College of the Holy Cross, Fall Semester, 2018
Math 135, Course Review Sheet (Professor Hwang)

The Registrar has scheduled the final exam for Tuesday, December 11, at 11:30 AM.

The final exam is cumulative, but will generally emphasize Chapters 3 and 4, since most of the ideas of the course get used there. Your best study strategy is to work lots of examples (suggested odd-numbered book problems, practice and group worksheets, midterm review sheets) referring to your notes and the textbook as needed, but as little as possible. When you can quickly and reliably work problems without assistance, you should be well prepared.

The major ideas and techniques in the course are listed below. You should not try to memorize everything, but instead try to interrelate the pieces of the course and understand why formulas work out the way they do and when they are applicable.

Chapter 1

Absolute values, distance on the number line; functions and graphs; linear functions, the quadratic formula, power functions and polynomials; trig functions and the unit circle; exponential and logarithmic functions and their properties; inverse functions and miscellaneous examples (floor, ceiling, signum).

Chapter 2

Rates of change, increments and secant slopes; limits and algebraic tricks for evaluating them, algebraic rules for working with limits; the basic examples

$$\lim_{h\to 0}\frac{e^h-1}{h}=1,\qquad \lim_{h\to 0}\frac{\sin h}{h}=1,\qquad \lim_{h\to 0}\frac{1-\cos h}{h}=0;$$

the squeeze theorem; one-sided limits, continuity, piecewise functions; infinite limits, limits at infinity; the intermediate value theorem and applications.

Chapter 3

Derivatives and the slope of the tangent line; the "linear approximation" characterization of the derivative: f is differentiable at a with derivative $f'(a)$ exactly when

$$f(x)=f(a)+f'(a)(x-a)+E(x),\quad \text{with}\quad \frac{E(x)}{x-a}\to 0 \text{ as } x\to a;$$

tangent lines at general points; formulas for differentiating power, exponential, log, and trig functions; derivative rules for sums, constant multiples, products, quotients, and compositions (the chain rule); patching functions to make them continuous or differentiable; the sign of the first or second derivative and the shape of a graph; implicit differentiation, derivatives of inverse functions.

Chapter 4

Using the tangent line to approximate the values of a function; the extreme value theorem; using derivatives to find local and global minima and maxima of a function; the statement of the mean value theorem; optimization word problems; Newton's method (repeated linear approximation to find roots of an equation).