Finding Maximums and Minimums on your Calculator (82, 83, 85, 86)   NAME:

1. We will work with the function $y = 8x^2 - 10x + 12$. Obtain a complete graph of this function on your calculator. (I like to start off in the standard window, and then change my *xmin*, *xmax*, *ymin*, and *ymax* accordingly.) Notice the graph will be barely visible at the top of the standard window. Sketch the graph, labeling the *xmin*, *xmax*, *ymin*, and *ymax*.

2. I found the window [-5,5] x [-10,40] gave me a nice picture of the graph. If you have not found an appropriate window use this one. Otherwise use the window you found in question 1. The graph should be relatively large on the screen.

Notice the vertex is a minimum. This means that the lowest *y*-value on the entire graph occurs here. We are interested in the *y* value that is this minimum and the *x* value that gives us this minimum. Let's find the *x* and *y* values of this minimum point.

On the **TI82** or **83**, press **2$^{\mathbf{nd}}$**, then the **TRACE** button. (The second function of the **TRACE** button is **CALC**.) Select **Minimum**. It will ask for a **left (or lower) bound**, a **right (or upper) bound**, and then a **guess**. To select the left (or lower) bound, move the cursor to the left of the vertex and press **ENTER**. To select the right (or upper) bound, move the cursor to the right of the vertex and press **ENTER**. Then move the cursor somewhere in the middle of the two and press **ENTER** to enter your guess.

On the **TI85**, once on the graph screen (meaning it shows a graph and the menu's first item is "**y(x)=**"), press **MORE**, and then select **MATH**. This opens up a menu, from which you will select **FMIN**, but you need to press **MORE** to get to this option. Then simply move your cursor to near the vertex and press **ENTER**.

For the **TI85**, sometimes this does not work; it will not give you a minimum or it won't give you the one you wanted. When this happens, you must define a lower and upper bound, basically an interval of values in which the calculator will look for the minimum. Let's practice this now. Exit out of this screen and get back to the basic graph screen. From the graph screen, press **MORE**, then select **MATH**. This time select **LOWER**. Then move the cursor to the left of the minimum and press **ENTER**. Then select **UPPER** from the menu. Move the cursor to the right of the minimum and press **ENTER**. Now select **FMIN** (need to press **MORE** to get to it). Move your cursor near the minimum and press **ENTER**. Your screen should read **FMIN** with a point's coordinates below that.

(**TI85** continued) This is the minimum point on the graph. To get rid of the upper and lower bounds you have just set, simply change the window (**RANGE**) values. When it regraphs on a different window, the bounds will be erased.

On the **TI86**, once on the graph screen (meaning it shows a graph and the menu's first item is "**y(x)=**"), press **MORE**, and then select **MATH**. This opens up a menu, from which you will select **FMIN**. It will ask for a **left bound**, a **right bound**, and then a **guess**. To select the left bound, move the cursor to the left of the vertex and press **ENTER**. To select the right bound, move the cursor to the right of the vertex and press **ENTER**. Then move the cursor somewhere in the middle of the two and press **ENTER** to enter your guess.

It will display the x and y values of the vertex (the minimum point). It will be obvious that you are done because it will read **Minimum** (or **FMIN**) and show the point's coordinates. *What are these values? Round to two decimal places. Draw the graph and plot this point along with its label (in ordered pair notation).*

3. Maximums are found similarly. Notice the same menu from which you got the **Minimum** function also contains the **Maximum** (on the **85** and **86**, **FMAX**) function. We will work with $y = -3.5x^2 + 5x + 2$. (The standard window will be fine.) *Sketch a graph of* $y = -3.5x^2 + 5x + 2$ *and label the vertex in ordered pair notation. Round to two decimal places.*

4. A ball is thrown upward at 30 feet per second from the top of a 50-foot tall building. The ball's height *h(x)* is given by $h(x) = -16x^2 + 30x + 50$ where x is the time in seconds after release. *Sketch a complete graph of this function. Then find the time in which it takes the ball to achieve its maximum height. Also, what is the maximum height achieved by the ball? On your graph, plot and label this maximum point. Round to two decimal places.*

5. The function $y = 5x^3 + 2x^2 - 4x + 3$ has both a maximum and a minimum. Graph it on the window [-5,5]x[-10,10] to get a nice graph. *Draw it below labeling the minimum and maximum in ordered pair notation. Round to two decimal places.*

6. One good reason to find the minimum and maximum points on a graph is to find out where the function is increasing or decreasing. Use interval notation and the x values found above to give the intervals where $y = 5x^3 + 2x^2 - 4x + 3$ is increasing and decreasing.

Increasing:

Decreasing: