Lecture Outline (Optimization I)
Wednesday, February 27

Announcements

1. Midterm 2 is on Thursday, 2/28/08, 7:00-9:00 PM in Herrin T175.

2. A review session will be held Wednesday, 2/27/08, at 7:00 in 380W.

Example:
A crazy billionaire gives you 10 meters of gold wire and asks you to construct a rectangle with maximum area. If you succeed, he’ll give you $1,000,000. What rectangle will you construct? What will be its dimensions and area?

Solution: The maximum is when x=5/2 - i.e. a square.

Optimization Problems - On closed intervals

Today we’re going to discuss how to apply the ideas of calculus to optimization problems. These problems fall into two general categories: those which require optimization of a cts fcn on a closed interval, and those which require optimization of a cts fcn on an open interval. The previous example is an example of the former. Let’s discuss strategies that work for the former type.

An optimization problem is essentially a word problem which asks you to maximize or minimize a certain quantity. In this regard, they are incredibly similar to the sorts of problems we’ve been doing in the last few days. Nearly all optimization problems can be solved by employing the following strategy:

1. Read and re-read the problem until you understand it. In particular, make sure you know the quantity you’re being asked to maximize or minimize.

2. Draw and label a picture which gives the relevant information.

3. Write equations that describe

   (a) the quantity that you’re attempting to maximize/minimize in terms of the other variables which appear in your drawing, and
(b) the constraints that your variables must obey.

4. Solve Equation (b) for one of the variables, and plug this result back into Equation (a).

5. Determine the domain of your function. This is very important!

6. If you have a continuous function on a closed interval, use the Extreme value theorem to find the absolute maximum or minimum of the quantity you’re looking for.

**Examples**

A piece of wire 12m long is cut into two pieces. One piece is bent into a square and the other is bent into an equilateral triangle. How should the wire be cut so that the total area enclosed is (a) a minimum and (b) a maximum? (Note: it is allowed to not cut at all, but instead to use all of it to construct either a square or a triangle.)

*Solution:*