AP Calculus AB

Course Syllabus

Introduction:

Calculus is essentially the study of the relationships among changing quantities, and the curriculum of AP Calculus AB introduces the student to this study through single-variable functions.

Through exploration, class discussion, hands-on activities, and traditional lecture, students in this course will gain a better understanding of the foundational concepts of calculus so that they may be more successful in future mathematics courses.

This course, when applicable, approaches the content in four ways – analytically, numerically, graphically, and verbally – and not through computational rules alone. Students also practice appropriate communication of the mathematics, be it written or verbal, particularly in explaining their solutions.

Technology also plays an important part in this course. All students need access to a graphing calculator throughout the semester, and many activities require the use of various computer software programs (graphing programs, computer algebra systems, spreadsheet applications, etc.) and CBL hardware. All of these can be provided to the student when needed.

Prerequisite:

This course assumes all students have successfully completed the typical high school mathematics sequence through trigonometry and analytical geometry. Students that have completed Honors Analysis or Advanced Algebra and Trigonometry meet this requirement. Calculus (the non-AP course) is *not* a prerequisite for AP Calculus AB.

Textbook and Calculator:

The primary textbook used in this course is James Stewart's *Calculus: Concepts and Contexts, 2nd edition*.

In addition to the text, this course also requires the use of the TI-89 calculator. The TI-89 is preferred over the TI-83/84 for its greater built-in capabilities in solving problems, performing experiments, interpreting results, and supporting conclusions throughout the semester.

Course Plan:

Below is an outline of the topics presented in this course along with the approximate time spent on each unit.

I. Limits (2 Weeks)

A. Concept of a limit (numerical and graphical approaches)
B. Limit evaluation
C. Infinite limits (limit definitions of asymptotes)
D. Continuity, Intermediate Value Theorem, Extreme Value Theorem

Assessments: Limit exploration (spreadsheet problem solving),
Boyle's Law lab (CBL/calculator experiment),
Exam

II. Derivatives (2 Weeks)

A. Concept of a derivative as the slope of the tangent line to a curve at a point
B. Instantaneous rates of change
C. Function derivatives (including the relationships among f, f', and f'')
D. Differentiability
E. Introduction to linearization
F. Introduction to graph behavior

Assessments: Graphing exploration,
Ball drop lab (CBL/calculator experiment),
Exam

III. Differentiation (3 Weeks)

A. Differentiation rules
B. Implicit differentiation
C. Rectilinear motion
D. Linear approximations
E. Differentials

Assessments: Bouncing wagon activity (graphing program problem solving),
Friction lab (CBL/calculator experiment),
Exam

Course Plan (continued):

IV. Applications of Differentiation (3 Weeks)

A. Mean Value Theorem
B. Absolute and relative extreme values
C. Graph behavior
D. l'Hospital's Rule
E. Related rates
F. Optimization
G. Antidifferentiation (slope fields)

Assessments: Graph behavior activity (graphing program problem solving),
Related rates lab (CBL/calculator experiment),
Exam

V. Integrals (2 Weeks)

A. Relationship between area and definite integrals (Riemann sums)
B. Definite integrals as an accumulator function
C. Fundamental Theorem of Calculus
D. Approximation techniques
E. Integration techniques

Assessments: Area exploration,
Exam

VI. Applications of Integration (2 Weeks)

A. Area between curves
B. Cross-sectional volume
C. Average value

Assessments: Volume activity,
Exam

VII. Differential Equations (2 Weeks)

A. Solving differential equations
B. Separable differential equations
C. Slope fields
D. Exponential growth and decay applications

Assessments: Law of Cooling lab (CBL/calculator experiment),
Exam

Additional Assessments:

In addition to the various activities, labs, and regular exams, this course also requires a midterm exam, one final exam, and one term project. The midterm assesses the curriculum topics through differentiation. The cumulative final exam covers all topics for the semester.

The term project is a collaborative activity that focuses on one or more particular concepts presented in this course, but in a much more in-depth manner.

With exception of the midterm and final exams (which are of a multiple-choice format), all activities and assessments require students to communicate the associated calculus concepts presented in written form.