Systems of Equations

1. Solve an equation for one of its variables

2. Substitute the expression in for that same variable in the other equation

3. Solve the one variable equation

4. Plug back in to find the other variable

$y = x + 1$ $2y = 3x$

Example: $\begin{cases} 2x + 3y = 5 \\ x + y = 5 \end{cases}$

$2y = 3x$

$2(x + 1) = 3x$

$2x + 2 = 3x$

$\underline{-2x \qquad\quad -2x}$

$2 = x$

$y = x + 1$

$y = 2 + 1 = 3$

Solution: (1, 3)

Solving Systems Using Elimination:

The **elimination method** is another way to solve systems. The goal with elimination (or linear combination) is to eliminate one of the variables using addition or subtraction. Oftentimes, it is easiest to create two terms that are opposite numbers and then add like terms.

When you don't have matching or opposite coefficients in front of like terms, you can create them by multiplying every term in an equation by the same number. Sometimes you may only have to adjust one equation, other times you must adjust both equations by multiplying by different numbers.

Solve $\begin{cases} x - 2y = -19 \\ 5x + 2y = 1 \end{cases}$ by elimination.

Step 1 $x - 2y = -19$ *Write the system so that like terms are aligned.*
       $+ 5x + 2y = \quad 1$

Step 2 $6x + 0 = -18$ *Add the equations to eliminate the y-terms.*
             $6x = -18$ *Simplify and solve for x.*
             $\dfrac{6x}{6} = \dfrac{-18}{6}$ *Divide both sides by 6.*
             $x = -3$

Step 3 $x - 2y = -19$ *Write one of the original equations.*
             $-3 - 2y = -19$ *Substitute −3 for x.*
             $+3 \qquad +3$ *Add 3 to both sides.*
             $-2y = -16$
             $\dfrac{-2y}{-2} = \dfrac{-16}{-2}$ *Divide both sides by −2.*
             $y = 8$

Step 4 $(-3, 8)$ *Write the solution as an ordered pair.*

Example: $\begin{cases} -2x + y = -10 \\ 7x + 5y = 1 \end{cases}$

Calculator Steps

1. Go to 2nd Matrix, arrow over to Edit.

2. Type in 2 X 3

3. Type in the numbers from your system

4. Press 2nd Quit

5. Go to 2nd Matrix, arrow over to Math, arrow up to and select RREF

6. Go to 2nd Matrix, select your matrix, press Enter. If the first 2 columns are filled with zeroes and 1's, then the answer to the system will be the numbers in the 3rd column.

Example: $\begin{cases} 5x - 6y = -32 \\ 3x + 6y = 48 \end{cases}$