

## Calculus B/C course outline

### UNIT 1: Limits and Their Properties

An Introduction to Limits

Properties of Limits

Techniques for Evaluating Limits: Graphical, Numeric, Analytic

Continuity and One-Sided Limits

Intermediate Value Theorem

Infinite Limits

### UNIT 2: Basic Differentiation

The Derivative and the Tangent Line Problem

Local Linearity

Basic Differentiation Rules and Rates of Change

The meaning of derivative: graphically, numerically, and analytically

Derivatives algebraically

Differentiability and Continuity

The Product/Quotient Rules, Higher-Order Derivatives

The Chain Rule

Implicit Differentiation

Related Rates

### UNIT 3: Differentiation: applications

Extrema on an Interval

Rolle's Theorem and the Mean Value Theorem

Increasing and Decreasing Functions and the First Derivative Test

Concavity, points of Inflection, and the Second Derivative Test

Limits at Infinity

A Summary of Curve Sketching: the graphs of  $f$ ,  $f'$ , and  $f''$

Optimization Problems

Linearization

### UNIT 4: Integration/Antidifferentiation

Area under a curve: Analytical and numeric antidifferentiation

Antiderivatives and Indefinite Integration

Area

Riemann Sums and Definite Integrals

The Trapezoidal Rule

The Fundamental Theorem of Calculus

Integration by Substitution

The 2nd Fundamental Theorem of Calculus and the Mean Value

Theorem for Integrals; the Average Value of a Function

Numerical Integration and tables

### UNIT 5: Log, Exp, and Other Transcendental functions

The Natural Logarithmic Function and Differentiation

The Natural Logarithmic Function and Integration

Inverse Functions

Exponential Functions: Differentiation and Integration

Bases Other than e and Applications

Seperable Differential Equations

Growth and Decay; Logistic Growth

Inverse Trigonometric Functions and Differentiation

Inverse Trigonometric Functions: Integration and Completing the Square

### UNIT 6: Integration Applications

Area of a Region Between Two Curves

Volume: The Disc Method

Volume: Cylindrical Shells

Volume: A Solid with Known Cross-section

Arc Length and Surfaces of Revolution

Moving Particles: an Application

### END OF FIRST SEMESTER

### UNIT 7: Other Advanced Techniques: Integration Etc.

Integration by Parts

Trigonometric Integrals

Trigonometric Substitution

Partial Fractions

Growth and Decay, logistic growth equations revisited

Euler's Method

Slope Fields

Tables and Other Techniques

L'Hôpital's Rule

Improper Integrals

### UNIT 8: Sequences and Series; Taylor and Maclaurin Polynomials

Sequences

Series

Convergence or Divergence: p-Series; Integral Test

Comparison Test

Alternating Series

Ratio and Root Tests

Taylor and Maclaurin polynomials and Lagrange Remainders – Taylor's Theorem

Power Series and radius or interval of convergence

Functions as Power series

UNIT 9: Parametric Equations, Polar graphs, and Vector-valued  
Functions

Parametric equations and plane curves

Calculus of parametric equations

Polar Coordinates and Polar Functions

Calculus of polar functions

Introduction to Vectors in Calculus

AP Calculus Exam – Thursday May 5<sup>th</sup>, 2016