Algebra 1 – Unit 7 **Date:** ______________

Solving Linear Systems by Elimination – Day 2

You will learn how to solve by elimination when both variables have different coefficients.

When both variables have different coefficients:

Step 1:	Put the equations in Standard Form (Ax + By = C), if needed.
Step 2:	**<u>Multiply one of both equations by a constant in order to make one of the variables have opposite coefficients</u>**
Step 3:	Add the like terms between the two equations. One variable will cancel out. Solve for the remaining variable.
Step 4:	Substitute this answer into either original equation to find the value of the other variable.
Step 5:	Write the solution for each variable as an ordered pair.

<u>Example 1:</u>

$$6x + 5y = 19$$
$$-3(2x + 3y = 5)$$

$$\cancel{6x} + 5y = 19$$
$$\cancel{-6x} - 9y = -15$$

$$-4y = 4$$
$$\frac{-4y}{-4} = \frac{4}{-4}$$
$$y = -1$$

Step 1: Put into standard form – already done!

Step 2: Multiply the second equation by <u>-3</u>, so the coefficients of <u>x</u> are <u>6 and -6</u>.

Step 3: Add the equations, and solve for <u>y</u>.

Step 4: <u>Solve</u> for <u>x</u>.

Step 5: Write the answer as an <u>ordered pair</u>.

$$6x + 5(-1) = 19$$
$$6x - 5 = 19$$
$$+5 \quad +5$$
$$\frac{6x}{6} = \frac{24}{6}$$
$$x = 4$$

Solution: <u>(4, -1)</u>

Example 2: $-2(x+y=2)$
$2x+7y=9$

$$\cancel{-2x}-2y=-4$$
$$+\quad \cancel{2x}+7y=9$$
$$\frac{5y}{5}=\frac{5}{5}$$
$$y=1$$

$$x+(1)=2$$
$$-1 \quad -1$$
$$x=1$$

$(1,1)$

Example 3: $3x+4y=-20$
$-3(x-5y=6)$

$$\cancel{3x}+4y=-20$$
$$+\quad \cancel{-3x}+15y=-18$$
$$\frac{19y}{19}=\frac{-38}{19}$$
$$y=-2$$

$$x-5(-2)=6$$
$$x+10=6$$
$$-10 \quad -10$$
$$x=-4$$

$(-4,-2)$

Sometimes you may need to multiply BOTH equations by constants to create opposite coefficients of one variable. When this happens, you will need to find the LEAST COMMON MULTIPLE (LCM) of the coefficients of one of the variables.

Example 1:

$$3(4x+5y=35)$$
$$4(-3x+2y=-9)$$

Step 1: Put into standard form – already done!

Step 2: Let's focus on eliminating the x variable in both equations. The LCM between 4 and -3 is 12.

- Multiply the first equation by 3, so that coefficient of x becomes 12.
- Multiply the second equation by 4, so that coefficient of x becomes -12.
- Now we have opposite coefficients of x!

Step 3: Add the equations, and solve for y.

Step 4: Solve for X.

Step 5: Write the answer as an ordered pair.

$$\cancel{12x}+15y=105$$
$$+\ \cancel{-12x}+8y=-36$$
$$\frac{23y}{23}=\frac{69}{23}$$
$$y=3$$

$$4x+5(3)=35$$
$$4x+15=35$$
$$-15\quad -15$$
$$\frac{4x}{4}=\frac{20}{4} \qquad x=5$$

Solution :(5, 3)

Example 2:

$$5(4x-3y=8)$$
$$-4(5x-2y=-11)$$

$$\cancel{20x}-15y=40$$
$$+\ \cancel{-20x}+8y=44$$
$$\frac{-7y}{-7}=\frac{84}{-7}$$
$$y=-12$$

$$4x-3(-12)=8$$
$$4x+36=8$$
$$-36\quad -36$$
$$\frac{4x}{4}=\frac{-28}{4}$$
$$x=-7$$

(-7, -12)

Example 3: $$\begin{aligned} 5\,(7x - 6y &= -1) \\ -7\,(5x - 4y &= 1) \end{aligned}$$

$$\begin{aligned} \cancel{35x} - 30y &= -5 \\ \cancel{-35x} + 28y &= -7 \\ \hline \frac{-2y}{-2} &= \frac{-12}{-2} \\ y &= 6 \end{aligned}$$

$(5, 6)$

$$\begin{aligned} 7x - 6(6) &= -1 \\ 7x - 36 &= -1 \\ +36 \quad & \;\; +36 \\ \hline \frac{7x}{7} &= \frac{35}{7} \\ x &= 5 \end{aligned}$$

SPECIAL CASES

$$\begin{aligned} 4x - 10y &= 8 \\ -2\,(2x - 5y &= -11) \end{aligned}$$

$$\begin{aligned} \cancel{4x} - \cancel{10y} &= 8 \\ + \quad \cancel{-4x} + \cancel{10y} &= 22 \\ \hline 0 &\neq 30 \end{aligned}$$

no solution

$$\begin{aligned} 3x - 6y &= 18 \\ -3\,(x - 2y &= 6) \end{aligned}$$

$$\begin{aligned} \cancel{3x} - \cancel{6y} &= \cancel{18} \\ + \quad \cancel{-3x} + \cancel{6y} &= \cancel{-18} \\ \hline 0 &= 0 \end{aligned}$$

infinite solutions