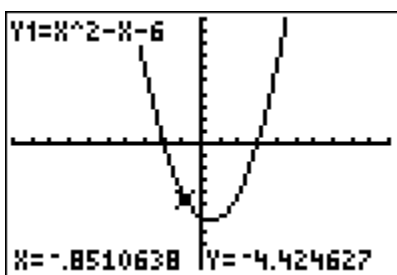


TI-83/84 & TI-86 Instructions for Graphing and Analyzing a Quadratic Function

(MAT 111 Section 2.6)

Below you will find key strokes and screen shots that will show you how to: 1) Graph a quadratic; 2) Find the vertical intercept; 3) Find the horizontal intercept(s), i.e. real zeros, if any; and 4) Find the minimum (vertex). (*Note that the quadratic illustrated is concave up. If it were concave down, you would find the maximum (vertex) instead of the minimum.*)

1. To Graph a Quadratic, enter the following key strokes. This will create a graph in a standard window (zoom 6) and will show the equation when you key in trace.



```
WINDOW
Xmin=-10
Xmax=10
Xscl=1
Ymin=-10
Ymax=10
Yscl=1
↓Xres=1
```

Note: The x and y values in your calculator may differ from those illustrated above.

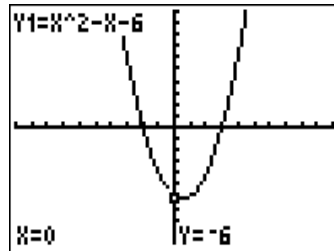
If you have a TI-86, use the following key strokes:



2. To Find the Vertical Intercept, enter the following keystrokes



If you have a TI-86, use the following key strokes: **GRAPH** **F4** **0** **ENTER**



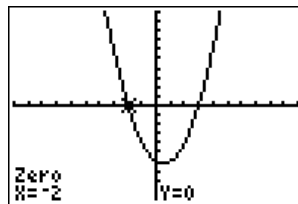
Algebra Note: The vertical intercept is the value of c when the quadratic equation is written in the form $y = ax^2 + bx + c$. In the above illustration, the vertical intercept is $y = -6$.

3. To find the zeros of the quadratic, enter the following key strokes. If the quadratic has 2 real zeros, as illustrated below, you will have to do this twice, once for each real zero.

a) Find the first real zero*



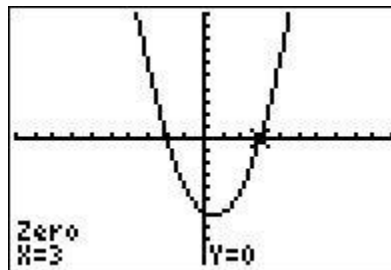
If you have a TI-86, use the following key strokes:



b) Find the second real zero *



If you have a TI-86, use the following key strokes:



**Note1: The numbers in the arrow key stroke entries above indicate how many times the key was pressed to get it to the required position. Your number of key presses may be different. It is important to have the Left Bound at an x value close to the left of the “zero” and to have the Right Bound close to the right of the “zero”. The exact number of presses may vary since “close” is not an exact concept.*

Note 2: A quadratic may have 0, 1, or 2 real zeros. If there were no real zeros, you would see that the graph would not touch or cross the x-axis so the procedure illustrated above would not work. If there were only 1 real zero, do not use this procedure as the calculator would return an error. Instead, use the procedure to find the minimum (vertex) shown in #4 below.

Algebra Note: The zeros can be found by either: (1) Factoring or (2) Quadratic Formula

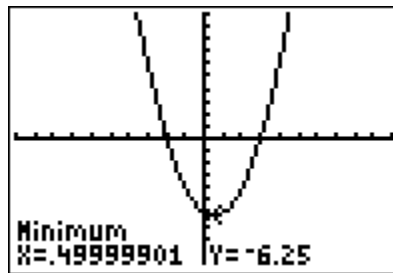
(1) Factoring works best when the factors are simple integers or fractions. The quadratic equation illustrated above is $y = x^2 - x - 6$ which would then be set equal to 0 and factored into $0 = (x - 3)(x + 2)$. Setting each factor equal to 0, you get $x - 3 = 0$, so $x = 3$ and $x + 2 = 0$, so $x = -2$.

(2) The quadratic formula is $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. In the illustrated equation $y = x^2 - x - 6$, $a = 1$, $b = -1$, and $c = -6$, so $x = \frac{1 \pm \sqrt{(-1)^2 - 4(1)(-6)}}{2(1)}$. $x = -2$ and $x = 3$, the same result you obtained using the calculator.

4. To find the vertex, enter the following key strokes. Note that the third key stroke is “3”, a minimum in the calculate menu since the parabola is concave up. If it were concave down, you would need to key in “4” (maximum) in the calculate menu.



If you have a TI-86, use the following key strokes:



Note 1: The direction of the first arrow (right) in the instructions above assumes your cursor is to the left of the vertex after you press “3”. If it is to the right of the vertex, use the left arrow instead. The main point is to have the Left Bound on the left of the vertex and the Right Bound on the right of the vertex.

Note 2: The x value of the vertex is displayed as .49999901 instead of the actual value of 0.5. On an exam, you should be able to translate what the calculator shows to the exact answer of 0.5. (Similar issues occur frequently when using a graphing calculator, e.g., it may display the zero of a function as 4 E-11 which is .00000000004, meaning the actual answer is 0.)

Note 3: Sometimes the answer really is a long repeating or nonrepeating decimal. In those situations, you should write the decimal to the number of decimal places requested (3 decimal places if not specified).

Algebra Note: The x value of the vertex can be found by using the formula $x = \frac{-b}{2a}$ where the constants come from the quadratic equation $y = ax^2 + bx + c$. In the illustrated example, $y = x^2 - x - 6$, $b = -1$ and $a = 1$, so the x value of the vertex is $x = \frac{-(-1)}{2(1)} = \frac{1}{2}$. The y value of the vertex is found by solving the equation with $x = \frac{1}{2}$; $y = (\frac{1}{2})^2 - \frac{1}{2} - 6$ so $y = -6.25$, the same result you obtained using the calculator.