Objectives for Math 165

1 Limits

1. Use graphical and numerical evidence to estimate limits and identify situations where limits fail to exist.

2. Apply rules to calculate limits.

3. Use the limit concept to determine where a function is continuous.

2 Derivatives

1. Use the limit definition to calculate a derivative, or to determine when a derivative fails to exist.

2. Calculate derivatives (of first and higher orders) with pencil and paper, without calculator or computer algebra software, using:

   (a) Linearity of the derivative;
   (b) Rules for products and quotients and the Chain Rule;
   (c) Rules for powers, trigonometric and inverse trignometric functions, and for logarithms and exponentials.

3. Use the derivative to find tangent lines to curves.

4. Calculate derivatives of functions defined implicitly.

5. Interpret the derivative as a rate of change.

6. Solve problems involving rates of change of variables subject to a functional relationship.

7. Approximate functions by using linearization (differentials).
3 Applications of the Derivative

1. Find critical points, and use them to locate maxima and minima.
2. Use the first derivative to determine where a function is increasing or decreasing.
3. Use second derivatives to determine concavity and find inflection points.
4. Apply the first and second derivative tests to classify critical points.
5. Use critical points and signs of first and second derivatives to sketch graphs of functions.
6. Use Differential Calculus to solve optimization problems.
7. Apply the Mean Value Theorem.
8. Use Newton’s method to improve approximate roots of equations.

4 The Integral

1. Find antiderivatives of functions; apply antiderivatives to solve separable first-order differential equations.
2. Use the definition to calculate a definite integral as a limit.
3. Apply the Fundamental Theorem of Calculus to evaluate definite integrals and to differentiate functions defined as integrals.
4. Use substitution to evaluate integrals.

5 Transcendental Functions

1. Use the relation between the derivative of a one to one function and the derivative of its inverse.
2. Calculate with exponentials and logarithms to any base.
3. Calculate derivatives of logarithmic, exponential and inverse trigonometric functions; interpret and apply such derivatives as usual.
4. Use logarithmic differentiation.
5. Use models describing exponential growth and decay.