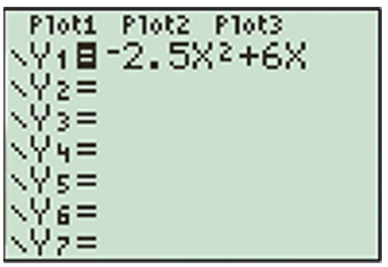
## Calculator Guide

# TI-83/84™ Skills
# Lesson 2.1: Quadratic Functions Expressed in Vertex Form

Graphing a quadratic function and exploring the characteristics of the graph.

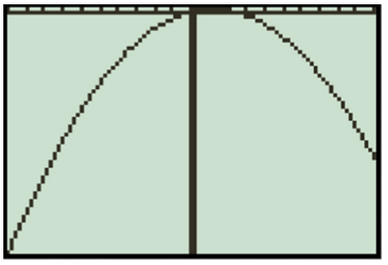
a. Graph $y = -2.5x^2 + 6x$




- Press [Y=]
- Press [(-)] [2] [.] [5] [X,T,Θ,n] [$x^2$] [+] [6] [X,T,Θ,n]
- Press [ENTER]

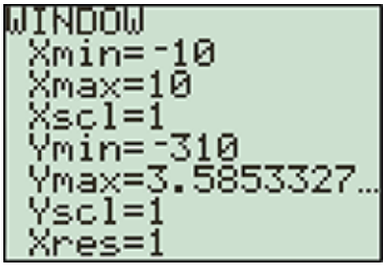
**Note**: Make sure that Stat Plot is off. None of the Plots should be highlighted. If any of them are, you need to press the up and right arrow keys to move the cursor to the highlighted Plot. Press [ENTER] to turn the Plot off.

b. Now you need to set the domain and range for the graph.



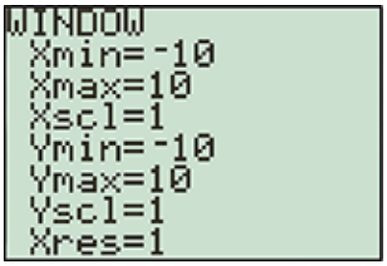
- Press [ZOOM] **Hint**: Top of column 3.
- Press [up arrow key]
- Press [0:ZoomFit]
- Press [ENTER]

c. Go to the WINDOW settings to refine your domain and range settings.




- Press [WINDOW] **Hint**: Top of column 2.
- You can see the domain values set by the calculator in Xmin= and Xmax=.
- You can see the range values set by the calculator in Ymin= and Ymax=.

d. We are going to change the WINDOW settings and explore how such changes affect the image of the graph shown on the calculator screen.
It is not necessary for the Ymin value to be –310. And, in fact, by narrowing the range, the vertex and *x*-intercepts will be more clear.

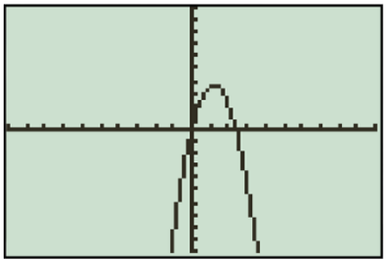



- With the cursor at Xmin= Press [-] [1] [0]
- Press the down arrow key.
- With the cursor at Xmax= Press [1] [0]
- Press the down arrow key.
- With the cursor at Xscl= Press [1]
- Press the down arrow key.
- With the cursor at Ymin= Press [-] [1] [0]
- Press the down arrow key.
- With the cursor at Ymax= Press [1] [0]
- Press the down arrow key.
- With the cursor at Yscl= Press [1]
- Press the down arrow key.
- Always leave Xres=1 at 1. This controls the resolution of the screen.

or

- Press [ZOOM]
- Press [6:ZStandard]

e. We are going to graph the function again to see how the image has changed with new window settings.

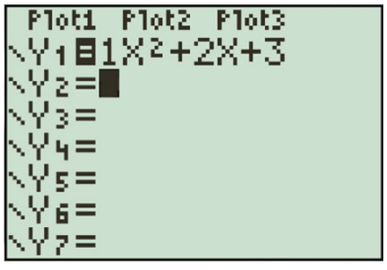


- Press [GRAPH] **Hint**: Top of column 5.

Discovering the properties of a quadratic function.

