Course Description

AP Calculus AB focuses on students' understanding of calculus concepts and provides experience with methods and applications. Through the study of the big ideas of calculus (e.g., modeling change, approximation and limits, and analysis of functions), the course becomes a cohesive whole, rather than a collection of unrelated topics. The course requires students to use definitions and theorems to build arguments and justify conclusions. The course features a multi -representational approach to calculus, with concepts, results, and problems expressed graphically, numerically, analytically, and verbally. Exploring connections among these representations builds understanding of how calculus applies limits to develop important ideas, definitions, formulas, and theorems. A sustained emphasis on clear communication of methods, reasoning, justifications, and conclusions is essential. Teachers and students will regularly use technology to reinforce relationships among functions, to confirm written work, to implement experimentation, and to assist in interpreting results. In alignment with the Holy Cross *Portrait of the Crusader*, students solve problems with innovation and imagination, think critically about the synthesis of data, and respond with defendable, original work.

Assessment Practices

Throughout this course, the teacher strives to include varied assessments, including traditional quizzes and tests to measure discrete skills; problem/solution/explanation opportunities where students solve a complex problem and communicate their reasoning; and, AP exam practice questions which are incorporated throughput the course.

Essential Questions
1. How do we represent patterns and operations using limits, derivatives and integrals?
2. How do we interpret and analyze real life situations using calculus?
3. How do we use technology to solve and/or visualize mathematical sentences?

Curriculum Framework

FIrst Quarter:

Summer Work to Reinforce Prerequisite Skills
- Define, apply and interpret the following types of functions and their graphs:
    - Linear
    - Quadratic
    - Higher order polynomials
    - Rational
    - Trigonometric
    - Exponential
    - Logarithmic

Limits and Continuity
- Define limits and continuity
- Apply limit and continuity definition to tables, graphs, and functions
- Remove discontinuities
- Connect limits to horizontal and vertical asymptotes

Differentiation
- Define average and instantaneous rates of change at a point
- Define the derivative of a function and using derivative notation
- Connect the differentiability and continuity
- Define and Apply derivative rules
- Define and Apply the derivative of various functions

Second Quarter:
Differentiation
- Apply the chain rule
- Define and Apply implicit differentiation
- Calculate higher order derivatives

Application of Differentiation
- Interpret the meaning of the derivative in context
- Connect position, velocity and acceleration
- Apply rates of changes in contexts other than motion
- Solve related rates problems
- Approximate values of a function using local linearity and linearization
- Use L'Hospital's rule for determining limits of indeterminate forms

Analytical Applications of Differentiation
- Apply the mean value theorem
- Apply the extreme value theorem
- Determine intervals on which a function is increasing or decreasing
- Define and Apply the first and second derivative tests
- Introduce and solve optimization problems
- Explore behaviors of implicit relations

Third Quarter:
Integration and Accumulation of Change
- Explore accumulation of change
- Approximate areas using Riemann sums, and trapezoidal rule
- Define the definite integral notation
- Define the Fundamental Theorem of Calculus
- Interpret the behavior of accumulating functions involving area
- Apply properties of definite integrals
- Find antiderivatives and indefinite integrals
- Integrate using substitution
- Integrate functions using long division and completing the square

Differential Equations
- Model situations with differential equations
- Verify solutions to differential equations
- Define and apply slope fields
- Find general and particular solutions using separation of variables

Fourth Quarter:

Applications of integration

- Find the average value of a function on an interval
- Connect position, velocity and acceleration function using integrals
- Apply accumulation functions and definite integrals in applied contexts
- Determine the area between curves expressed as a function of x or y
- Determine the area between curves that intersect at more than two points
- Explore and Find volumes with cross sections
- Explore different methods to find volume rotation across x, y or other axis.

Resources

- Calculus Graphical, numerical, algebraic 6th edition- Finney, Demana, Waits, Kennedy, Bressoud
- MyMathLab. (mymathlabforschool.com)
- Graphing Calculator (Recommended TI-84+)
- Desmos application (ISO/Android or web)

Grading

- 20 % MyMathLab
- 80% Student work - assignments and assessments are graded based on a point system.