

SOLVING SYSTEMS OF LINEAR EQUATIONS

The Substitution Method

To solve a system of linear equations in two variables,

1. Choose one of the equations and solve for a single variable.
2. Substitute the expression for the variable chosen in step one into the other equation.
3. Solve the resulting equation in one variable.
4. Back-substitute the value obtained in step 3 into the equation obtained in step 1 and solve to obtain the value of the other variable.
5. Check the solution in both equations.
6. Write the solution as an ordered pair.

The substitution method works best when *either* of these conditions exists:

1. One of the variables has a coefficient of one, or
2. One of the variables can be made to have a coefficient of one without introducing fractions.

Ex.
$$\begin{cases} x + y = 6 \\ 2x - y = 0 \end{cases}$$

$x = 6 - y$

$2(6 - y) - y = 0$

$12 - 2y - y = 0$

$-3y = -12$

$y = 4$

Back-substitute into either equation using $y = 4$

$x + 4 = 6$

$x = 2$

Solution: (2, 4)

Addition Method (Elimination Method)

To solve a system of linear equations in two variables in addition,

1. Write, if necessary, both equations in general form, $ax+by+c$
2. Multiply one or both equations by factors that will prove opposites coefficients for one of the variables, if needed.
3. Add the equations to eliminate one equation and one variable.
4. Solve the linear equation obtained in step 3.
5. Do one of the following:
 - A. Substitute the value obtained in step 4 into either of the original equations and solve to obtain the value of the other variable, or
 - B. Repeat steps 1-5 for the other variable.
6. Check the solutions in both equations.
7. Write the solution as an ordered pair.

$$\begin{cases} 2x - 3y = -2 \\ x + y = 4 \end{cases}$$

$2x - 3y = -2$

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

$2x - 3y = -2$

$-2x - 2y = -8$

$-5y = -10$

$y = 2$

Back-substitute into either equation

$2x - 3(2) = -2$

$2x - 6 = -2$

$2x = 4$

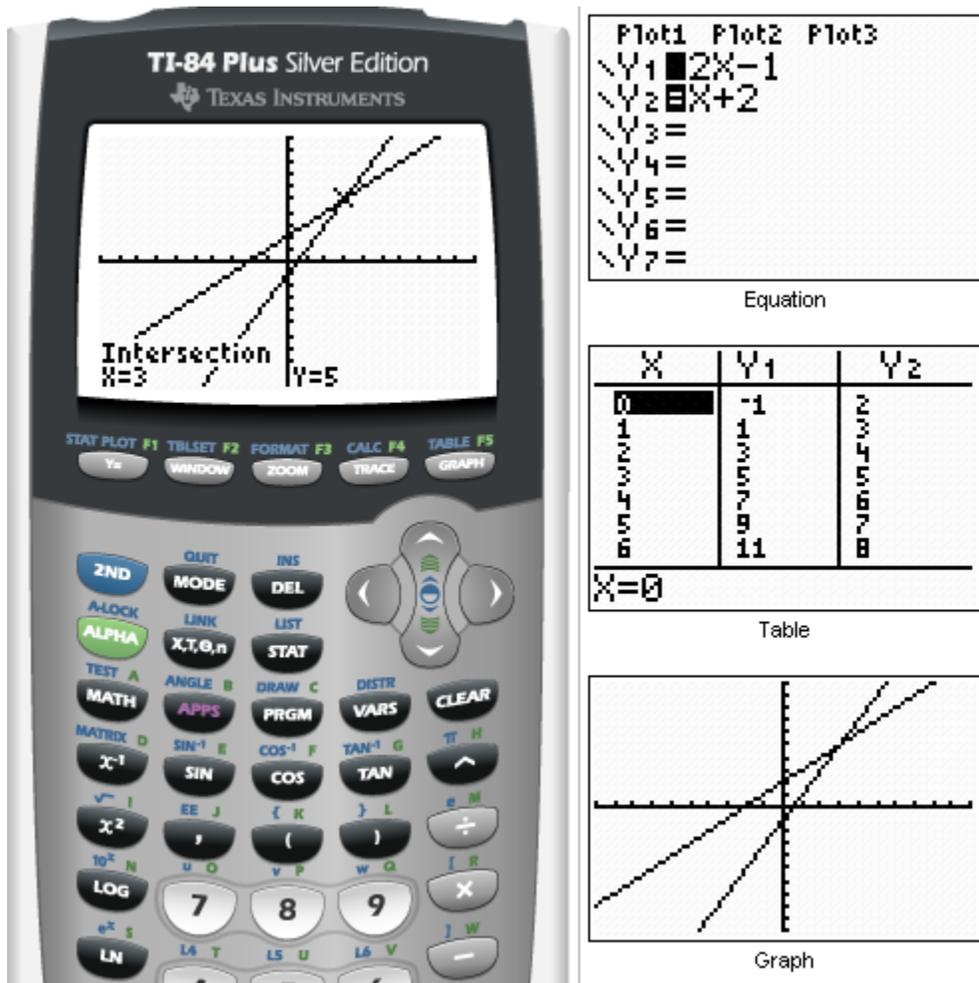
$x = 2$

The solution is (2,2)

Graphing Method

To solve a system of linear equations in two variables

1. Graph the linear equations on the same set of axes
2. Calculate the point of intersection
3. The point of intersection is the solution of the system of equations.
4. Check the solution in both ordered pairs.



The solution is (3, 5).

Three types of linear systems of Equations:

Consistent: Intersecting lines and exactly one solution

Inconsistent: parallel lines and no solution

Dependent: same line and infinite number of solutions