Lesson 4 – Solving Linear Equations

For the past three lessons, we learned about functions. A function is a rule that tells you what to do with an *x* in order to get a *y*-value. But how are functions different from **equations**?

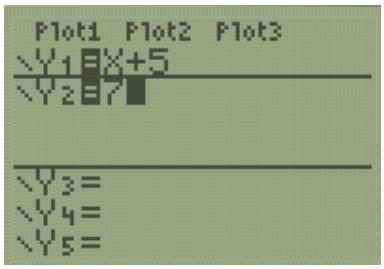
When told to solve an equation for a variable, such as solving $\mathbf{3}\boldsymbol{x} + \mathbf{2} = \boldsymbol{x} - \mathbf{1}$, we are looking for a single value (sometimes more) that will makes both sides of the equation have the same *y*-value.

Most students solve *algebraically*. They do operations on both sides of the equation until the variable is by itself and a number is on the other side of the equal sign. However, all equations can be solved using graphs and tables as well. This lesson, we will practice solving linear equations.

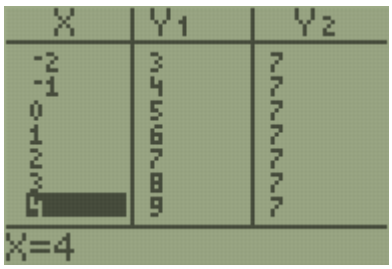
Solving (mostly) linear equations

Consider how to solve the equation $\boldsymbol{x} + \mathbf{5} = \mathbf{7}$.

Method 1 – Using a table



Press **Y=**, enter one side of the **=** sign as **Y1** and the other side as **Y2**

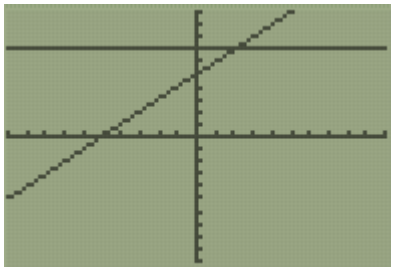


Find the x-value where **Y1** equals **Y2**

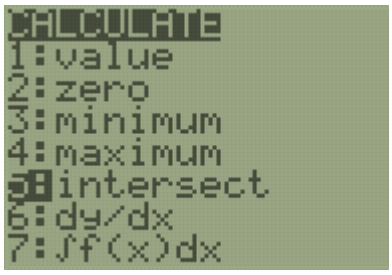
Notice that Y1 = Y2 when x = 2. **The x-value is the solution to the equation**.

Method 2 – Using a graph

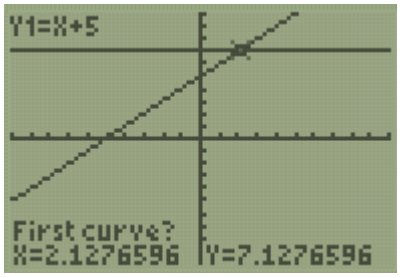
Do the same first step as before: Press **Y=**, enter one side of the **=** sign as **Y1** and the other side as **Y2**.



Press **GRAPH**. **The solution is the point where the graphs intersect**.

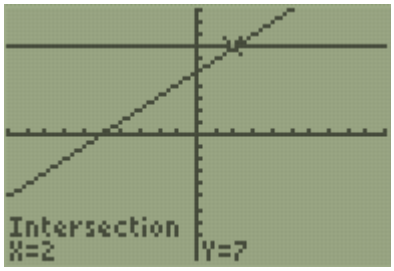


Press **2nd**, **TRACE**, use the **down arrow** to choose choice **"5: intersect,"** and press **ENTER**



Use the left or right arrow to move the blinker close to the desired point.

Then press **ENTER**, **ENTER**, **ENTER**.



The graph intersects at the point **(2,7).** The solution to the equation is the **x-value 2.**

We need both the table method and the graph method to solve equations. The table method is fast and simple, but if the solution to the equation is a decimal or a fraction, then the solution will not show up in the standard table. The graphing method will always work, but it is a little more complicated.

1. Solve the equation $\boldsymbol{3x + 2 = x - 1}$ using a table or graph. Show evidence of your method to support your answer.

You also have the tools to solve equations involving the other nonlinear function families using graphs or tables. **Solve** the following equations using graphs or tables in your calculator. Some equations have more than one solution. ***One equation has no solution!***

2. $2|x - 1| - 8 = 2$

3. $-x^2 + 4x = 4 - x$

4. $2(1.5)^x + 1 = -3$

5. $3x^2 + 2x = 0$

6. Summarize how to determine a solution to an equation using a graph or table. Explain how you can tell when an equation has no solution.

Method 3 – Solving linear equations algebraically

Marcos solved the equation $\boldsymbol{7x - 3(x + 1) = 2(x + 4)}$ algebraically below.

7. Explain each step of his process.

$7x - 3(x + 1) = 2(x + 4)$

$7x - 3x - 3 = 2x + 8$

$4x - 3 = 2x + 8$

$2x - 3 = 11$

$2x = 14$

$x = 7$

8. Show how Marcos could check that his answer is correct using a graphing calculator.

9. Solve each equation algebraically. Check that your answer is correct using a graphing calculator.
   a. $4x + 10 = 2x + 7$
   b. $2(5x - 3) = 3(4x + 1)$
   c. $12 - 2(x + 5) = 4$
   d. $17 - 3(3x - 5) = 2 + x$

10. Write a general summary explaining how to solve linear equations algebraically.

You are also expected to solve linear equations algebraically that contain fractions.

11. Explain each step of the process to solve $\boldsymbol{6-\frac{2}{3}(x+5)=4x}$.

$6-\frac{2}{3}(x+5)=4x$

$6-\frac{2}{3}x-\frac{10}{3}=4x$

$\frac{8}{3}-\frac{2}{3}x=4x$

$\frac{8}{3}=\frac{14}{3}x$

$x=\frac{4}{7}\ or\ .5714285714$

12. Show how to check that the answer is correct using the graphing calculator.

13. Solve each linear equation for the variable algebraically. Check that your answers are correct using a graphing calculator.

a. $-\frac{2}{3}(x+12)+\frac{2}{3}x=-\frac{5}{4}x+2$

b. $\frac{3}{4}x-6=\frac{1}{2}x-9$

c. $\frac{1}{6}y+8=10-\frac{2}{3}y$