Worksheet #20: Min/Max Problems

April 20, 2005

When we hear the question "what is the maximum (or minimum) value that a function obtains", you should be thinking: *Min's and Max's occurs at a function's critical points and critical points are where the derivative equals zero.* The question might be asked in different ways, but look for the key words: most, least, best, and worst. One important point: you need to have the function in terms of one variable, so you can take its derivative.

Question: A 12 ounces can of coke holds approximately 360 ml of liquid. What are the best dimensions for the coke can in order to minimize the cost of the can? Assume all sides of the can cost the same.

- Draw some pictures. One picture should be of a three-dimensioal can and the other should be the three two-dimensional (circles and rectangle) components that make up the can.
- Identify your variables. What are the units that you will be using? You can control the radius of the can and its height. But you can not make the can too big. Why not? Once the radius and height are set, the surface area (or cost) can be determined.
- What is your constraint? Can the can have radius 10 cm and be 30 cm tall? In this problem, what is the equation that you are force to honor?
- What is the formula for the surface area of the can? In this problem, why is minimizing the surface area the same as minimizing the cost of the can?
- Re-write the cost function in terms of the radius. How do you get rid of the height variable?
- Minimize this function. What is the radius of the can that minimizes the cost? What is the height?

Question: A 12 ounces can of coke holds approximately 360 ml of liquid. What are the best dimensions for the coke can in order to minimize the cost of the can if the top of the can cost twice as much as the rest of the sides?

- What is your constraint?
- What would be the new formula for the cost if the top cost twice as much as the rest of the sides of the can?
- Re-write the cost function in terms of the radius. How do you get rid of the height variable?
- Minimize this function. What is the radius of the can that minimizes the cost? What is the height?
- Is this can taller or shorter than one in the first problem?