text{ for } x.$$

$$y = \underline{-5} \quad \text{Solve for } y.$$

The solution is (2, -5).

CHECK Substitute 2 for x and -5 for y in the original equations.

$$\begin{array}{r} \text{Equation 1} \qquad \qquad \qquad \text{Equation 2} \\ 3x - 3y = 21 \qquad \qquad \qquad 8x + 6y = -14 \\ 3(\underline{2}) - 3(\underline{-5}) \stackrel{?}{=} 21 \quad 8(\underline{2}) + 6(\underline{-5}) \stackrel{?}{=} -14 \\ \underline{21} = 21 \checkmark \qquad \qquad \qquad \underline{-14} = -14 \checkmark \end{array}$$

Example 2 Multiply both equations, then subtract

Solve the linear system: $3y = -2x + 17$ Equation 1

$3x + 5y = 27$ Equation 2

Solution

1. **Arrange** the equations so that like terms are in columns.

$2x + 3y = 17$ Rewrite Equation 1.

$3x + 5y = 27$ Write Equation 2.

2. **Multiply** Equation 1 by 3 and Equation 2 by 2 so that the coefficient of x in each equation is the least common multiple of 2 and 3, or 6.

$2x + 3y = 17$ $\times 2$ \rightarrow $6x + 9y = 51$

$3x + 5y = 27$ $\times 3$ \rightarrow $6x + 10y = 54$

3. **Subtract** the equations. $-1y = -3$

4. **Solve** for y . $y = 3$

5. **Substitute** 3 for y in either of the original equations and solve for x .

$3x + 5y = 27$ Write Equation 2.

$3x + 5(3) = 27$ Substitute 3 for y .

$x = 4$ Solve for x .

The solution is (4, 3).

✓ **Checkpoint** Solve the linear system using elimination.

1. $7x + 2y = 26$

$10x - 5y = -10$

 $(2, 6)$

2. $5y = 9x - 8$

$-20x + 10y = -10$

 $(-3, -7)$ **Homework**