

# Algebra 1

## Lesson 7.3

### Solve Linear Systems by Elimination (Addition and Subtraction)

#### Warm-Up

Solve the following system of equations using the Substitution Method.

$$x - y = 2 \rightarrow x = y + 2$$

$$3x + 2y = 11$$

$$3(y + 2) + 2y = 11$$

$$3y + 6 + 2y = 11$$

$$5y = 5$$
$$y = 1$$

$$x = (1) + 2$$

$$x = 3$$

$$(3, 1)$$

IF COEFFICIENTS ARE OPPOSITES  $\rightarrow$  ADD 2 EQUATIONS

IF COEFFICIENTS ARE THE SAME [OR]  $\rightarrow$  SUBTRACT  
MULTIPLY ONE EQUATION BY -1 AND ADD 2 EQUATIONS

#### Example 1. Using Addition to Eliminate a Variable

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

$$4x - 5y = 22$$

(a) When the coefficients of one variable are opposites we can **eliminate** that variable by adding the equations.

(b) Solve the resulting equation for  $x$ .

(c) Substitute the solution from (b) into either one of the original equations to find the  $y$ -value.

(d) Write the solution to the system as an ordered pair.

$$\begin{array}{r} 2x + 5y = -4 \\ + 4x - 5y = 22 \\ \hline 6x = 18 \end{array}$$

$$x = 3$$

$$2(3) + 5y = -4$$
$$-6 \quad -6$$

$$5y = -10$$

$$y = -2$$

$$(3, -2)$$

#### Example 2. Multiplying an Equation by Negative 1

$$5x + 6y = 4$$

$$7x + 6y = 8$$

(a) When the coefficients of one variable are the same we can **eliminate** that variable by multiplying one equation by -1 and adding the equations.

(b) Solve the resulting equation for  $x$ .

(c) Substitute the solution to (b) into one of the original equations to find the  $y$ -value.

(d) Write the solution to the system as an ordered pair.

$$\begin{array}{r} (-1)(5x + 6y = 4) \rightarrow -5x - 6y = -4 \\ 7x + 6y = 8 \\ \hline 2x = 4 \end{array}$$

$$x = 2$$

$$7(2) + 6y = 8$$
$$-14 \quad -14$$

$$6y = -6$$

$$y = -1$$

$$(2, -1)$$

**Example 3. Arranging Like Terms**

$$-3x + 9y = 18$$

$$3x = -7y + 30$$

(a) Rewrite the second equation in Standard Form (line up the x-values and the y-values).

(b) When the coefficients of one variable are opposites we can **eliminate** that variable by adding the equations.

(c) Solve the resulting equation for y.

(d) Substitute the solution to (b) into one of the original equations to find the x-value.

(e) Write the solution to the system as an ordered pair.

$$\begin{array}{r} -3x + 9y = 18 \rightarrow -3x + 9y = 18 \\ 3x = -7y + 30 \rightarrow + 3x + 7y = 30 \\ \hline +7y \quad +7y \\ \hline 16y = 48 \\ y = 3 \end{array}$$

$(3, 3)$

$$\begin{array}{r} 3x + 7(3) = 30 \\ 3x + 21 = 30 \\ 3x = 9 \\ x = 3 \end{array}$$

**Try It!**

Solve each system using Elimination.

(a)  $3x + 2y = 41$

$+ 5x - 2y = 15$

$$8x = 56$$

$$x = 7$$

$$(7, 10)$$

$$3(7) + 2y = 41$$

$$2y = 20$$

$$y = 10$$

(a)  $(x - y = 5) \rightarrow -x + y = -5$

(b)  $2x - y = 13 \rightarrow + 2x - y = 13$

$$x = 8$$

$$2(8) - y = 13$$

$$-y = -3$$

$$y = 3$$

$$(8, 3)$$

**Assignment**

New: Pg. 447 #2, 4, 6, 10, 12, 16, 20, 26, 42

**Review:**

Use **Substitution** to solve the linear system.

1.  $x = 5y$

$$2x + 3y = -13$$

2.  $y = -2x$

$$x + y = 7$$