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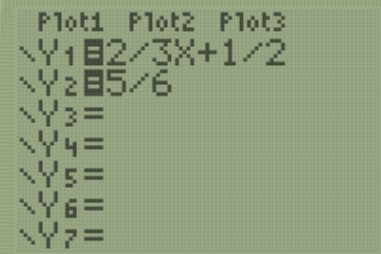
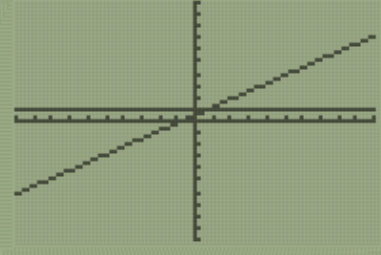
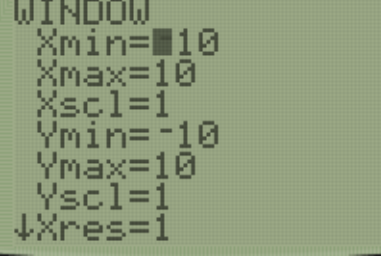
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Solving Equations

When solving equations our goal is to find the missing value, or solution. Whether an equation has one solution, or multiple solutions, when we solve equations most of the time we pray the equation will be “nice” and have some easy-to-find solution. However, this is not always the case. Fortunately, now we have the help of technology to aid us in finding solutions. By now, we understand how to solve equations algebraically, but luckily, we also can understand how to find them using technology.

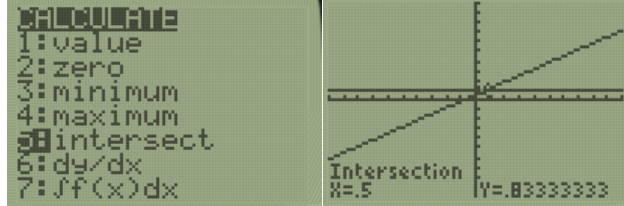
Let’s start by looking at the equation, $\frac{2}{3}x + \frac{1}{2} = \frac{5}{6}$. We are familiar with how to solve this algebraically, but how do we solve this using the calculator?

Solve algebraically in the space provided:

<p>Step 1: Hit the “y=” button on your calculator. Enter $\frac{2}{3}x + \frac{1}{2}$ into Y1 and $\frac{5}{6}$ into Y2. (Note: Anything to the left of the = sign is entered for Y1, and anything to the right of the = sign is entered for Y2.)</p>		
<p>Step 2: Hit the “Graph” button in order to view your equation graphically. (Notice: You graph should display two intersecting lines. One representing $\frac{2}{3}x + \frac{1}{2}$ and the other representing $\frac{5}{6}$.)</p>		
<p>Step 3: For some graphs, the standard window size will suffice, however this is not always the case. If you are unable to view the intersection of the lines it is because you must expand your window size. You can do this by hitting the “window” button and changing the size of your graph. (Here the standard window size allows us to view the intersection.)</p>		

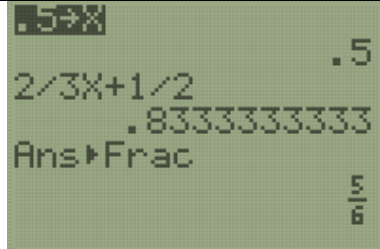
Step 4:

Once we have returned to our graph by hitting the "Graph" button we can now find the intersection of the lines. We do so by hitting "2nd-Trace (Calc)" and entering number "5" or "intersect." Hit "enter" for first curve, "enter" for second curve, and "enter" for guess? to arrive at a solution. (Note: On this graph we can see there is only one intersection.)



Step 5:

After completing Step 4, we can see the intersection of our lines occurs when x=.5. This means the value of x when $\frac{2}{3}x + \frac{1}{2} = \frac{5}{6}$ is $\frac{1}{2}$. We can check our solution by storing $\frac{1}{2}$ in for x, and entering our equation. Enter ".5→X" and hit "enter." Next we enter the expression " $\frac{2}{3}x + \frac{1}{2}$ " (note: this is only the expression on the left side of the equal sign. We do not enter $\frac{5}{6}$ because this is the solution we are looking for) into the calculator and hit "enter." This will give us the solution for $\frac{2}{3}x + \frac{1}{2}$ when $x=\frac{1}{2}$, which we can see is .83333333 repeating. Enter "MATH→1 Fraction" to view our answer in fraction form, which we can see is $\frac{5}{6}$.



