Quadratic worksheet NAME:
Maximums and minimums

We will investigate quadratic relationships whose graphs have maximum or minimum *y* values. They are called local or relative maximums or minimums because, compared to other nearby points, they have the largest or smallest *y*-value.

1. Below are two quadratic functions, one with a maximum and one with a minimum. Graph both and label the minimum or maximum. Find these points exactly using the Maximum and Minimum functions on your calculator. Label these points on your graph in ordered pair notation. Round the values to two decimal places. Approximate the *x* and *y* intercepts.

a.) $y = -2x^2 + 3x + 5$	b.) $y = 2x^2 + 3x + 5$

c.) What about the quadratic function's formula tells you if the vertex will be a maximum or a minimum?

2. Algebraically determine the vertex of the quadratic function $y = 3x^2 + 4x - 5$. **Show work.** (You may check your work using the QUADRATC (or QUAD2) program.) Remember the vertex has both an *x* and a *y* value.

3. A rocket is fired at an inclination of 45 degrees to the horizontal, with a muzzle velocity of 200 feet per second. The height *h* of the rocket is given by $h(x) = \frac{-32x^2}{40{,}000} + x$ where *x* is the horizontal distance from the firing point. In setting a good window, it helps to know it finally lands 1,250 feet from the firing point.

a.) Use this information to draw a **complete graph** of the rocket's path.

b.) What is the maximum height the rocket achieves? Plot this point on the graph above and label it in ordered pair notation.

c.) How far from the firing point does the rocket achieve its maximum height?

4. Laquisha has a farm and on this farm she has a cow. She needs to build a rectangular enclosure for her cow. She has 500 feet of fencing, and she will use it all. She wants to make an enclosure with the largest area possible. Let’s figure the dimensions of the enclosure step by step.

a.) First, we need to use the fact that the perimeter (measurement of how far we would walk if we were to walk around the enclosure) is 500 feet. We will use this to figure the relationship between the width and length of the enclosure. **Remember the perimeter of a rectangle is two times the width plus two times the length.** Make a verbal model that describes the relationship between the length and the width of the enclosure. Use x to represent the width. Then use your verbal model to write an expression for the length in terms of the width, x. Simplify it as much as you can.

b.) **The area of a rectangle is length times width.** Use x for width and your expression for length to write an equation for area in terms of width, $A(x)$ = ???.

c.) This area function is what we want to maximize. (Notice the coefficient of the x^2 term is negative and so will result in a maximum on the graph.) So graph it and find the maximum. Show the graph with the maximum labeled. What should the dimensions of the enclosure be to maximize the area?

5. Let’s summarize the facts about quadratic function vertices.

a.) How do you tell if the vertex of a quadratic function $y = ax^2 + bx + c$ will be a maximum or a minimum?

b.) How do you find the x-value of the vertex of the function $y = ax^2 + bx + c$?

c.) Once you know the x-value of the vertex, how do you find the corresponding y-value?