PRECALCULUS
WORKSHEET ON OPTIMIZATION

Steps for Solving Optimization Problems:
1) Read the problem.
2) Sketch a picture if possible. Label the picture, using variables for unknown quantities.
3) Write a function, expressing the quantity to be maximized or minimized as a function of one or more variables.
4) If your function has more than one independent variable, write an equation relating the independent variables.
5) Determine the domain of the independent variable (the values for which the stated problem makes sense.)
6) Determine the maximum and minimum values by using your graphing calculator. Draw a sketch of the function you used, label your answer on your sketch, and then write your answer in a sentence.

In each of the following, write a function in one variable, and then use your calculator to find the answer. Draw a sketch of the function you used, label your answer on your sketch, and then write your answer in a sentence. The functions represented below are either polynomial or rational functions.

1. An open box is to be made from a rectangular piece of cardstock, 8.5 inches wide and 11 inches tall, by cutting out squares of equal size from the four corners and bending up the sides. Find the maximum volume that the box can have. What size squares should be cut to create the box of maximum volume?
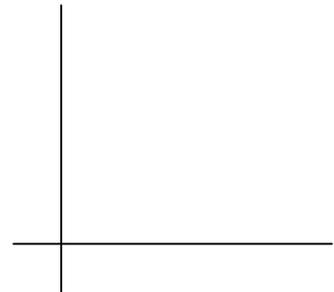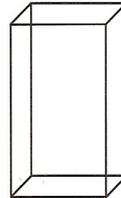
2. A farmer has 120 feet of fencing with which to enclose two adjacent rectangular pens as shown. What dimensions should be used so that the enclosed area will be a maximum? What will the area be?
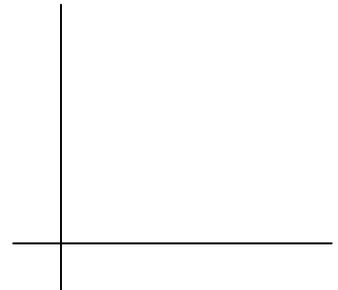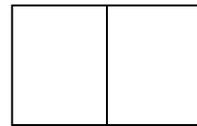
3. A closed box with a square base must have a volume of 5000 cu. cm. Find the dimensions of the box that will minimize the amount of material used.
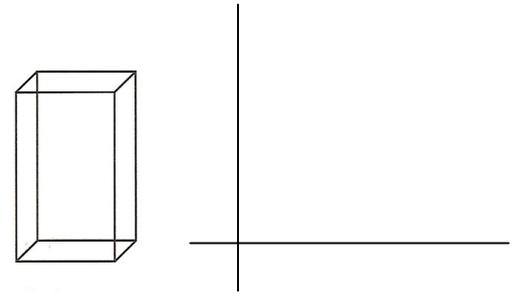
4. A cylindrical can with closed bottom and closed top is to be constructed to have a volume of one gallon (approximately 231 cubic inches). The material used to make the bottom and top costs $0.06 per square inch, and the material used to make the curved surface costs $0.03 per square inch. Find the radius and height of the can that minimize the total cost, and determine what that minimum cost is.

5. A rancher has 180 feet of fencing with which to enclose four adjacent rectangular corrals as shown. What dimensions should be used so that the enclosed area will be a maximum? What will the area be?

6. A rectangle is bounded by the x-axis and the semicircle $y = \sqrt{25 - x^2}$ as shown. What length and width should the rectangle have so that its area is a maximum?