Systems of Linear Equations

A **system of linear equations** is a collection of two or more equations. Often the equations will be related in the problem being solved.

A **solution set** a system of equations in two variables is the set containing all **ordered pairs**, (x, y), that are a solutions to both equations of the system. If we have 3 equations in 3 unknowns, the solution set is the set of **ordered triples**, (x, y, z), that are solutions to all 3 equations. Beyond this we often just use the term **n-tuple**, or **vector**, $(x_1, x_2, \ldots, x_n)$, for n variables with n equations, where n is the number of variables and equations.

When there is exactly one solution the system is called an **independent system**:
1.) One ordered pair solution, find one value for x & one value for y (or n-tuple)
2.) The lines intersect at one point
3.) The lines have different slopes

If there are no ordered pairs that solve both equations the system is called **inconsistent:**
1.) Zero solutions, come to a statement that is false no matter what values of x & y are used
2.) The lines never intersect
3.) The lines have the same slope

When there is more than one solution to the system the system is called a **dependent system** of equations.
1.) infinite solutions, come to a statement that is true no matter what values of x & y are used
2.) The equations represent the same straight line
3.) They will have the same slope AND the same y-intercept

NOTES:
- In order to have a unique solution for the system, there must be the same number of unique equations as there are variables. So if there are 2 variables, we must have 2 unique equations; 4 variables, 4 unique equations; etc.
- The methods, substitution, addition & graphing are the same no matter how many variables/equations you have, although you may have to repeat steps to get it down to one equation in one variable.
- The graphing method works very well for 2 equations/2 unknowns. It is more difficult for 3 equations/3 unknowns, & impossible for any other situations with our technologies.
- There is a 4th method for solving systems of equations. This method uses matrices & is very good for solving systems involving 4 or more equations. You are not required to know this method for completing this course.