Calculus Lab 5

1 November 2006

Work in pair or individually, as you wish. When you are done, I would suggest printing out your work and/or emailing it to yourself. You will likely want to refer to this stuff when doing later homework problems.

This lab is based on an exercise described on "Lesson #74 Introduction to Applied Maximum Minimum Problems," `http://www.pen.k12.va.us/Div/Winchester/jhhs/math/lessons/calculus/day74.html`, accessed 31 October 2006.

Goals:

- Practice formulating and solving min-max optimization problems.
- Gain further experience using Maple to take derivatives and analyze functions.

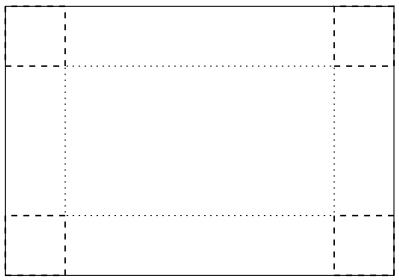

Figure 1: Making a box from a piece of paper.

Suppose you need to make a box out of a piece of paper that is 8.5 by 11 inches. To make the box, you must cut four identical squares off of each corner, as shown in Fig. 1. Once the squares are gone, fold along the dotted lines. Affix the edges with scotch tape. The result should be a rectangular box that is open on the top.

1. Your goal is to make such a box that has the maximum volume. What size squares should you cut out from the paper? Make a reasonable guess, cut out the squares and build a box.
2. Measure the volume of the box you just built.
3. Write an expression for the volume V of the box as a function of x, the length of the side of the squares that are removed.
4. Use Maple to plot $V(x)$.
5. What value of x maximizes $V(x)$? I'd suggest using Maple to help you with the algebra.
6. How close is your box to the optimal one?