

Advanced Placement (AP) Calculus AB

Course Description: An Advanced Placement (AP) course in calculus is comparable to first semester calculus in college. It is a very demanding math course and success depends on ability, development of prerequisite skills, and a willingness to study. Students who take the AP Calculus class will be expected to seek college credit by taking the AP Calculus AB exam.

This course will emphasize problem-solving methods that require students to represent problems numerically, verbally, analytically, and graphically. We start day one working with functions. We will stress that functions can be represented in different ways; by equation, in a table, by a graph, or in words. We will look at the main types of functions that occur in calculus and describe the process of using these functions as mathematical models of real-world phenomena. We will use the graphing calculators and graphing software for computers. The graphing calculator is a great tool to continue this discussion of the limit of a function using the TABLE feature for our numerical discussion, the graphing capability to both see and write about the limit of a function. Students will need to purchase or rent a graphing calculator. The TI-84 calculator should be considered for this class. I am not familiar with others.

Students will work in pairs via tables provided in the classroom to encourage discussion and agreement of solutions not only of practice problems assigned to take home, but also on problems work during class, which will regularly be presented orally or at the SMART Board.

We will have calculus explorations to provide hands-on practice with concepts and techniques of calculus. Students will discover concepts on their own or in cooperative groups via the many web resources available and "CALCULUS EXPLORATIONS" by Foerster, which allows students to learn by graphical and numerical methods as well as by traditional algebraic methods. Also, writing is a strong component and students will verbalize their conclusions in paragraph form.

Textbook: *Calculus: Graphical, Numerical, Algebraic*, Third Edition. Authors Finney, Demana, Waits, Kennedy. Publisher: Pearson, Addison Wesley, 2007.

Pre-requisites: Accelerated Math 1, 2, & 3

Objectives: These are the objectives as stated in the *College Board Advanced Placement Calculus Course Description*.

The student will be able:

- To work with functions in a variety of ways: graphical, numerical, analytical, or verbal and understand the connections between these representations.
- To understand the meaning of the derivative and be able to use derivatives to solve problems.
- To understand the meaning of the definite integral and be able to use integrals to solve problems.
- To understand the relationship between the derivative and the integral.
- To communicate about mathematics both orally and in well-written sentences.
- To use technology to help solve problems.
- To determine the reasonableness of an answer.
- To appreciate calculus as a human accomplishment.

(This is a one semester block class and we move at a rapid pace – especially during the second semester -- when we have only 16 weeks to prepare for the AP Calculus exam)

Time line: Limits and Continuity of Functions (2 weeks)

- The limiting process
- Limits with algebra
- Limits from tables of data
- Limits from graphs (secants and tangents animation)
- One sided limits
- Limits involving infinity (calculator investigation)
- End behavior
- Continuity story
- Discontinuities

Derivatives (4.5 weeks)

- The definition
- The graph of the derivative (Internet puzzles)
- Formulas for derivatives
- Rates of change (Internet)
- Derivatives of trig functions
- The chain rule
- Implicit differentiation
- Higher order derivatives
- Related Rates

- Differentials and local linearization (Internet animation)
- Applications in velocity and acceleration
- Derivatives of logarithmic and exponential functions
- Inverse Trig derivatives

Applications of derivatives (4 weeks)

- Minimum and maximum values (Internet)
- Rolle's Theorem
- The Mean Value Theorem
- What does f' say about the graph of f ? (Internet puzzles)
- The second derivative test
- Limits at infinity
- Curve sketching
- Optimization problems
- Applications to economics
- Newton's method
- Slope fields
- Anti-derivatives

Integrals (1.5 weeks)

- Areas and distances
- The Riemann Sum
- The definite integral
- The Fundamental Theorem of Calculus
- Total change theorem
- The substitution rule

Applications with Integrals (3 weeks)

- Area between curves
- Volumes by disk and washer
- Volumes by shells
- Volumes by cross sections (tipped glass - Internet)
- Average value of a function

Review (1 week)

- AP Practice Exam

Past AP calculus exam questions are used throughout the semester to reinforce the concepts that we are studying. Free Response questions are sometimes used as culminating activities when we finish discussing a topic. I use past AP free response items for group activity too.

Students use their calculators to discover the relationships between limits, asymptotes, and holes in a graph. We also use the calculator to discuss local linearization, derivatives at a point, Riemann sums, and the definite integral. The

Internet is utilized as a tool to show animations of topics like area under the curve and volumes of solids.

Many of the resources used in this class were taken with permission from summer College Board AP Calculus workshops— a most valuable resource.

Evaluation Students will be expected to attend class regularly, participate in

Procedures: class discussion, and complete all assignments.

Nine weeks grades will be determined as follows;

Tests (including a midterm) 50%

Class Participation: 10%

Daily Assignments: 40%

Assignments may include, but are not limited to, Problem solving, Oral Presentations, Writing about mathematics, Group Work.

Semester grades will be determined as follows;

First nine weeks grade 42.5 %

Second nine weeks grade 42.5 %

Final Exam 15 %

AP Exam: The AP Calculus AB exam will be given on Wed, May 6, 2009 during the morning, 8 a.m. All students who take AP Calculus will be expected to take the exam.

Internet Resources:

AP Central (apcentral.collegeboard.com)

AP Calculus Electronic Discussion Group (EDG)

Cynthia Lanius Introduction to Rates of change website:

<http://math.rice.edu/~lanius/Algebra/stress.html>

Visual Calculus website - min and max drill:

<http://archives.math.utk.edu/visual.calculus/3/max.1/>

Reimann Sums Animation website:

<http://math.fullerton.edu/mathews/a2001/Animations/Riemann/LeftRiemann/LeftRiemannaa.html>

Mathematica animations:

http://www.calculus.org/Contributions/def_derivative.mov

Animations for Calculus: <http://www.ima.umn.edu/~arnold/graphics.html#bounce>

The Calculus Page (java applets for math): <http://www.plu.edu/~heathdj/java/>

Graphs of f and f' :

<http://www.ugrad.math.ubc.ca/coursedoc/math100/notes/derivs/practice.html>

Great Stuff in Calculus - graph puzzles:

<http://mathforum.org/mathtools/cell/c,15.7,ALL,ALL/>

AP exam practice questions <http://www.sparknotes.com/testprep/ap/>