AP Calculus AB
Course Syllabus

Number crunching and symbol manipulation are only small parts of learning calculus. Conceptual understanding of topics is also important. One of the major goals is for the students to learn how to use precise language to describe these concepts and the relationships between ideas.

Course Planner

Primary Textbook
Finney, Ross L., Franklin Demana, Bert Waits, and Daniel Kennedy. *Calculus: Graphical, Numerical, Algebraic*. Reading, Mass.: Addison-Wesley, 1999.
The chapter numbers follow the textbook.

This course is taught over two terms on a four period day block schedule.

Chapter 1: Prerequisites for Calculus (7 days)
- Elementary functions:
    - o Linear, power, exponential/logarithmic, trigonometric/inverse trigonometric
- Parametric equations
- Getting familiar with the graphing calculator

Chapter 2: Limits and Continuity (6 days)
- Limits:
    - o Limit at a point, limit at infinity, infinite limits
    - o Properties of limits
- Continuity
- Tangent line to a curve
- Slope of a curve at a point

Chapter 3: Derivatives (16 days)
- Definition of f'
- Derivative at a point
- Relating the graphs of f and f'
- Where does $f'(a)$ fail to exist?
- Rules for differentiation:
    - o Sum, product, and quotient
- Chain Rule
- Implicit differentiation
- Derivatives of trigonometric, inverse trigonometric, exponential and logarithmic functions

Chapter 4: Applications of Derivatives (12 days)

- Mean Value Theorem
- Using the derivative to find:
    - Critical point(s) and extreme values
    - When the function is increasing or decreasing
    - Point(s) of inflection
    - When the function is concave up or concave down
- Optimization problems
- Using the tangent line to approximate function values
- Differentials and change
- Related rates

Chapter 5: The Definite Integral (10 days)

- RAM (Rectangle Approximation Method)
- Riemann sums
- Finding an antiderivative
- Using a definite integral to find area, volume, average value of a function
- Fundamental Theorem of Calculus
- Approximating the definite integral:
    - Trapezoidal Rule, Simpson's Rule, Error Analysis

Chapter 6: Differential Equations and Mathematical Modeling (12 days)

- Slope fields
- Antiderivatives and the indefinite integral
- Techniques of integration:
    - Substitution and integration by parts
- Separable differential equations
- Exponential growth and decay
- Logistic growth

Chapter 7: Applications of Definite Integrals (10 days)

- Using the definite integral to discuss:
    - Net change—motion on a line, consumption over time
    - Area, volume, length of a curve, surface area of a solid of revolution
    - Work

Final Exam and Review (8 days)

In this course, students take a comprehensive final exam in similar format to the AP Exam. This exam consists of both free response and multiple-choice questions, including calculator and non-calculator active portions.

During review, students work collaboratively in cooperative groups while working out AP style questions, including previously released AP questions.

Review for AP Exam

Students who do not continue in the AP Calculus BC course attend review sessions during the month before the AP exam to review for the exam

Teaching Strategies

AP Calculus AB Course Description
The topic outline shown above is the skeleton of our course. We study every area mentioned in the *AP Calculus AB Course Description*. We also include some other topics— Simpson's Rule, integration by parts, volume by cylindrical shells, work—as an extension and preparation for AP Calculus BC.

Functions from Multiple Representations
Functions represented analytically comprise one segment of our study of calculus. There are so many situations that use functions described verbally, graphically, or numerically, and we work with those along the way. Students are taught how to use graphing calculators to help solve problems, investigate possible solutions, interpret results, and support analytical conclusions. For example, before and after finding a limit of a function analytically, we graph the function on the graphing calculator and investigate the limit using "trace" or the table of values. We use this approach throughout the course with derivatives and integrals as well. Ideas are continually investigated analytically, graphically, and numerically. The TI overhead viewscreen is used as a tool to teach students how to use their graphing calculators to prepare for the calculator portions of our exams.
When a function is presented graphically we can describe its behavior in broad strokes, and sometimes we can describe the details of its behavior at some specific points. On the other hand, when a function described analytically is graphed, we are careful to check that technological "features" do not mask some behavior.
Students are instructed and encouraged to use technology, particularly the graphing calculator, as a tool to enhance their understanding of calculus.

Student Communication

Student communication is stressed throughout the course. Students often work with partners or cooperative groups while solving problems. Students are expected to explain their solutions to their partner or group both verbally and in written form. Students are often asked to come to the board and explain their solution to the class. This allows me to see any mistakes or misunderstandings and clear up confusion immediately. It also allows me to make sure they are showing the appropriate work necessary before the test.

Student Evaluation
Students work together in small groups to discuss immediate questions from the assignment. Questions that are not resolved are passed on for discussion with the entire class.
Quizzes cover small pieces of material, usually work from the prior two or three days. Tests cover larger amounts of material, usually the entire chapter. In-class tests are divided into calculator and non-calculator sections similar to the AP Exam. Most questions are free response, with a few multiple-choice questions included.

Web Resources
- AP Central (apcentral.collegeboard.com)