MA104 - WPR II Topics

J. Fuselier

1. Maximums, Minimums, etc.

   - Know how to define *local* maximum and minimum of a function.
   - Know how to define *absolute* (or global) maximum and minimum of a function.
   - Know how to define a critical number for a function, and how to find the critical numbers for a function.
   - Know what the Extreme Value Theorem says (including which types of functions it applies to).
   - Know what Fermat's Theorem is, and how it relates to critical numbers.
   - Be able to find the absolute maximum and absolute minimum of a continuous function on a closed interval (i.e. be able to execute the Closed Interval Method given in your textbook).
   - Know the definitions for concave up, concave down, and inflection point. Also be able to identify these graphically.
   - Understand how the graph of a function relates to the graph of its derivative. For example, if f is increasing, what does that mean about f'? We made a table cataloging this type of information during Lesson 16.
   - Understand what the second derivative tells us about the original function and about the first derivative. This could be graphically, or just in understanding how to interpret different types of rates of change. Again, see our table from Lesson 16.
   - Be able to classify critical numbers as local max/min by applying the First or Second Derivative Tests, and by using a graph.
   - Be able to sketch
     - f given f'
     - f' given f
     - f'' given f'

2. Optimization

   - Be able to realize when a word problem is an optimization problem, by looking for words such as "largest, smallest, least, most, cheapest, etc."
   - Set up your optimization problem by
     - Writing down the function you want to maximize or minimize. (This is called the *objective function.*)
     - Using some extra information (often called a *constraint*) to write your objective function in terms of only *one* variable.
   - Maximize or minimize your objective function using the techniques mentioned in the above section. **It is essential that you show your work, even if you have Mathematica do the calculations for you!**
   - Remember to check that your answer makes sense, and is actually the type of extreme value you are looking for. Also, remember to be sure you are answering all the questions you have been asked, and include units if appropriate!

3. Implicit Differentiation and Related Rates

- Know the difference between an explicitly and implicitly defined function.
- Know how to find the derivative of an implicitly defined function using implicit differentiation. (Don't forget the chain rule!!)
- Be able to recognize a word problem as being a related rates problem, by looking for words that give information on how quantities in some scenario are changing.
- Use the steps we talked about in Lesson 23 to set up and solve your problem. Remember the following hints:
  - Identify all the quantities that are changing over time in the problem, and give them names.
  - Don't plug in specific numbers that are given in the problem until *after* you have set up your relating equation and taken the derivative. (The only exception to this is if you are given a number that stays the same for every point in time for the scenario.)
  - It is possible you may need some trick (similar triangles, etc) to simplify your relating equation. Keep an eye out for this! (See #23 in section 3.9, for example.)