3.3 Optimization

The word "optimization" carries with it a number of meanings. In Mathematics, to **optimize** means to **find the "best" solution** to some real world problem. In terms of functions, the best solution is most often **a maximum or a minimum.**

Some argue that optimal method for learning about optimization is by simply jumping in and doing it. And so…

An Algorithmic Procedure for finding the Extrema of Functions

1. **Read** the problem carefully and determine what aspect of reality is being optimized.

2. **Write down all relevant functions and/or equations** which describe the problem. Pictures will help! (keep in mind "intervals of existence")
   2.1. **Note**: The function you wish to optimize may have two independent variables. You need to reduce to a single independent variable by using some "additional information".

3. **Differentiate the function** which is describing the problem **and find the critical values** (where the derivative is zero.)
   3.1. **Note**: The critical values will be at either a max or a min. We need to figure out which we have!

4. **Test the critical values** (and endpoints for a closed domain) to **determine the optimal value.**

5. **ANSWER THE QUESTION** (This may seem obvious, but make sure you answer the question that is asked!)

Example 3.3.1

From your text – Pg. 145 #3

A farmer has 600 m of fence and wants to enclose a rectangular field beside a river. Determine the dimensions of the fenced field in which the maximum area is enclosed. (Fencing is required on only three sides: those that aren't next to the river.)

Example 3.3.2

From your text – Pg. 146 #9

The volume of a square-based rectangular cardboard box needs to be 1000 cm^3. Determine the dimensions that require the minimum amount of material to manufacture all six faces. Assume that there will be no waste material. The machinery available cannot fabricate material smaller than 2 cm in length.

Class/Homework for Section 3.3

Pg. 145 #4 - 8