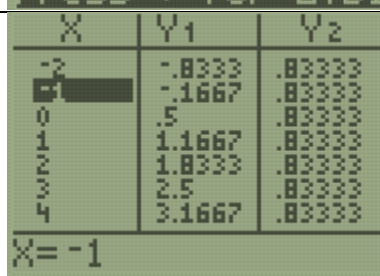
Step 6:

We have found our solution by using the first curve, second curve, guess method however this is not the only way to find a value for x on the calculator. Many times people can experience an error using the "first curve, second curve, guess" method. So we can find a solution using another method. Returning to our equation by hitting "Y=" we can see the information we entered from Step 1 has remained. Next, we enter "2nd→Graph (Table)" to view our values in table form.



Step 7:

We can see from our table that Y2 is equal to .833333. If we recall from Step 5, .833333 repeating is $\frac{5}{6}$ in decimal form. This makes sense because $\frac{5}{6}$ is a number value, which makes Y2 a straight line, resulting in all values of Y2 being equal. To find where Y2 and Y1 intersect, we must find where their values are equal. We can do this one of two ways. The first is scroll the table toward .833333 repeating for the value of Y1 to find the value for X, or we



can look at our solution from Step 4 where we completed the “first curve, second curve, guess” method to see what our x value is. Once we find that X value on our table we can see if Y1 and Y2 match. (Note: They should.)

Step 8:

By looking at the Table from Step 7 we can see there is no value displayed where Y1 and Y2 are equal to each other. In order to fix this we must alter our increment of x. We can do so by entering “2nd→Window (TBLSET)” and changing our TblStart and Tbl to -1.5 and .5 respectively. This will cause our table to increase by values of .5 instead of 1. (Note: For different equations the value of the Tbl and TblStart may vary depending on intersection of the two lines. Looking at our Graph and using the first curve, second curve, guess method can help us find a value to increase by.)



Step 9:

Now that we have changed our Table Setup, we can return to our Table by entering “2nd→Graph (Table)” and finding where Y1 and Y2 are equal to one another. We can see here that these lines intersect when x equals .5, which is the value we got when solving the equation algebraically, doing the first curve, second curve, guess method and storing .5 in for x to check our answer.

X	Y1	Y2
-1.5	-.5	.83333
-1	-.1667	.83333
-.5	.16667	.83333
0	.5	.83333
.5	.83333	.83333
1	1.1667	.83333
1.5	1.5	.83333

X=.5

We have now solved an equation using multiple methods, and arrived at the same solution each time. This verifies that our answer is correct. Now we will look at a parabolic equation. What do we know about parabolas? What can we assume if we are looking for the intersection of two lines if one is a parabolic expression?

Consider $x^2+2x+1=9$. Solving for x in this equation can get messy. So, how can we rewrite this equation to make it easy to solve?

Let’s consider rewriting this equation.

How can we rewrite this? Who can tell me what our new equation will be?

Rewriting $x^2+2x+1=9$ and setting it equal to zero will give us $x^2+2x-8=0$.

What form is our new equation in?

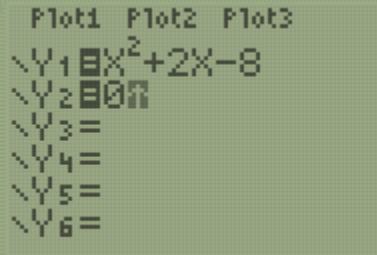
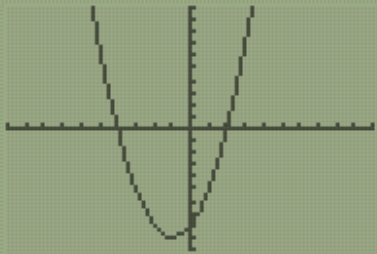
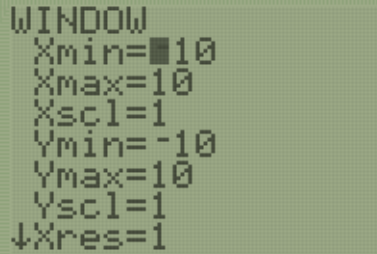
Who can tell us what the quadratic formula is?

From here we can solve this one of two ways. We can factor this equation, or we can plug our values into the quadratic equation.

Now, how do we solve this algebraically? Use the space provided below.

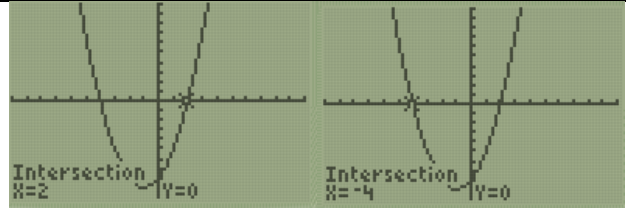
What do we see about our solution?

Let's complete Number 2 using the same method we used for number one.

