MATHEMATICS 1000 (Calculus I)
Optimisation Problems

The following problems will be covered during regular lectures.

1. A farmer with 120 feet of fencing wants to enclose a rectangular area and then divide it into two pens with fencing parallel to one side of the rectangle. What is the largest possible total area of the two pens?

2. A closed cylindrical can is to hold 2π litres of liquid. How should we choose the height and the radius of the can in order to minimise the amount of material needed for its manufacture?

3. An open-topped box is to have a volume of 20 m^3. All the sides of the box are rectangular, and its length is to be twice its width. Material for the base of the box costs $12 per square metre, while material for the sides costs $4 per square metre. Find the cost of the materials for the cheapest such box.

4. Marshall Wyatt Earp is closing in fast on that infamous outlaw, Johnny Ringo. But Ringo knows that there's a hiding place on the opposite side of the San Pedro River, 5 miles downstream from his current position. All along this stretch, the river is 1 mile wide. Ringo can swim at 2 miles per hour and run at 3 miles per hour. To one decimal place, how far downriver should Ringo come ashore in order to reach the hiding place as quickly as possible?

The following problems will be covered during Tutorial #8 (time permitting).

1. A farmer wants to fence in a rectangular plot of land, the area of which is 2400 m^2. She wants to use additional fencing to build four internal divider fences, all parallel to the same side of the fence. What is the minimum total length of fencing that this project will require?

2. Four metres of wire is to be used to form a square and a circle. How much, if any, of the wire should be used for the square and how much, if any, should be used for the circle in order to enclose the maximum total area?