Math 141- Review Sheet for 1st Exam

The first exam is Monday Sept. 26 and will cover all of Chapter 2. (plus 1.1-1.4 is assumed) and section 3.1. As a good first step make sure you understand all the quiz problems and homework problems! This sheet is designed to help you organize your studying, not to be exhaustive.

Definitions to know:
- Average rate of change vs. instantaneous rate of change.
- Slope of secant line vs. slope of tangent line.
- Formal definition of limits, one-sided limits, infinite limits and limits at infinity.
- f(x) is continuous at x=a, discontinuous at x=a.
- Continuous from the left, continuous from the right.
- Jump discontinuity, removable discontinuity, infinite discontinuity.
- Continuous on a closed interval.
- Horizontal, vertical asymptotes.
- Definition of the derivative of a function.
- f(x) is differentiable at a, differentiable on an open interval.
- Vertical tangent line.
- Second derivative.

Theory to Know:
- Limit laws for functions, understand them and when to apply.
- Formal definition of a limit.
- Squeeze theorem.
- Continuity theorems that arise from limit theorems (e.g. 2.5 Thms 4, 5, 6,7, 9)
- Intermediate value theorem.
- Understand how a function may fail to be differentiable.
- Differentiability implies continuity (Thm 4 p.156).
- Understand the different interpretations of the derivative (velocity, instantaneous rate of change, slope of the tangent) and also higher derivatives (acceleration for example).

Skills you should have:
- Calculate limits of functions given graphs and/or formulas.
- Sketch a graph of a function given specified limits and/or values.
- Formally prove limits exist for linear functions (e.g. p.114 #19, 20).
- For other functions, given an ε show how to obtain a δ.
- Determine where a function is continuous and describe its discontinuities given either a graph or formula.
- Apply the intermediate value theorem (for example to show roots must exist).
- Calculate average and instantaneous rates of change and slopes of tangent lines using limits.
- Find horizontal and vertical asymptotes.
- Give an example of a function with prescribed horizontal or vertical asymptotes.
- Calculate the derivative of a function *from the definition*. (e.g. p.155 ex #4, p.162 #21-31)
- Given the graph of y=f(x), sketch the graph of its derivative, and vice versa.
- Solve homework problems!
- I highly recommend the review on page 165-168, especially the true-false questions. I like to give true-false questions to test understanding of theory!
- Calculate derivatives of polynomials using the rules in 3.1
- Find the equation of tangent lines to a graph y=f(x).