

# Topics Covered in AP Calculus (AB)

## SEMESTER 1

### Chapter 1: Prerequisites for Calculus (6 days)

[We will review this chapter very quickly, since the topics were covered in depth in the precalculus course.]

- 1-1 Lines
- 1-2 Functions and graphs
- 1-3 Exponential Functions
- 1-5 Functions and Logarithms
- 1-6 Trigonometric Functions

### Chapter 2: Limits and Continuity (12 days)

- 2-1 Rates of Change and Limits
  - average and instantaneous speed
  - limits and graphs
  - formal definition of limit
  - properties of limits
  - sandwich theorem
- 2-2 Limits Involving Infinity
  - asymptotes
- 2-3 Continuity
  - definition of continuity of a function at a point and on an interval
  - Intermediate Value theorem
- 2-4 Rates of Change and Tangent Lines

### Chapter 3: Derivatives [30 days]

- 3-1 Derivative of a Function
  - definition & notation
  - graphs of  $f$  and  $f'$
- 3-2 Differentiability
  - differentiability and graphs
  - Intermediate Value theorem for derivatives
- 3-3 Rules for Differentiation
  - differentiation of constants, polynomials and other powers of  $x$ .
  - product and quotient rules
  - second and higher-order derivatives
- 3-4 Velocity and Other Rates of Change
- 3-5 Derivatives of Trigonometric Functions
  - derivatives of the 6 trig functions
  - simple harmonic motion
- 3-6 Chain Rule
  - derivatives of parametric functions
- 3-7 Implicit Differentiation
- 3-8 Derivatives of Inverse Trigonometric Functions
- 3-9 Derivatives of Exponential and Logarithmic Functions
  - derivatives of  $e^x$ ,  $a^x$ ,  $\ln x$ , and  $\log_z x$
  - logarithmic differentiation

## **Chapter 4: Applications of Derivatives (22 days)**

- 4-1 Extreme Values of Functions
  - absolute and local maxima and minima
  - critical points
- 4-2 Mean Value Theorem
  - requirements and statement of MVT
  - antiderivatives
- 4-3 Relating the graphs of  $f$ ,  $f'$  and  $f''$ 
  - First derivative test for local extrema
  - concavity and the 2<sup>nd</sup> derivative; 2<sup>nd</sup> derivative test
  - analyzing graphs of  $f$ ,  $f'$  and  $f''$
- 4-4 Modeling and Optimization
  - max/min applications
- 4-5 Linearization
  - Newton's method
  - differentials
- 4-6 Related Rates
  - lots of applications

## **Chapter 8 selection (3 days)**

- 8-2 L'Hôpital's Rule

## **SEMESTER 2**

### **Chapter 5: The Definite Integral (18 days)**

- 5-1 Estimating with Finite Sums
  - approximating areas under graphs using rectangles
  - approximating volumes of revolution
- 5-2 Definite Integrals
  - Riemann sums
  - notation and terminology
  - definite integral as an area
  - calculating integrals using known areas
  - numerical integration on calculator
- 5-3 Definite Integrals and Antiderivatives
  - properties of integrals
  - average value of a function
  - Mean Value thm. for definite integrals
- 5-4 Fundamental Theorem of Calculus
  - Statement of the theorem, parts I and II
  - evaluating definite integrals and their derivatives
- 5-5 Trapezoid Rule

### **Chapter 6: Differential Equations and Mathematical Modeling (18 days)**

- 6-1 Slope Fields
  - intro. to differential equations
  - slope fields

- 6-2 Antidifferentiation by Substitution
  - substitution in indefinite and in definite integrals
- 6-3 Antidifferentiation by Parts
  - product rule for integrals
  - repeated use of integration by parts
- 6-4 Exponential Growth and Decay
  - separable differential equations
  - law of exponential change with applications
- 6-5 Logistic Growth
  - partial fractions
  - population growth models

## **Chapter 7: Applications of Definite Integrals (12 days)**

- 7-1 Integral as Net Change
  - models of net change (distance, consumption, etc.)
- 7-2 Areas in the Plane
  - area between curves
  - integrating areas with respect to  $y$
- 7-3 Volumes
  - volume of a solid
  - volumes of rotation (circular & washer cross-sections; cylindrical shells)

### **Review for AP Exam**

We will have 3 – 4 weeks to review for the exam.  
 Students practice solving problems using released AP questions and other resources.  
 We also discuss test-taking strategies.

## **AFTER THE AP EXAM**

Selected topics, as time permits.

- 8-4 Improper Integrals (6 days)
  - integrals with infinite integration limits
  - integrands with discontinuities
  - comparison test for convergence and divergence

## **Ch. 9: Functions as Polynomials and Series (9 days)**

- 9-1 Power Series
  - convergence/divergence
  - term-by-term differentiation and integration of a series
- 9-2 Taylor Series
  - constructing a series for a function
  - Taylor and Maclaurin series