

MATHEMATICS 121 Differential Calculus CALCULUS AND ANALYTIC GEOMETRY I

I. Introduction

A. Catalog Description

There are two main topics in the calculus for functions of one variable: differentiation and integration. Math 121 focuses on differentiation starting with limits and continuity, then introducing the derivative, and finishing with applications of the derivative in a variety of contexts. The central ideas are explored from the symbolic, graphic, numeric, and physical model points of view. Use is made of graphing calculators. *Prerequisite: Mathematics 111, or its equivalent.* Satisfies the Mathematical Reasoning core requirement.

B. Objectives

The primary goal for students in this course is to appreciate the power and the beauty of the calculus. Students will study concepts, techniques, and applications connected to the central ideas of function, limit, continuity, and derivative. Students will also sharpen their critical thinking, logical reasoning, and problem solving skills.

This course satisfies the Mathematical Approaches category of the university's core curriculum by developing an appreciation of the power of Mathematics and formal methods to provide a way of understanding a problem unambiguously, describing its relation to other problems, and specifying clearly an approach to its solution. A student in this course will develop a variety of mathematical skills, an understanding of formal reasoning, and a facility with applications. Specifically, this course will develop the study of formal logic, at least to the extent that is required to understand mathematical proof.

C. Prerequisites - Mathematics 111, or its equivalent.

II. Required Topics

A. Functions

1. Definition and notation
2. Representations of functions
3. Classes of elementary functions

B. Limits

1. Definition of limit
2. Properties
3. Techniques for analyzing limits

C. Continuity

1. Definition of continuity
2. Techniques for analyzing continuity
3. Intermediate Value Theorem
4. Extreme Value Theorem

II. Required Topics (continued)

D. Differentiation

1. Differentiable functions and derivatives
2. Derivative theorems (constant factor, sum, product, quotient, chain rule)
3. Interpretations of the derivative (slope and velocity)
4. Notation for derivatives
5. Tangent line approximation
6. Implicit differentiation
7. Higher derivatives
8. Mean Value Theorem

E. Applications of differentiation

1. First derivatives and increasing vs. decreasing
2. Second derivatives and concavity
3. Optimization
4. Related rates

III. Bibliography

G. L. Bradley & Calculus
K. J. Smith,

Thomas Dick & Charles Patton, Calculus of a Single Variable

A. Ostebee and P. Zorn, Calculus

D. Hughes-Hallett & Calculus
A. Gleason,

J. Stewart Calculus