

Calculus AB

2007 - 2008

Brief Description of Course

This course covers the topics limits, continuity, differentiation, antidifferentiation, definite integrals, with applications to the physical and engineering sciences.

Unit Information

Unit Name or Timeframe:

Limits and Continuity: Chapter 1
2 weeks

Content and/or Skills Taught:

- Concept of limit, exploring limits graphically using the graphing calculator, which will include conjecturing the limit from the graph and estimating limits numerically using the table feature (includes one-sided limits)
- Computation of limits using algebra
- Concept of continuity and its implications (Intermediate Value Theorem), explain in writing and sketch examples of types of functions that have essential vs. removable discontinuity (holes, jumps, asymptotes)
- Limits Involving Infinity (asymptotic and unbounded behavior)
- Formal Definition of Limit (delta-epsilon)

Major Assignments and/or Assessments:

Unit Name or Timeframe:

Differentiation: Chapter 2
3 weeks

Content and/or Skills Taught:

- Concept of Derivative: Tangent Lines, Instantaneous Rate of Change, Velocity (investigate the concept of the derivative with the graphing calculator by estimating the value of the derivative using the graph and table features to calculating the average rate of change over increasingly smaller intervals)
- Limit Definition of the Derivative (limit of the difference quotient, limit of the average rate of change), relationship between differentiability and continuity
- Computation of Derivatives: Power, Sum/Difference, Product and Quotient Rules
- Derivatives of Trigonometric Functions
- Derivatives of Exponential and Logarithmic Functions
- Chain Rule
- Implicit Differentiation and Related Rates
- Mean Value Theorem (including the geometric meaning, which can be shown using the graphing calculator)

Major Assignments and/or Assessments:

CBL Velocity Test: Interpreting Velocity Graphs
How Many Licks? Related Rate Activity using Tootsie Roll Pops

Both of these labs require the use of graphing calculators and their accessories, and students are required to submit a write-up of their findings.

Unit Name or Timeframe:

Applications of Differentiation: Chapter 3
2 weeks

Content and/or Skills Taught:

- Linear Approximation and L'Hopital's Rule
- Newton's Method
- Maximum and Minimum Values (First, use the graphing calculator to identify the location of the extrema as the "peaks" and "troughs" of the graph to lead students to a conjecture that such values can be found independent of the graph by setting the first derivative equal to zero, or that the slope must change sign. Then formally state First Derivative Test, Extreme Value Theorem)
- Increasing and Decreasing Functions (relationship between the increasing and decreasing behavior of f and the sign of f' , corresponding characteristics of graphs of f and f')
- Concavity (points of inflection as places where concavity changes, relationship between the concavity of f and the sign of f'' , Second Derivative Test)
- Overview of Curve Sketching (students will synthesize the corresponding characteristics between the graphs of f , f' , and f'' by graphing all three on a single plane and making conclusions in writing about their observations; interpretation of the derivative as a rate of change in varied applied contexts, including velocity, speed and acceleration)
- Optimization as a real-world application of the absolute extrema, where students must show the calculations leading to their conclusion, which must be communicated verbally.

Major Assignments and/or Assessments:

Sample AP Free-Response Exam Questions, as applicable
For free-response questions that require the use of the graphing calculator, students must give a written justification of their answer as prompted.

Unit Name or Timeframe:

Integration: Chapter 4
3 weeks

Content and/or Skills Taught:

- Antiderivatives (antiderivatives following directly from derivatives of basic functions, determine a position function given the velocity or acceleration function and an initial condition)
- Sums and Sigma Notation
- Area (estimating area using left, right, and midpoint evaluation of Riemann sums using the table feature of the graphing calculator; using limit of a sum to calculate the exact area, students are taught to check their answers using the graphing calculator)
- The Definite Integral (interpretation of the definite integral as a limit of Riemann sums over subdivisions, basic properties of definite integrals, interpretation of the definite integral as the net change of a quantity over an interval, net change of distance/signed area versus total distance/total area, average value of a function and the Integral Mean Value Theorem)

Major Assignments and/or Assessments:

CBL Walk This Way Activity: Introduction to Integration
This activity requires the use of graphing calculators and their accessories, and students are required to submit a write-up of their findings.
Sample AP Free-Response Exam Questions, as applicable

For free-response questions that require the use of the graphing calculator, students must give a written justification of their answer as prompted.

Unit Name or Timeframe:

Application of the Definite Integral: Chapter 5
2 weeks

Content and/or Skills Taught:

- Area Between Two Curves (top/bottom, right/left, dx and dy, both by hand and using the graphing calculator)
- Volume by Circular Disk Method (horizontal and vertical axes of revolution, both by hand and using the graphing calculator)
- Volume by Circular Washer Method (horizontal and vertical axes of revolution, both by hand and using the graphing calculator)
- Volume by Slicing (cross-sectional areas perpendicular to the x-axis)

Major Assignments and/or Assessments:

Play-Doh Activity (acquired from an AP workshop) to assist in visually demonstrating volumes by slicing

Sample AP Exam Free-Response Questions, as applicable

For free-response questions that require the use of the graphing calculator.

Unit Name or Timeframe:

Exponentials, Logarithms, and Other Transcendental Functions: Chapter 6
5 weeks (on an every other day basis)

Content and/or Skills Taught:

- The Natural Logarithm Revisited (redefine $\ln x$ as the definite integral of $1/t$ from 1 to x , review of logarithm properties, derivatives of logs and integrals of functions in the form of $1/x$)
- Inverse Functions (use the graphing calculator to conjecture the geometric relationship between a function and its inverse; how to find an inverse, if possible; the connection between one-to-one and continuity; using the first derivative to determine if the function is monotonic, thus one-to-one; calculating the derivative of an inverse of a function indirectly)
- The Exponential Function Revisited (redefine e^x and review of derivatives and integrals involving exponential functions with any base b)
- Growth and Decay Problems (deriving exponential models, including Newton's Law of Cooling, to solve real-world problems involving growth and decay)
- Separable Differential Equations (solving separable differential equations using an initial condition)
- Slope Fields (constructing slope fields given a differential, draw a specific solution given an initial condition)
- Inverse Trigonometric Functions (review of definitions from Pre-Calculus)
- The Calculus of Inverse Trigonometric Functions (derivatives and integrals of the inverse trigonometric functions)
- Hyperbolic Functions (definitions, identities, derivatives, and integrals involving the hyperbolic trigonometric functions and their inverses)

Major Assignments and/or Assessments:

A Watched Cup Never Cools: A Newton's Law Activity or CBL Chill Out: How Hot Objects Cool
Extension Activity

This activity requires the use of graphing calculators and their accessories, and students are required to submit a write-up of their findings.

AP 2004-2005 Workshop Material Activities with Differential Equations and Slope Fields
Sample AP Free-Response Exam Questions, as applicable
For free-response questions that require the use of the graphing calculator, students must give a written justification of their answer as prompted.

Textbooks

Title:Calculus

Publisher: McGraw Hill

Published Date: 2002

Author: Robert Smith

Second Author: Minton Roland

Description:

Second edition single variable

Other Course Materials

Material Type:Graphing Calculator

Description:

TI 83+ and TI 89 graphing calculators

Material Type:Other

Description:

A Watched Cup Never Cools by Ellen Kamischke

CBL 2 LabPro by Chris Brueningsen

AP Workshop Materials

Websites

URL:apcentral.collegeboard.com

Description:

AP sample questions