Advanced Placement Calculus AB Syllabus

I. Purpose and Overview

The overall purpose of this course is to present and reinforce the fundamental principles, concepts, and methods or calculus. In addition, these concepts will be used to establish a common set of uses that apply to both applications and theories. Calculus finds its application and importance in not only higher mathematical studies, but also in physics, engineering, chemistry, finance and economics, among others.

For success in this course, there must be thorough understanding of previous mathematical methods, including, but not limited to, algebra, geometry, and trigonometry. The underlying principles and methods of calculus grow directly from the foundation of the subjects mentioned. Calculus adds to these foundations the concept of the limit process. Understanding the concepts of limits is necessary to understand the fundamental structure of calculus. In fact, the strength and methodology of calculus derives directly from this concept. As a result, all study in this course grows from this understanding. This course will be a combination of lecture and problem solving in applications. The lectures should provide a solid base for the concepts of calculus, and the problem solving provides students the opportunity to further examine and build on these concepts. The course will rely heavily on manual techniques for solving abstract mathematical equations, graphing, and applications. A graphing calculator will be used when it is necessary and when it can help advance learning to the point of gaining proficiency.

II. Student Goals and Objectives

By the end of this course, students should be able to accomplish the following:

- Develop an appreciation and understanding of calculus
- Manipulate various representations for functions and understand the connections between these methods of representations
- Express both and oral and written ability to communicate the principles of mathematics, as well as express an understanding of solutions
- Gain an advanced understanding of the relationship between the derivative and integral as expressed in the Fundamental Theorem of Calculus
- Understand the meaning of the derivative, both in terms of a rate of change and a linear approximation
- Use derivates to solve a variety of problems

- Understand the meaning of the definite integral, both in terms of a limit of Reimann sums and as the net accumulation of a rate of change
- Use integrals to solve a variety of problems
- Express a written description of a physical situation with a function, differential equation, or integral
- Use understanding of calculus principles to determine the reasonableness of provided solutions
- Use graphing calculators, computer software, and other materials to solve, experiment, investigate, and verify concepts
- Show the practical application of derivates and integrals to solve problems taken from theoretical foundations and practical scenarios

III. Required Materials

The textbook for this course is Calculus of A Single Variable (Eighth Edition), written by Ron Larson, Robert Hostetler, and Bruce Edwards. It is published by Houghton Mifflin.

This course will also require use and knowledge of the Texas Instrument TI-83 Plus graphing calculator. This calculator will be provided. Other calculators may be used, provided they have at least the same capabilities as the TI-83 Plus.

IV. Assessments

Students will be graded on daily work and participation. In addition there will be a minimum of two tests per six weeks. In addition, there will be cumulative examinations at the end of each semester. Each examination will assess understanding of all concepts covered to that point.

V. Course and Curriculum Guide

First Six Weeks

The following concepts will be covered:

- Review of the Cartesian Plane and functions
- Graphs of equations
- Lines in the plane
- Functions
- Review of trigonometric functions
- Limits – and introduction
- Properties of Limits

- Techniques for evaluating limits
- Continuity and one-sided limits
- Infinite Limits
- Concepts of differentiation
- Derivatives and tangent lines
- Basic differentiation rules
- Rates of change
- Product and Quotient Rules
- The Chain Rule

Second Six Weeks

The following concepts will be covered:

- Implicit differentiation
- Related rates of change
- Applications of differentiation
- Extrema on an interval
- Rolle's Theorem and Mean Value Theorem
- Increasing/decreasing functions
- The First Derivative Test
- Concavity
- The Second Derivative Test
- Limits at infinity
- Curve sketching – a summary

Third Six Weeks

The following concepts will be covered:

- Optimization problems
- Newton's Method
- Differentials
- Business and economic applications of differentials

Fourth Six Weeks

The following concepts will be covered:

- Anti-derivatives
- Indefinite integration

- Area and integration
- Reimann Sums and definite integrals
- Fundamental Theorem of Calculus
- Integration by substitution
- Numerical integration
- Natural Logarithmic Function and differentiation
- Natural Logarithmic Function and integration
- Inverse function
- Exponential functions
- Bases other than e
- Growth and decay of differential equations

Fifth Six Weeks

The following concepts will be covered:

- Inverse trigonometric functions (differentiation)
- Inverse trigonometric functions (completing the square)
- Hyperbolic functions
- Area of a Region between two curves
- Volume: Disc method
- Volume: Shell method

Sixth Six Weeks

The following concepts will be covered:

- Arc length
- Surfaces of revolution
- Work
- Fluid Pressure
- Fluid Force
- Moments
- Centers of Mass
- Centroids