

## Math 141- Review Sheet for 1<sup>st</sup> Exam

The first exam is Monday Sept. 25 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.
- Greatest integer function
- $f(x)$  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.158).
- 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.117 #19, 20).
- For other functions, given an  $\epsilon$  show how to obtain a  $\delta$  (p117 #6, 7).
- 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.
- Calculate the derivative of a function *from the definition*. (e.g. p.155 ex #2, p.163 #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 166-169, 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  $y=f(x)$ .