

AP Calculus

Grade Level:	12 (with Recommendation)
Length:	1 Year
Period(s) Per Day:	1
Credit:	1
Credit Requirement Fulfilled:	Mathematics

Course Description

AP Calculus is a course designed to meet the College Board Advanced Placement AB standards. Students are expected to take the AP test for Calculus AB at the end of the year. This is a very challenging mathematics course, being the equivalent of one semester of college calculus. Students entering the class should have performed strongly in Algebra 2 and Trig & Calc.

The main instructional technique will be group lecture, with students writing down notes, examples, and working out practice problems throughout the lesson. Discussing how topics are related to each other will provide a necessary connection that we can use to fuel further lessons. Use of graphing calculators (TI-89) will also be necessary to interpret difficult functions and data sets and to test hypothesis about functions and their behavior.

Our class will focus on the big ideas of basic calculus with a focus on problem-solving, exploring problems from multiple angles, and how to use the graphing calculator to assist in visualize and understand a given scenario. By mastering the building blocks of calculus (limits, derivatives, and integrals), students will be able to view the world through the eyes of calculus to appreciate the beauty and application of higher-order mathematics.

Theme Samples

1. Limits
2. Derivatives
3. Applications of Integrals
4. Differential equations

Course Objectives and Expectations

1. To understand Limits, Functions, Graphs, and Continuity
2. To take derivatives of functions
3. To use integrals to find area
4. To verify the different conic sections.
5. To solve differential equations.

Pacing

Semester 1

Unit 1- Limits, Functions, Graphs, and Continuity

Unit 2- Derivatives

1st Semester

Limits, Functions, Graphs, and Continuity

- A. Describe the idea of finding a limit
- B. Evaluate limits algebraically
- C. Evaluate limits from a graph or table
- D. Find equations of vertical and horizontal asymptotes
- E. Determine end behavior of a function
- F. Determine if a function is continuous at a point
- G. Classify discontinuities as “removable”, “jump”, or “infinite”
- H. Understand and apply the “Intermediate Value Theorem”
- I. Understand and apply the “Extreme Value Theorem”

Derivatives

- A. Describe the meaning of a derivative
- B. Find the derivative of a function using the limit definition of a derivative
- C. Find whether a function is differentiable at a point
- D. Find whether a function is locally linear at a point
- E. Determine and explain how being continuous and differentiable are related
- F. Use the theorems on differentiability on differentiation to find derivatives of polynomial and rational functions (Power Rule, Product Rule, Quotient Rule, and Chain Rule)
- G. Find the equation of a tangent line to a curve at a point
- H. Find the equation of a normal line to a curve at a point
- I. Understand average and instantaneous rate of change
- J. Apply implicit Differentiation
- K. Find higher order derivatives
- L. Find the derivative and tangent line for an inverse function
- M. Using the 2nd derivative and points of inflection to determine concavity of a function
- N. Graphing the derivative from data, both by hand and using a calculator
- O. Apply derivatives to solve Related Rate and Optimization problems
- P. Understand the definition of the derivative using the symmetric difference quotient
- Q. Understand and apply the Mean-Value Theorem
- R. Use the First and Second Derivative Test
- S. Connect $F'(x)$ and $F''(x)$ with graph $F(x)$
- T. Find derivatives of Polynomial, Rational, Exponential, and Trigonometric functions
- U. Solve Rectilinear Motion problems
- V. Determine an anti-derivative for a given function

Semester 2

Unit 3- Applications of Integrals

Unit 4- Differential Equations

Unit 5- AP Exam Review

2nd Semester

Applications of Integrals

- A. Approximate areas under a curve with left-hand, right-hand, midpoint, and trapezoid methods
- B. Use Riemann Sum definition to calculate area under a curve
- C. Calculate areas under and between curves
- D. Understand and apply the Fundamental Theorems of Integral Calculus
- E. Evaluate definite integrals with and without a calculator
- F. Calculate the average value of a function
- G. Find the net distance traveled by an object
- H. Find the total distance traveled by an object
- I. Use integration by “u-substitution”
- J. Evaluate indefinite integrals using the Power Rule and the Chain Rule for Integration
- K. Find volumes of solids of revolution using disk and washer method
- L. Find volume of solids with known cross sections

Differential Equations

- A. Solve differential equations by the method of “separation of variables”
- B. Solve growth and decay problems, logistic problems, and other applications to differential equation
- C. Understand slope fields
- D. Sketch a slope field given a differential equation

AP Exam Review

- A. Sample Test Questions

Timeline

Unit 1	(3 weeks to cover)
Unit 2	(12 week to cover)
Unit 3	(6 weeks to cover)
Unit 4	(2 weeks to cover)
Unit 5	(4 weeks to cover)