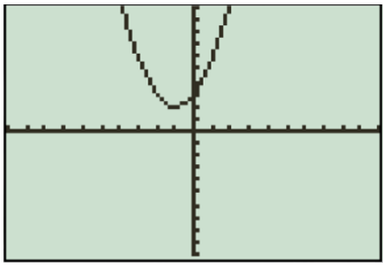
How to find the *x*-intercepts, the *y*-intercept, the vertex, the maximum or minimum values, and the axis of symmetry using the TI83/84 calculator:

1. Enter the following function in standard form into your calculator:
$y = x^2 + 2x + 3$, where $a = 1$, $b = 2$, and $c = 3$:




- Press [Y=]
- Press [X,T,Θ,n] [$x^2$] [+] [2] [X,T,Θ,n] [+] [3]
- Press [ENTER]

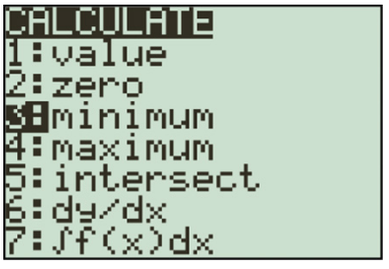
**Note**: Make sure that Stat Plot is off. None of the Plots should be highlighted. If any of them are, you need to press the up and right arrow keys to move the cursor to the highlighted Plot. Press [ENTER] to turn the Plot off.



- Press [ZOOM]
- Press [6:Zstandard]

**Hint**: Top of column 3.

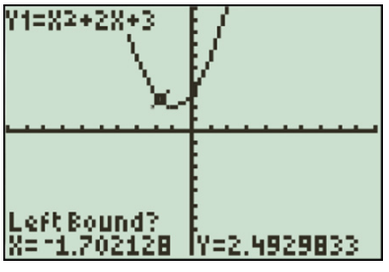
The vertex of the graph of a quadratic function (minimum or maximum) can be found using the minimum and maximum commands.




- Press [2nd] [TRACE]
- Press [3:minimum]

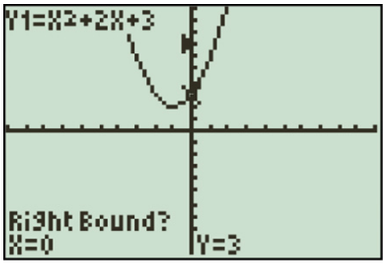
**Hint**: Top of column 4.

Since the parabola opens up, it has a minimum value. By finding the minimum, you will actually be finding the coordinates of the vertex and the equation of the axis of symmetry.



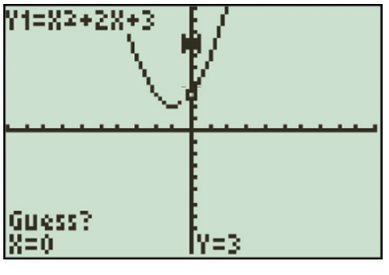

You are now asked for the left boundary.

- Press [left arrow key] several times to move the cursor to the left side of the parabola's minimum point.
- Press [ENTER]



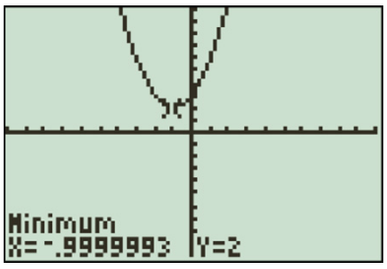

Now the calculator asks for the right boundary.

- Press [right arrow key] several times to move the cursor to the right side of the parabola's minimum point.
- Press [ENTER]



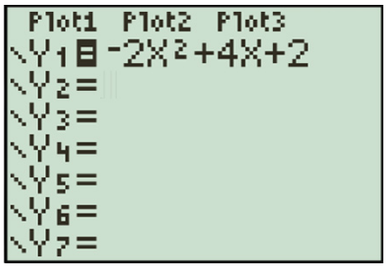

Now the calculator will ask you to guess where the vertex (minimum) is located.

- Press [ENTER]

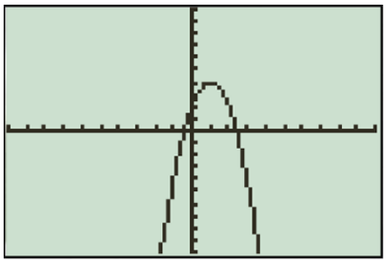



The vertex of the graph is (–1, 2). Therefore, the equation of the axis of symmetry is $x = -1$, and the minimum value of the function is 2.
All parabolas that open up will have a minimum value and all parabolas that open down will have a maximum value. A maximum can be found in the same way as a minimum, but when you press [2nd] [TRACE], select [4: maximum] instead, and then follow the same procedure outlined above.

