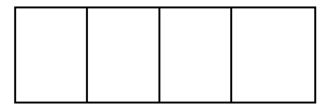
Name: ______________________ **Precalculus Unit 4, Lesson 4A**

Aim: How do we solve optimization problems involving volume and surface area?

I. Do Now:

1. 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?



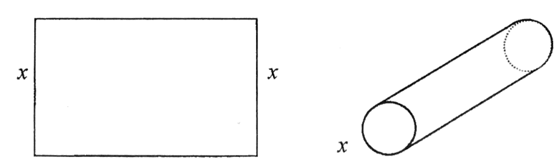
II. Steps for Solving Optimization Problems:

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.

III. Applications Involving Volume and Surface Area

2. A rectangular piece of sheet metal with perimeter 50 cm is rolled into a cylinder with open ends. The side with length x is the circumference of the base.
   (a) Express the area of the base as a function of x.
   (b) Express the volume of the cylinder as a function of x. Then, state the domain of this function.
   (c) Find the value of x, to the nearest hundredth, that maximizes the volume.
   (d) Find the maximum volume, to the nearest hundredth.



3. A closed box with a square base must have a volume of 5000 cubic 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 will minimize the total cost, and determine what that minimum cost is.