

## 7.3 Solve Linear Systems By Elimination

Let's examine the system:

$$\begin{array}{r} 2x + 4y = 2 \\ 4x - 4y = 16 \\ \hline 6x = 18 \end{array}$$

$$\begin{array}{r} 6x = 18 \\ \boxed{x = 3} \end{array}$$

$$2(3) + 4y = 2$$

$$6 + 4y = 2$$

$$4y = -4$$

$$y = -1$$

$$\boxed{(3, -1)}$$

➤ Add the 2 equations together to create 1 equation;

➤ What results? *y's canceled*

➤ Why do you think that happened? *Coefficients were 4 and -4*

➤ Solve for the variable that remains;

➤ Can you solve for the other variable now?

*Yes, plug in  $x=3$  and solve for  $y$*

➤ Check your answers in the original equations!

$$2(3) + 4(-1) = 2$$

$$6 - 4 = 2$$

$$2 = 2 \checkmark$$

$$4(3) - 4(-1) = 16$$

$$12 + 4 = 16$$

$$16 = 16 \checkmark$$

**This process is called ELIMINATION, because in the first step you eliminated one of the variables when you added the equations together. Notice the coefficients on the eliminated variable were OPPOSITE SIGNS.**

### Steps to solve linear systems by ELIMINATION:

Step 1	Re-arrange each equation in the form $Ax + By = C$ , so that $x$ 's, $y$ 's and constants are lined up.
Step 2	Add the equations together. Notice that one variable is eliminated.
Step 3	Solve for the variable that remains.
Step 4	Plug this value back into one of the equations and solve for the other variable.
Step 5	Write solution as ordered pair and check!

EXAMPLES:

$$\begin{array}{r}
 1. \quad x + 5y = 9 \\
 \quad 4x - 5y = -14 \\
 \hline
 \quad 5x = -5 \\
 \quad x = -1
 \end{array}$$

$$\begin{array}{r}
 -1 + 5y = 9 \\
 5y = 10 \\
 y = 2
 \end{array}$$

$$\boxed{(-1, 2)}$$

$$\begin{array}{r}
 2. \quad -8x = -3y + 12 \\
 \quad 8x - 9y = 12 \\
 \hline
 \quad -8x + 3y = 12 \\
 \quad -6y = 24
 \end{array}$$

$$\boxed{y = -4}$$

$$8x - 9(-4) = 12$$

$$8x + 36 = 12$$

$$8x = -24$$

$$\boxed{x = -3}$$

$$\boxed{(-3, -4)}$$

$$\begin{array}{r}
 3. \quad -4y = 2 - 3x \\
 \quad 3x + 2y = 26
 \end{array}$$

$$-4y = 2 - 3x$$

$$+3x \quad +3x$$

$$-1(3x - 4y) = 2(-1)$$

$$3x + 2y = 26$$

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

$$\hline 6y = 24$$

$$y = 4$$

$$3x + 2(4) = 26$$

$$3x + 8 = 26$$

$$3x = 18$$

$$x = 6$$

$$\boxed{(6, 4)}$$

$$\begin{array}{r}
 4. \quad x = -6y + 13 \\
 \quad 6y = 2x - 8
 \end{array}$$

$$x = -6y + 13$$

$$6y = 2x - 8$$

$$-1(x + 6y) = 13(-1)$$

$$-2x + 6y = -8$$

$$-2x + 6y = -8$$

$$-1x - 6y = -13$$

$$\hline -3x = -21$$

$$x = 7$$

$$6y = 2(7) - 8$$

$$6y = 14 - 8$$

$$6y = 6$$

$$y = 1$$

$$\boxed{(7, 1)}$$

**EXTRA PRACTICE (a.k.a. Homework)** – Write and solve these problems on your own sheet of notebook paper – Use **ELIMINATION** to solve each linear system AND check your solutions!

$$\begin{array}{r}
 1.) \quad x + 4y = 9 \\
 \quad -x - 2y = 3
 \end{array}$$

$$\begin{array}{r}
 2.) \quad 5x = 3y - 14 \\
 \quad x - 2 = -3y
 \end{array}$$

$$\begin{array}{r}
 3.) \quad 4x + 3y = 18 \\
 \quad 4x - 2y = 8
 \end{array}$$

$$\begin{array}{r}
 4.) \quad 2y = 22 + 5x \\
 \quad 3x + 1 = -2y
 \end{array}$$