2. Enter the following function in standard form into your calculator:
$y = -2x^2 + 4x + 2$, where $a = -2$, $b = 4$ and $c = 2$

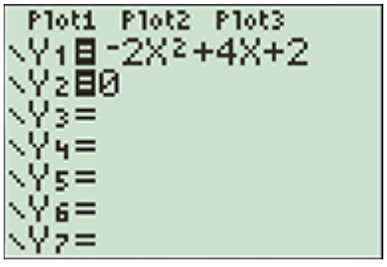



- Press [Y=]
- Press [-] [2] [X,T,Θ,n] [x²] [+] [4] [X,T,Θ,n] [+] [2]
- Press [ENTER]

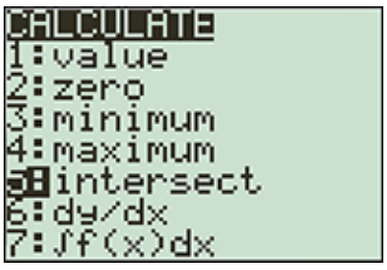


- Press [ZOOM] **Hint**: Top of column 3.
- Press [6:ZStandard]

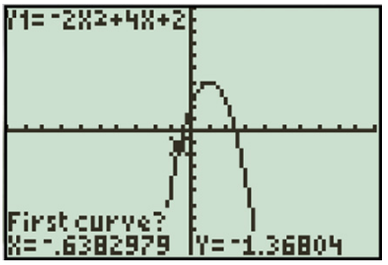
The *x*-intercepts of a graph can be determined by finding the points of intersection between the curve and the *x*-axis.



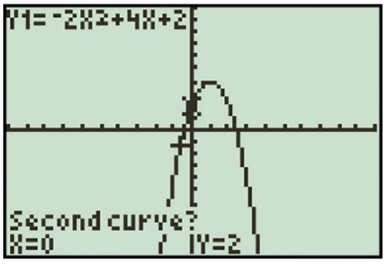

- Press [Y=] **Hint:** Top of column 1.
- Press [Down Arrow]
- Press [0] Remember that the *x*-axis is really just $y = 0$.
- Press [ENTER]



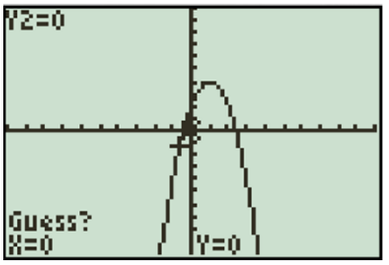

- Press [2nd] [TRACE]
- Press [5:intersect]



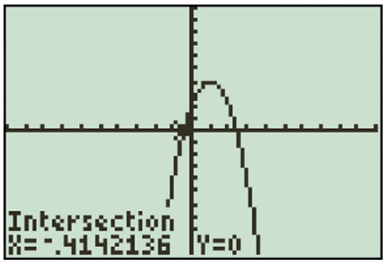

- Press [left arrow key] several times to move the cursor near one of the *x*-intercepts
- Press [ENTER]
- Now the calculator will ask you for the second curve.



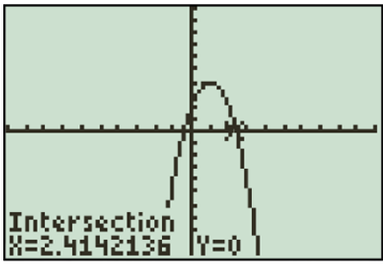

- Press [ENTER]




- Now the calculator will ask you to guess.
- Press [ENTER]

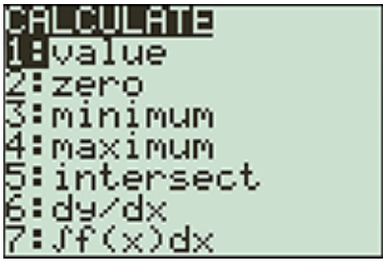



One of the *x*-intercepts of the graph is: (–.4142136, 0)



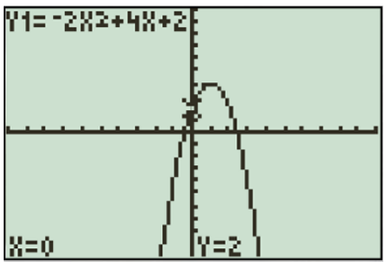

Use this same procedure to find the second *x*-intercept.
The second *x*-intercept is: (2.4142136, 0)
Note: *x*-intercepts can also be determined using [2:Zero].
- Press [2nd][Trace]
- Press [2:Zero]

The *y*-intercept of the graph of a function can be determined by evaluating the function for $x = 0$.



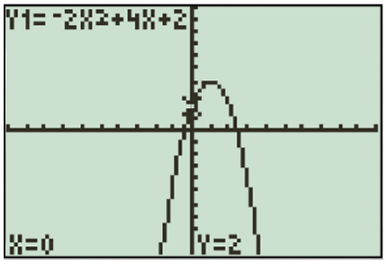

- Press [2nd] [TRACE]
- Press [1:value]

**Hint**: Top of column 4




You are now asked for an $x$-value. Since the $y$-intercept is the point where the graph of the function crosses the $y$-axis, $x = 0$.

- Press [0]
- Press [ENTER]




The $y$-intercept is 2.