Spring 1999

Math 215 – APPLIED CALCULUS I (4)

Basic concepts; differentiation, differential equations and integration with applications directed primarily to the life sciences.

Pre: C or better in 140 or precalculus assessment.

0. (Re)introduction to function theory (1 week)

A. We review polynomial (especially linear) functions, logarithms, exponentials and to some extent trigonometric functions. Special attention will be paid to the graphs of these functions.

B. The concept of composition of functions and inverse function is also considered again.

C. New topics introduced here may include boundedness, continuity, limits at infinity, monotonicity, local and absolute extremes and concavity of functions.

1. Differentiation (8 weeks)

A. We define and give several interpretations to the idea of differentiation. Differentials are used to approximate the change in the value of a function.

B. The derivative of most of the functions considered in section 0 are introduced. Some of these derivatives will be computed using the definition; others will simply be given and these formulas will be supported by computer experimentation. If subsequently a more rigorous justification of any of these latter formulas is possible then it will be given.

C. The standard rules for differentiating sums, products, quotients and composition of functions are presented. The chain rule is used to obtain the derivative to the inverse of a differentiable function.

D. The Mean Value Theorem is presented and used. In particular, we will show that antiderivates are determined up to an additive constant.

E. Applications of differentiation are considered. In particular, properties of the graphs of functions and optimization are studied.

F. The study of differential equations is begun; we examine exponential growth and decay, the logistic differential equation and perhaps separation of variables. Also Euler's method can be introduced and used as the basis for numerical studies.

G. Partial differentiation could be introduced here.

2. Integration (5 weeks)

A. We define and give several interpretations to the idea of integration. Numerical methods of integration are considered.

B. The Fundamental Theorem is presented and used.

C. The standard integration rules are studied, in particular, substitution and integration by parts.

D. Applications of integration are introduced.

E. Improper integrals are defined and computed.

3. Introduction to calculus of several variables (2 weeks)

A. Partial derivatives are introduced.

B. As an application we could consider optimization problems in 2 variables.

Various topics in this course will be supplemented by work in a computer lab that will meet once each week. Obvious examples are numerical integration and solving differential equations using Euler's method. Also the students will be introduced to a symbolic manipulation package by means of which they will be able to algebraically (or formally) differentiate and integrate functions.