M117 SECTION 4.1 SOLVING SYSTEMS OF LINEAR EQUATIONS BY GRAPHING
SECTION 4.2 SOLVING SYSTEMS OF LINEAR EQUATIONS BY SUBSTITUTION

Two or more linear equations considered together are called a system of linear equations. To solve a system of linear equations means to find all the ordered pairs that are solutions of all the equations in the system.

To determine if a point is a solution to a SYSTEM, you plug the point into EACH linear equation and see if it a solution to BOTH!

EXAMPLE: Given the system:

$x + y = 5$

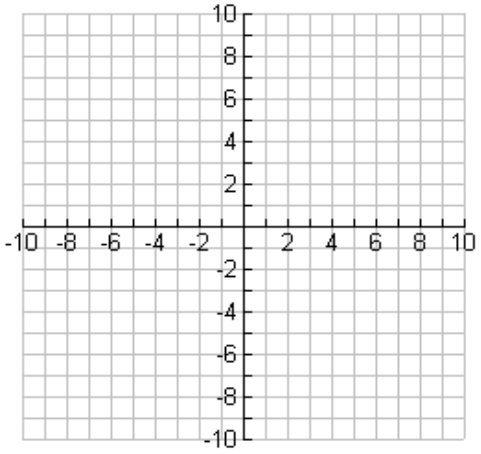
$2x - y = 4$

Is (-1, 6) a solution?

Is (3, 2) a solution?

A. GRAPHING METHOD

Suppose that we graph $x - 2y = 4$ and $x + 2y = 8$ on the same set of axes.



Be sure to express your answer as an ORDERED PAIR!!
(x, y)

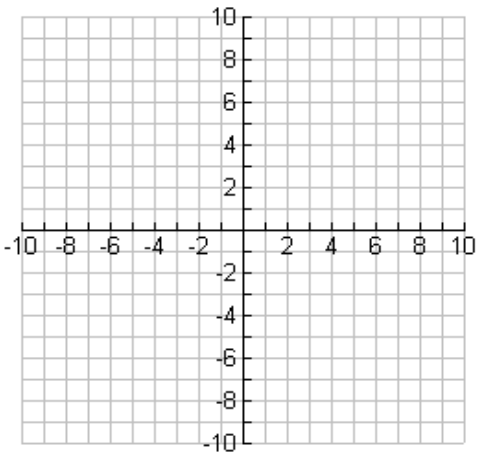
THE POINT OF INTERSECTION is the only point that lies on both of the lines.

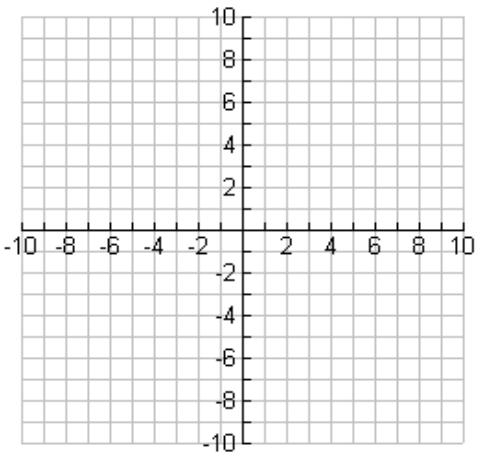
Therefore, the POINT OF INTERSECTION IS THE SOLUTION TO THE EQUATION!

Solve the following systems by graphing:

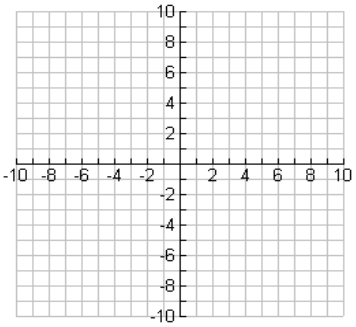
$x + y = 5$
$x - 2y = -4$

$x + y = 6$
$x + y = 2$





When solving systems of equations using GRAPHING your graphs could yield the following three cases or possibilities:

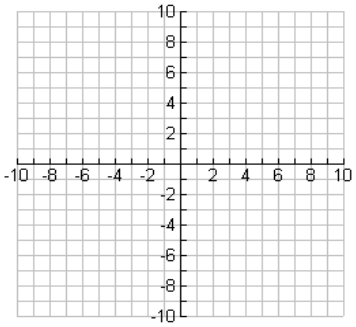


CASE I

The lines INTERSECT.

The solution is:

_____

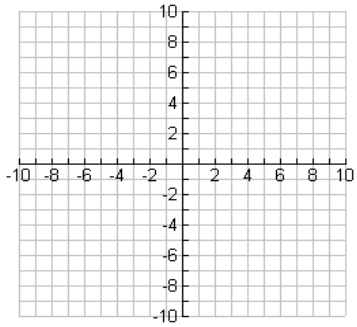


CASE II

The lines are THE SAME.

The solution is:

_____



CASE III

The lines are PARALLEL.

The solution is:

_____

B. SUBSTITUTION METHOD

It should now be obvious that solving a system of equations by graphing requires very accurate graphs. Even then it is not always easy (or accurate) to determine the point where the 2 lines intersect in order to find the solution. Thus, we need to investigate other methods for finding the solution of system of linear equations. We will examine the first alternative method : Substitution.

SUBSTITUTION METHOD

STEP 1 Solve one of the equations for one variable in terms of the other. (Choose wisely to avoid fractions if possible!)

STEP 2 Substitute the expression found in STEP 1 into the other equation. (Now there is only one variable in the new equation.)

STEP 3 Solve.

STEP 4 Plug the solution found in STEP 3 back into the equation in STEP 1 to determine the value of the other variable.

STEP 5 Remember that your solution is an ordered pair (the point where the two lines intersect) and should be written as such (x, y). Look for ***inconsistent*** (parallel lines – Ø or no solution) OR ***dependent*** (same line –infinitely many solutions) systems. **Remember that it is okay to get "0 - zero" for x or y, but it is not okay for the x (or y) variable to drop completely out of the problem.**

EXAMPLES

$$\begin{pmatrix} x + y = 16 \\ x - y = -2 \end{pmatrix}$$

$$\begin{pmatrix} 9x - 2y = -38 \\ y = -5x \end{pmatrix}$$

$$\begin{pmatrix} x + 4y = 1 \\ 3x - 7y = 2 \end{pmatrix}$$

$$\begin{pmatrix} x - 3y = 5 \\ -2x + 6y = -10 \end{pmatrix}$$

Write the equivalent equation by multiplying both sides of the equation by the given nonzero number.

$-4x + y = 3$ (by -2)