

AP Calculus AB Syllabus

Course Description:

This course is designed to prepare students for the AP Calculus AB Test as well as college level calculus courses. The primary text book is *Calculus of a Single Variable*, 6th ed. By Larson, Hostetler and Edwards (1998 Houghton Mifflin). Students are expected to use graphical, numerical and analytical approaches to problem solving. The topics covered are outlined in the *AP Calculus Course Description* available through the college board.

Course Planner: (Based on block scheduling – 90 days, 90 minute periods)

Pre-calculus topics

- Graphs and Transformations of functions 1 day
- Linear Models and Slope 1 day
- Symmetry, Even and Odd functions, Domain and Range 2 days

Students will be able to work with functions graphically, numerically, analytically and verbally throughout this unit. Students will use tables for graphing, review formulas and methods, and use graphing calculators throughout the unit.

Limits and Continuity

- Finding limits graphically, numerically and analytically 2 days
- Continuity 2 days
- Intermediate Value Theorem and Extreme Value Theorem 2 days
- Asymptotes and unbounded behavior 1 day
- Infinite Limits 1 day

Student Activity/Lab: Students will develop an intuitive understanding of the nature of limits and explore the connection between the graphical, numerical and analytical approaches to determining limits. Students will complete this activity by investigating behavior of several functions numerically using a t-chart or calculator tables and graphically using calculators. This lab is completed at the beginning of the Limits unit. After students have covered the material relating to analytical methods of finding limits, students again re-visit exploring the connection between evaluating limits graphically, numerically and analytically.

Derivatives

- Limit definition of derivatives 2 days
- Average/Instantaneous rate of change 1 day
- Power rule, rates of change 2 days
- Product and Quotient Rule 2 days
- Tangent Lines and Normal Lines 1 day
- Derivatives of trig Functions 1 day
- Chain Rule 2 days
- Implicit differentiation 2 days
- Characteristics of the graphs of f , f' and f'' 2 days
- Tangent Line Approximation 1 day
- Finding Derivatives using technology 2 days
- Higher Order Derivatives 1 day

Student Activity/Lab: Students will determine the rule for taking derivatives of composite functions (chain rule). Students will be given composite functions and asked to guess the derivative and then determine the derivative using a TI-89 calculator. Students will complete the activity by explaining in sentences how to take the derivative of a composite function.

Applications of Derivatives

- Related Rates problems 2 days
- Finding Extrema 2 days
- Rolles Theorem and Mean Value Theorem 1 day
- First Derivative Test 2 days
- Concavity and 2nd derivative test 2 days
- Analyzing graphs of $f(x)$ 2 days
- Problems involving rates of change (position, velocity and acceleration) 1 day
- Optimization problems 2 days
- Using graphing calculator to find derivatives 1 day

Integrals

- Riemann Sums (left, right, and midpoint sums) 2 days
- Definite Integrals 1 day
- Fundamental Theorem of Calculus (Average value of a function) 2 days
- Integrating by substitution 2 days
- Trig formulas 1 day
- Numerical Integration – trapezoidal rule 2 days
- Using graphing calculator to find integrals 1 day

Student Activity/Lab: Students will gain an understanding of the geometry involved in the methods of numerical integration. Students will develop the formula for the trapezoid rule. Students will be given problems with graphs with inscribed and circumscribed rectangles drawn. Students will calculate Riemann sums, make a table of results and write a paragraph about the conclusions they have drawn. Students will then re-work the given problems by using trapezoids instead of rectangles. Students will show algebraically or geometrically that the Trapezoid Rule is the average of the left hand and right hand Riemann sums.

Applications of Integrals

- Area of region bounded by curves 2 days
- Volume of solid of revolution (Disk method, Washer method) 2 days

Student Activity/Lab: Students will use calculus to find the volume of a food item. Students will choose a food item and use any method to find its volume then verify the volume using water displacement, filled box or other methods. Students will present their findings to the class and hand in a written summary of the project.

Logarithmic, exponential functions

- Inverse Trigonometric Functions 2 days
- Natural log functions 1 day
- Derivatives of logarithmic, exponential and inverse trigonometric functions 2 days
- Exponential functions 2 days

Differential Equations

- Solving differential equations 2 days
- Slope fields 2 days

Miscellaneous Topics

- Newton's method 2 days
- Linear Approximations 1 day

*Throughout the course students will demonstrate understanding of concepts by communicating orally and in written form solutions to calculus problems. Group activities and projects will allow students to orally demonstrate understanding. AP Practice Free Response Questions administered weekly will allow students to demonstrate understanding in written form.

Calculators:

Teachers use TI-84 and TI-89 calculators for presentations. Students who do not have a TI-89 themselves are issued one 2nd semester.

Evaluation:

Grades are determined as followed:

40% - daily work made up of homework, quizzes, labs and student activities.

60% - tests*

*Most tests contain 2 parts. Students are allowed to use calculators on one part. The other part will contain problems/questions in which calculators are not allowed. This is to better prepare for the AP Test.

*2nd semester tests include multiple choice items and free-response items.

Computer Software:

AP Exam Review Computer Lab Tutorial – used 2nd semester.
apexlearning.com

Other Resources:

Be Prepared for the AP Calculus Exam by Mark Howell and Martha Montgomery (2005, Skylight Publishing).

Multiple-Choice and Free-Response Questions in Preparation for the AP Calculus (AB) Examination by David Lederman. 8th Edition, (2003, D&S Marketing Systems, Inc.).