Algebra 1: 6.2 Guided Notes **Name** ______________________________ **Period** ________

Using Linear Combinations to Solve a Linear System

Learning Goal:
To solve a system of equations algebraically using linear combinations (elimination).

Solving Systems of Equations

1) Use **graphing** to get an approximate answer or if the lines are easy to graph, i.e. slope-intercept form.
2) Use **substitution** if one variable can be easily replaced by it's value or an expression that includes the other variable, i.e. y = or x =.
3) Use **linear combinations** when it easy to eliminate a variable by **adding** or **subtracting** the system of equations.

Solving a System of Equations Using Linear Combinations

1. **Stack the system of equations** so common terms (like x and y) line up.
2. **Choose which variable to eliminate**. The coefficients should be equal, but with opposite signs.
   a. *Does one of the variables have the same coefficient in both equations?*
   b. *Can you multiply one or both equations by a number so one of the variables will have the same coefficient in both equations? Hint: find the LCM (least common multiple).*
3. **Add the system of equations** to eliminate one of the variables.
4. **Solve for one variable**.
5. Plug the solution into one of the equations to **solve for the other variable**.
6. **Write** your solution **as an ordered pair**.

Solving a System by Adding Equations

Steps:	**Example 1**
	$2x + 5y = 17$ $6x - 5y = -9$
▪ Eliminate y by adding the system of equations.	$2x + 5y = 17$ $\underline{6x - 5y = -9}$ $8x + 0 = 8$ **Since 5y + –5y = 0, add the equations to eliminate y.**
▪ Solve for x.	$8x = 8$ $x = 1$
▪ Replace the value of x in one of the equations to solve for y.	$2x + 5y = 17$ $2(1) + 5y = 17$ $2 + 5y = 17$ $5y = 15$ $y = 3$ **The solution is (1, 3).**

Let's Practice:

$2x + 3y = 11$
$-2x + 9y = 1$

The solution is (4, 1).

What if the 2nd equation was 2x – 9y = -1? How would you solve it?

Solving a System by Multiplying One Equation

Steps:	Example 2
▪ Stack the equations so common terms line up.	$15y = 2x - 32$ $-7x + 5y = -17$
▪ Multiply the 2nd equation by -3 so the coefficients of y are equal but with opposite signs.	$-2x + 15y = -32$ $-7x + 5y = -17$ → $[-7x + 5y = -17] \times -3$
▪ Eliminate y by adding the system of equations.	$-2x + 15y = -32$ $21x - 15y = 51$ $19x + 0 = 19$
▪ Solve for x.	$19x = 19$ $x = 1$
▪ Replace the value of x in one of the equations to solve for y.	$-2x + 15y = -32$ $-2(1) + 15y = -32$ $-2 + 15y = -32$ $15y = -30$ $y = -2$ **The solution is (1, -2).**

Let's Practice:

$6x + 3y = -6$
$-2x + 5y = 14$

The solution is (-2, 2).

Solving a System by Multiplying Both Equations

Steps:	**Example 3**
▪ Multiply the 1st equation by 3 and the 2nd equation by -2 so the coefficients of the same variable are the equal but with opposite signs.	$3x + 2y = 1$ $4x + 3y = -2$ $3x + 2y = 1 \rightarrow [3x + 2y = 1] \times 3$ $4x + 3y = -2 \rightarrow [4x + 3y = -2] \times -2$
▪ Eliminate y by adding the system of equations.	$9x + 6y = 3$ $-8x - 6y = 4$ $x + 0 = 7$
▪ Solve for x.	$x = 7$
▪ Replace the value of x in one of the equations to solve for y.	$3x + 2y = 1$ $3(7) + 2y = 1$ $21 + 2y = 1$ $2y = -20$ $y = -10$ **The solution is (7, –10).**

Let's Practice:

$7x - 3y = -5$
$3x + 2y = 11$

The solution is (1, 4).

If you ELIMINATE both variables and you are left with a TRUE statement, then the system of equations has INFINITE SOLUTIONS. A FALSE statement means there is NO SOLUTION.