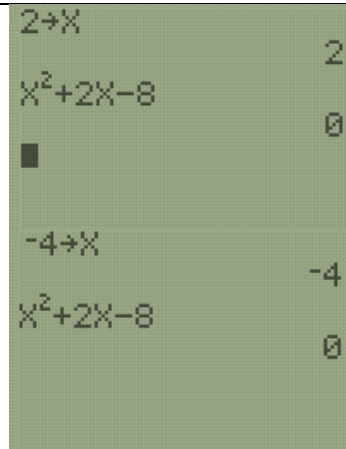
<p>Step 1: Hit the “y=” button on your calculator. Enter x^2+2x-8 into Y1 and 0 into Y2. (Note: Anything to the left of the = sign is entered for Y1, and anything to the right of the = sign is entered for Y2.)</p>	 <pre>Plot1 Plot2 Plot3 Y1=X^2+2X-8 Y2=0 Y3= Y4= Y5= Y6=</pre>	
<p>Step 2: Hit the “Graph” button in order to view your equation graphically. (Notice: Your graph is displaying two intersecting lines, however we must keep in mind one of our lines is 0.)</p>		
<p>Step 3: In this particular graph the standard window size will suffice. We can see the intersection of our two lines under these values.</p>	 <pre>WINDOW Xmin=10 Xmax=10 Xscl=1 Ymin=-10 Ymax=10 Yscl=1 Xres=1</pre>	

Step 4:

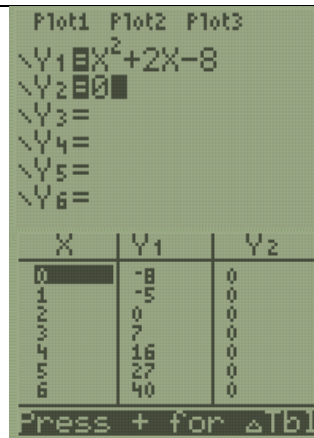
Once we have returned to our graph by hitting the "Graph" button we can now find the intersection of the lines. We do so by hitting "2nd-Trace (Calc)" and entering number "5" or "intersect." Hit "enter" for first curve, "enter" for second curve, and "enter" for guess? to arrive at a solution. (Note: On this graph we can see there is more than one intersection so we must perform this step twice.)

**Step 5:**

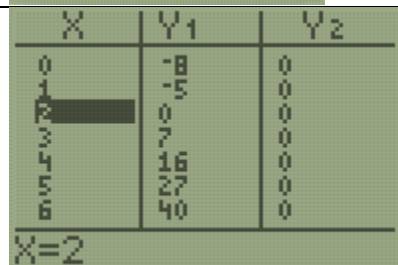
After completing Step 4, we can see the intersection of our lines occurs when $x=2$ and $x=-4$. This means the value of x when $x^2+2x-8=0$ is both 2 and -4. We can check our solution by storing 2 in for x , and entering our equation. Enter "2→X" and hit "enter." Next we enter the expression " x^2+2x-8 " (note: this is only the expression on the left side of the equal sign. We do not enter 0 because this is the solution we are looking for) into the calculator and hit "enter." This will give us the solution for x^2+2x-8 when $x=2$, which we can see is 0. We must repeat this same process except now we must store 4 for x . We can see we will still arrive at 0 for a solution.

**Step 6:**

Returning to our equation by hitting "Y=" we can see the information we entered from Step 1 has remained. Next, we enter "2nd→Graph (Table)" to view our values in table form.

**Step 7:**

We can see from our table that Y_2 is equal to 0. This makes sense because 0 is a number value, which makes Y_2 a straight line, resulting in all values being equal. To find where Y_2 and Y_1 intersect, we must find where their values are equal. We can do this one of two ways. The first is scroll the table toward 0 repeating for the value of Y_1 to find X , or we can look at our solution from Step 4 where we completed the "first curve, second curve, guess" method to see the value we found for x . Remember, because we are dealing with a parabola we will have two intersections, therefore we have two solutions. The table shows us our solutions



when $x^2+2x-8=0$ is both 2 and -4, which is what we found when we completed the work algebraically and using the first curve, second curve, guess.

X	Y ₁	Y ₂
-5	7	0
-4	0	0
-3	-5	0
-2	-8	0
-1	-9	0
0	-8	0
1	-5	0

X = -4

Step 8:
By looking at the table we found in Step 7 we can see that if the values in our Table Setup increase by .5 or 1 we will be able to find where the values are equal. In other cases this may have to change in order to see where the lines intersect.

TABLE SETUP
TblStart=-1.5
 Δ Tbl=.5
Indent: Auto Ask
Depend: Auto Ask

Step 9:
Recall our original equation $x^2+2x+1=9$ before we rewrote it in quadratic form. What would happen if we plugged this into Y1 and Y2? Do we arrive at the same solutions? Try solving this problem.

