Systems of Equations

There are three possible methods of solving systems of equations: **elimination**, **substitution**, and **graphing**. (Graphing, of course, only works on systems of two equations, unless you have three-dimensional paper.) In elimination and substitution, the strategy is the same: to remove variables from the system one by one until you have one equation and one unknown left.

METHOD 1: ELIMINATION

To solve a system using elimination:

a. Pick two equations from the system, and multiply one of the equations (or both equations) by a factor so that the coefficients on one of the variables will cancel when the two equations are added. (e.g. 6x and −6x)
b. Add the resulting equations to each other.
c. Repeat Steps a and b, always targeting the same variable, until you have one fewer equation than you started with. You must use each of your original equations at least once. If you do this, you will eliminate one variable.
d. Repeat Steps a, b and c until you have only one variable left. Solve.
e. Work backwards through the variables you eliminated to determine their values by plugging in values for the variables you know.

Example 1: Solve by elimination:

$$2x + 3y = 13 \qquad ①$$
$$x - 2y = -4 \qquad ②$$

Solution: $-2x + 4y = 8$ ③ ←Multiply equation ② by −2

Now we add equations #1 and #3, and get:

$$0x + 7y = 21 \qquad ③ \qquad ① + ③$$
$$y = 3$$

Now we plug our value for y into one of the equations we started with:

$$2x + 3[3] = 13$$
$$2x + 9 = 13$$
$$2x = 4$$
$$x = 2$$

Therefore the solution is $x = 2$, $y = 3$.

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