7-3 Solving Systems by Elimination

If we have a system of equations and both equations are in $y = mx + b$ like:

$$y = \frac{2}{3}x + 4$$
$$y = -4x - 3$$

We should solve the system by using the **Graphing** method!!

If we have a system of equations and one equation is solved for a variable like:

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

We should solve the system by using the **Substitution** method!!

However if we have a system of equations that looks like:

$$3x - 5y = 8$$
$$2x + 5y = -3$$

We should solve the system by using the **Elimination** method!!

With the Elimination Method we **ELIMINATE** one of the variables in order to have an equation with only one variable.

To see the process of Elimination in action, let's look at an equation with one variable and circle each time it happens.

$$3(x - 4) = 2x - 7$$

$$
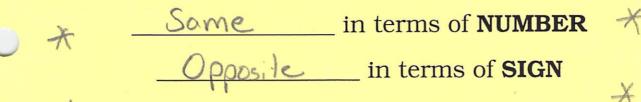\begin{array}{c|c}
3x - 12 & 2x - 7 \\
-2x & -2x \\
\hline
x - 12 & -7 \\
+12 & +12 \\
\hline
x & 5
\end{array}
$$

Notice both times we eliminate (cross out) a term the coefficients/numbers are:

✳ _____ **Same** _____ in terms of **NUMBER** ✳

_____ **Opposite** _____ in terms of **SIGN**

✳   ✳

Are these terms ready to be eliminated??
If they are not we are allowed to **multiply a term(s) by something so they are!!**

$$+4x$$
$$\underline{-4x}$$
$$0$$

$$-7y$$
$$\underline{+7y}$$
$$0$$

$$+6x \qquad 6x$$
$$\underline{2(-3x)} \quad \underline{-6x}$$
$$0$$

$$-2x \quad -2x$$
$$\underline{2(+1x)} \quad \underline{+2x}$$
$$0$$

$$+6x \qquad +6x$$
$$\underline{-1(+6x)} \quad \underline{-6x}$$
$$0$$

$$-4(+2x) \quad -8x$$
$$\underline{+8x} \qquad \underline{+8x}$$
$$0$$

$$-2(-5x) \quad 10x$$
$$\underline{-10x} \qquad \underline{-10x}$$
$$0$$

Challenge
$$-2(3x) \quad -6x$$
$$\underline{3(2x)} \quad \underline{6x}$$
$$0$$

Ok so here we go....

1. Eliminate	2. Solve for other variable	3. Check
$6x - 5y = -9$ $\underline{2x + 5y = 17}$ $\dfrac{8x}{8} = \dfrac{8}{8}$ $x = 1$	$6x - 5y = -9$ $6(1) - 5y = -9$ $\begin{array}{rr}6 - 5y &= -9\\ -6 & -6\end{array}$ $\dfrac{-5y}{-5} = \dfrac{-15}{-5}$ $y = 3$	$(1, 3)$ $2x + 5y = 17$ $2(1) + 5(3) = 17$ $17 = 17 \checkmark$
2. $\begin{array}{l}6x - 3y = 3 \longrightarrow 6x - 3y = 3\\ -1(6x - 5y = -3) \longrightarrow -6x + 5y = 3\end{array}$ $\dfrac{2y}{2} = \dfrac{6}{2}$ $\boxed{y = 3}$	$6x - 3y = 3$ $6x - 3(3) = 3$ $\begin{array}{rr}6x - 9 &= 3\\ +9 & +9\end{array}$ $\dfrac{6x}{6} = \dfrac{12}{6}$ $\boxed{x = 2}$	$(2, 3)$ $6x - 5y = -3$ $6(2) - 5(3) = -3$ $-3 = -3 \checkmark$

3.

$7(5x + y = 9) \rightarrow 35x + 7y = 63$

$10x - 7y = -18 \rightarrow 10x - 7y = -18$

$$\frac{45x}{45} = \frac{45}{45}$$

$$\boxed{x = 1}$$

$5(1) + y = 9$

$5 + y = 9$
$-5 \qquad -5$

$$\boxed{y = 4}$$

$\boxed{(1, 4)}$

$10(1) - 7(4) = -18$

$10 - 28 = -18$

$-18 = -18 \checkmark$

4. Test Worthy Question

$5(2x + 3y = 3) \rightarrow 10x + 15y = 15$

$-2(5x - 2y = 17) \rightarrow -10x + 4y = -34$

$$\frac{19y}{19} = \frac{-19}{19}$$

$$\boxed{y = -1}$$

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

$2x - 3 = 3$

$$\frac{2x}{2} = \frac{6}{2}$$

$$\boxed{x = 3}$$

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

$5(3) - 2(-1) = 17$

$15 + 2 = 17$

$17 = 17 \checkmark$

Name_____

1. Eliminate one variable	2. Solve for other variable	3. Check
$5x + 3y = 10$ $2x - 3y = 4$		
1. Eliminate one variable	2. Solve for other variable	3. Check
$5x - 3y = 9$ $x + 5y = 13$		
1. Eliminate one variable	2. Solve for other variable	3. Check
$4x + 2y = 14$ $7x - 3y = -8$		