Solving A System of Equations

Method #1 – Graphing
1. Graph both lines.
2. The coordinates of the point where they intersect is the solution to the system.

Note: This is not the most accurate method of finding the solution.

Method #2 – Substitution
Use this method when one of the equations has x or y by itself.

1. Select the equation that has an x or a y without a coefficient in front of it.
2. Rearrange this equation to get that variable by itself.
3. Substitute this value in the second equation.
4. Solve for the remaining variable.
5. Use your answer and the equation from Step 2 to solve for the second variable.

Example:
$$x - 5y = 17$$
$$2x - 7y = 22$$

1. The first equation has an x without a coefficient.
2. Get the x by itself. $x = 17 + 5y$

3. Substitute $17 + 5y$ into the second equation for x. $2(17 + 5y) - 7y = 22$

4. Solve for y.
$$34 + 10y - 7y = 22$$
$$34 + 3y = 22$$
$$3y = -12$$
$$y = -4$$

5. Use $y = -4$ in the equation from Step 2 to solve for x.
$$x = 17 + 5(-4)$$
$$x = 17 - 20$$
$$x = -3$$

The solution to this system is (-3, -4).

Method #3 – Addition or Subtraction

1. Add or subtract the equations to get rid of one variable. The variable you are going to eliminate is the one that has the coefficient in both equations.
   a. If the signs in front of the coefficients are different, add the equations.
   b. If the signs in front of the coefficients are the same, subtract the equations.
2. Solve for the remaining variable.
3. Use your answer from Step 2 and put it in one of the original equations to solve for the second variable.

Example:

$$3x + 2y = 8$$
$$3x + 5y = 14$$

1. The x's are going to be eliminated because both of them are preceded by a 3. Since the 3's are both positive, subtract the equations.

$$3x + 2y = 8$$
$$-(3x + 5y = 14)$$
$$3x + 2y = 8$$
$$\underline{-3x - 5y = -14}$$
$$-3y = -6$$

2. Solve for y.

$$y = 2$$

3. Use $y = 2$ in the first equation to solve for x.

$$3x + 2(2) = 8$$
$$3x + 4 = 8$$
$$3x = 4$$
$$x = 4/3$$

The solution to this system is (4/3, 2).