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Objective: Solving Quadratic Equations by Graphing

Homework QF-9 –   NYA p.570 #51 – 56 (solve, don't follow direction)
                NYA p.571 #2 – 7

Do Now: Find the solutions of the quadratic equations

  1. $y = x^2 + 6x - 16$ 2. $y = 3x^2 + 8x + 4$
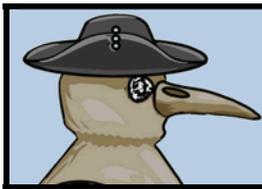
Exam Prep: Where are the solutions of a quadratic equation?

  A) on both the x and y axis   B) x-axis   C) y-axis   D) underwater
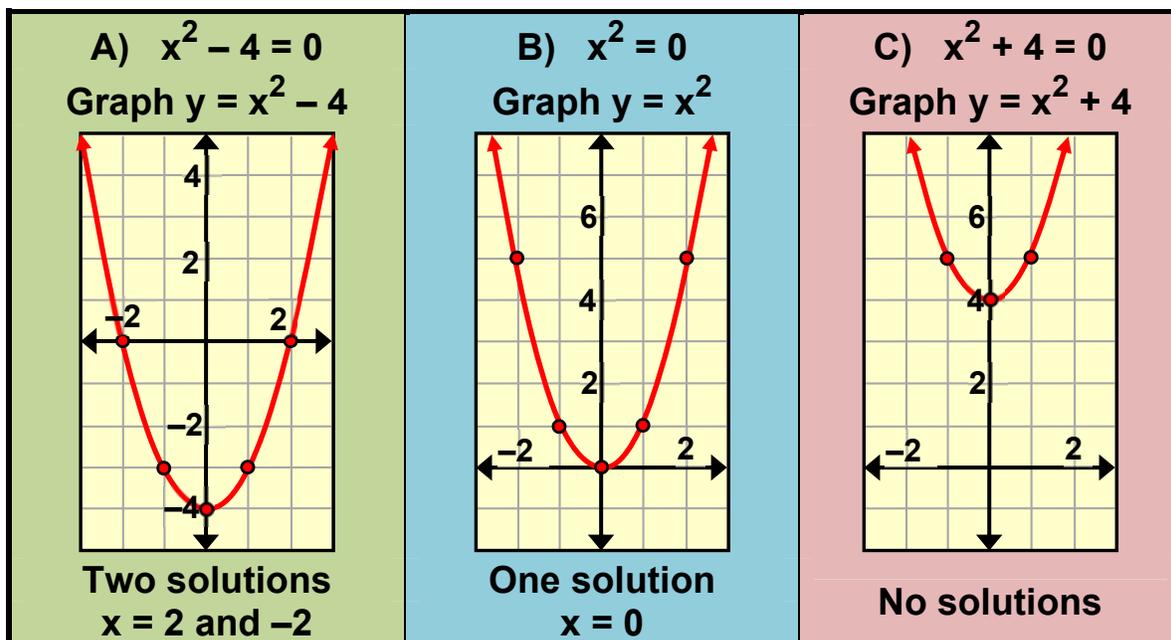

The journey continues…

You REALLY need a TI graphing calculator.

RECALL BUT DO NOT COPY (FROM EARLIER LESSON)

Remember: Standard form of the Quadratic Equation is $ax^2 + bx + c$, with $a \neq 0$

One of the ways of solving a quadratic equation is to find the x-intercepts known as the <u>roots of the equation</u>, or <u>zeroes of the function</u>.

Quadratic Equations have two, one, or no solutions.

A) $x^2 - 4 = 0$ Graph $y = x^2 - 4$	B) $x^2 = 0$ Graph $y = x^2$	C) $x^2 + 4 = 0$ Graph $y = x^2 + 4$
Two solutions x = 2 and –2	One solution x = 0	No solutions

Let us defer to our friend The Coaster Monkey for help!
(Zero Function Handout)

When finding the solutions to a Quadratic equation GRAPHICALLY, you look for where the function crosses the x-axis. Your TI has a built-in function that does exactly what you need! It is called the `zero` and it can be accessed in the **CALC** menu on your TI.

STEP 1	Type your function into **Y=** in Y1 or any other spot on the list. As you type it, you will see the equals sign highlight, this means that it is active and will appear on the graph. Here we are using the Quadratic function $x^2 - 3x - 4$. If you check, you will see our solutions will be x = –1 and 3. Let's find them!
STEP 2	Take a look at the graph to make sure it has solutions and will appear on the screen. You need to **see** where the function crosses the x-axis in order to execute the `zero` function. Use the **WINDOW** and **ZOOM** features of the TI to set the correct view of the graph (these features are addressed in a separate Coaster Monkey graphing calculator guide).
STEP 3	Select the `zero` function in the **CALC** menu, it can be accessed by pressing **2nd** and **TRACE**, and selecting option #2. *Note: The minimum(3), maximum(4), and intersect(5) functions work in a similar fashion.*

STEP 4	Set the bounding area and "guess" what point you want. You must understand that when you move the cursor along the graph, you are changing x-values, therefore you only move left and right along the graph. Let's find the right point first. First the screen will prompt for a "left bound" location. Use left-right keys to choose a point that has an x-value that is to the left (or less than) the `zero` you want. You will see a right-facing arrowhead appear indicated where you chose. Next, choose the "right bound" location. Make sure your cursor is to the right (or more than) the `zero` you want. Notice the left-facing arrow head. Lastly they ask for a "guess." The location of the guess is only needed when there are two points of interest in the bounding area. So as long as your left/right bound surround just one `zero`, you can just hit **ENTER**.

LEFT-BOUND	RIGHT-BOUND	GUESS	FIRST ZERO: x = 4

STEP 5	Repeat the process to find the second `zero`. You will find it to be x = –1. The Doctor warns that this process can appear to vary because of other things you have set in the calculator, such as more than one function in your **Y=**. Also, sometimes the y-value shown doesn't appear to be zero, it may come up as 1ᴇ-14 or something similar. This is an abbreviation of scientific notation for 1×10^{-14}, a small number near zero. You may consider it the same as zero, as it is a result of the calculator's limitations. Try some more, you need to practice using the calculator; it is the only way to be able to use it as a tool to solve problems.

Practice: Find the roots (solutions) graphically

1. $x^2 + 2x - 15 = 0$	2. $2x^2 - 9x - 5 = 0$	3. $x^2 - 12x + 36 = 0$
4. $x^2 - 9 = 0$	5. $x^2 + x + 3 = 0$	6. $-8x^2 - 14x - 5 = 0$

Solve graphically

7. $y = x^2 - 6x$

You may also find the axis of symmetry and vertex…

x	y