361 CALCULUS

GRADE: 11 and 12

LEVEL: Honors

CREDITS: 5/5

PRE REQUISITE: A grade of "B" or better in Pre Calculus 360 or department Chairperson recommendation

BASIC TEXT: Calculus Graphical, Numerical and Algebraic
Finney, Thomas, et al. Addison Wesley, 1995

SUPPLEMENTAL READINGS: None

REQUIRED MATERIALS: Writing Utensils, Notebook, Graphing Calculator

COURSE DESCRIPTION

This course is intended for capable math students who are planning careers in mathematics, science or engineering fields. It is a rigorous course which includes the study of limits, derivatives, integrals and their applications.

MISSION RELATED GOALS:

This class will provide the student with a variety of opportunities to demonstrate academic excellence and intellectual curiosity by communicating effectively, solving complex problems, and working with others toward a common goal.

STUDENT EXPECTATIONS FOR LEARNING ADDRESSED:

Students will be afforded opportunities to apply mathematical concepts to real-world applications. A variety of teaching methods will be used to foster an environment that promotes self-confidence and respect for others throughout the school and global community.

GENERAL PERFORMANCE OBJECTIVES:

The student will be able to:

1. Gain a solid foundation in the study of elementary functions;
2. Develop techniques in differential and integral calculus;
3. Apply the techniques acquired to problem-solving strategies in a variety of situations;
4. Connect and integrate the calculus to real world situations;
5. Use technology to develop concepts and investigate theory;

6. Benefit from on going review and self-evaluation

MASSACHUSETTS FRAMEWORK STRANDS:

This course goes beyond the frameworks set by the state. All students will have already completed each strand as a pre-requisite for this course.

CURRICULUM FRAMEWORK LEARNING STANDARDS:

This course goes beyond the frameworks set by the state. All students will have already completed each strand as a pre-requisite for this course.

UNITS AND THEMES:

I. Introduction – Review (8 days)
II. Limits (8 days)
III. The Derivative (10 days)
V. Application of Derivatives (14 days)
V. Integral Calculus (14 Days)
VI. Applications of Definite Integrals (12 days)
VII Transcendental Functions (10 days)
VIII Review, Mid-Term Finals (4 days)

COURSE OUTLINE:

I. Introduction – Review (8 days)

A. Linear Functions
B. Geometric Transformations of Graphs
C. Trigonometry Topics

II. Limits (8 days)

A. Intuitive Concept of a Limit
B. Continuity
C. Algebraic Limits
D. Trigonometric Limits
E. Limits Involving Infinity

III. The Derivative (10 days)

A. Average Rate of Change of a Function
B. Definition of Derivative
C. Differentiation Rules
D. Applications Involving Velocity
E. Implicit Differentiation
F. Tangent Line Approximations (Linearization)

IV. Application of Derivatives (14 days)

A. Maxima, Minima and the Mean Value Theorem
B. First and Second Derivative Tests
C. Optimization
D. Rational Functions
E. Radical and Transcendental Functions
F. Related Rates of Change
G. Mathematical Modeling and Anti-derivatives

V. Integral Calculus (14 Days)

A. Area Using Rectangle Approximation Methods
B. Definite Integrals
C. Anti-derivatives
D. The Fundamental Theorem of Calculus
E. Solving Initial Value Problems using Indefinite Integrals
F. Substitution Method for Integrals
G. Approximation Methods (Trapezoid Rule)

VI. Applications of Definite Integrals (12 days)

A. Area Between Curves
B. Volumes using Disks
C. Volumes using Washers (Horizontal)

VII Transcendental Functions (10 days)

A. The Natural Logarithm
B. The Exponential Function
C. Other Exponential and Logarithmic Functions
D. Exponential Growth and Decay

VIII Review, Mid-Term Finals (4 days)

SUGGESTED INSTRUCTIONAL STRATEGIES:

1. Lecture
2. Written exercises
3. Group Work
4. Projects
5. Use of Manipulatives
6. Use of a Variety of questioning techniques
7. Board Work
8. Calculator Activities
9. Student Presentations
10. A variety of assessment tools

SUGGESTED INTEGRATED ACTIVITIES:

1. Newton's Law of Cooling
2. Volumes of solids of revolution
3. Speed of falling objects
4. Study motion and how the derivative describes position, velocity, and acceleration
5. Exponential Growth and Decay
6. Investment Examples
7. Related rates

USE OF TOOLS/TECHNOLOGY

1. Graphing calculators
2. Computer Generated solids of revolution
3. Multiple overhead transparencies

ASSESSMENT TECHNIQUES

1. Tests
2. Quizzes
3. Partner Quizzes
4. Oral Presentation of Open Response Questions