MTH 200 APPLIED CALCULUS – Course Objectives (revised 1/07)

Students will be expected to demonstrate an intuitive understanding of the principal ideas of differential and integral calculus. Students will also be expected to use calculus in solving problems from areas including business, economics, and the social and natural sciences. A comprehensive departmental final exam testing the degree of mastery of the following course objectives is required.

0. Students are expected to review Algebra skills as needed. (i.e. exponent rules, factoring, solving equations, . . .)

1. Algebra
   - 1.1 Solve application problems involving profit, cost, revenue, demand, and supply functions.
   - 1.2 Use the compound interest formula to solve problems.
   - 1.3 Review graphing quadratic polynomial, exponential, logarithmic, and piecewise functions.
   - 1.4 Obtain linear and quadratic functions using modeling.

2. Limits and Continuity
   - 2.1 Write an intuitive, precise English definition of a limit, e.g., Def'n: $\lim_{x \to a} f(x) = L$ means "f(x) can be made arbitrarily close to L by making x sufficiently close, but not equal to a."
   - 2.2 Write an intuitive, precise English definition of a continuity, e.g.,
     Def'n: Continuity
     Numerical: "A function is continuous over an interval I if the limit of the function is the same as its function value for each value of x within the interval I."
     Graphical: "a continuous function is one whose graph can be drawn without lifting pencil from paper."
   - 2.3 Evaluate limits of functions numerically and graphically.
   - 2.4 Evaluate limits of functions algebraically using algebraic rules.
   - 2.5 Determine whether a function is continuous at a point c.

3. Derivatives
   - 3.1 Explain average rate of change and instantaneous rate of change.
   - 3.2 Compute average rate of change (slope of secant line) using a simplified difference quotient.
   - 3.3 Write the definition of the derivative of a function and find the derivative of a polynomial function using the definition. $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$, provided the limit exists.
   - 3.4 Differentiate powers of x, exponential (e^x) and logarithmic (*ln x)* functions.
   - 3.5 Differentiate sums and differences, products and quotients, and composite functions.
   - 3.6 Determine higher order derivatives.

4. Applications of Derivatives
   - 4.1 Find slopes and equations of tangent lines at a given point.
   - 4.2 Find points where the tangent line is horizontal or has slope equal to a specified value.
   - 4.3 Determine marginal cost, revenue and profit functions.
   - 4.4 Find relative extrema and points of inflection of a function.

4.5 Demonstrate and explain the relationship between the graph of a polynomial function and its first and second derivative.
4.6 Use first and second derivative information to sketch the graph of polynomial functions.
4.7 Determine absolute extrema of a function.
4.8 Solve problems involving rectilinear motion.
4.9 Solve optimization problems from several areas including business, economics and the social and natural sciences.

5. Exponential and Logarithmic Functions
   5.1 Review the properties of and the relationship between exponential and logarithmic functions.
   5.2 Differentiate e^x, $e^{f(x)}$, ln x, and ln f(x).
   5.3 Solve growth and decay application problems.

6. Antiderivatives
   6.1 Write and apply the definition of an indefinite integral.
   6.2 Determine general antiderivatives using basic integration formulas and rules.
   6.3 Use an initial condition to find a particular solution to the equation y = $\int f(x)\,dx$ and to solve application problems.

7. Integration
   7.1 Write and apply the definition of a definite integral.
   7.2 Use basic formulas along with rules including: substitution, integration by parts*, and table of integrals, to evaluate both definite and indefinite integrals of appropriate polynomial, algebraic, exponential, and logarithmic functions.

8. Applications of Integration
   8.1 Apply integration techniques to finding the area under a curve and the area between two curves.
   8.2 Solve problems involving rectilinear motion.
   8.3 Solve problems involving average value of a function over a closed interval.
   8.4 Determine consumer's and producer's surplus at the supply/demand equilibrium point.
   8.5 Solve applications using the models $\int_0^T P_0 e^{\pm kt}\,dt$.
9. Functions of Two or More Variables
   9.1 Evaluate functions of several variables.
   9.2 Determine partial derivatives and second order partial derivatives.
   9.3* Solve multivariable optimization problems using the D-Test.

** Not yet approved by the Mathematics Department, but it is recommended these topics be covered.*