

# Calculus AP Syllabus (First Semester)

## Unit 1: Function limits and continuity

Lesson 01: Limit fundamentals, definitions

Lesson 02: Limits of rational and graphed functions

Lesson 03: Limit theorems, limits of trig functions

Lesson 04: Limits involving infinity

Lesson 05: Piecewise functions and continuity

Unit 1 review

Unit 1 test

## Unit 2: Derivative fundamentals

Lesson 01: Average and instantaneous rates of change

Definition of the derivative at  $x = c$

Lesson 02: Equations of tangent and normal lines

Lesson 03: Formal definition of the derivative

Lesson 04: A graphical look at derivatives

Lesson 05: Differentiability

Unit 2 review

Unit 2 test

## Unit 3: Derivatives formulas; derivative of trig and piecewise functions

Lesson 01: Constant and power rules

Lesson 02: Product and quotient rules

Lesson 03: Trig function derivatives

Lesson 04: Linear approximations

Derivatives of piecewise functions

Lesson 05: Calculator derivatives

Cumulative review, unit 3

Unit 3 review

Unit 3 test

#### **Unit 4: Chain Rule; higher order derivatives, applied rates of change**

Lesson 01: Chain rule fundamentals

Lesson 02: Chain rule applied to trig functions

Lesson 03: Higher order derivatives

Lesson 04: Applied rates of change

Velocity, speed, and acceleration:

Cumulative review

Unit 4 review

Unit 4 test

#### **Unit 5: Implicit differentiation**

Lesson 01: Implicit differentiation fundamentals

Lesson 02: Tangent and normal lines (with implicit derivatives)  
Implicit higher order derivatives

Lesson 03: Related rates

Lesson 04: More related rate problems

Cumulative review

Unit 5 review

Unit 5 test

#### **Unit 6: Rolle's Theorem and the Mean Value Theorem First and second derivative tests; Critical values**

Lesson 1: Rolle's Theorem and the Mean Value Theorem

Lesson 2: First derivative test: Increasing/decreasing intervals  
Critical values

Lesson 3: Local and absolute extrema

Lesson 4: Second derivative test: Concavity

Lesson 5: Graphs relating  $f(x)$ ,  $f'(x)$ , and  $f''(x)$

Cumulative review

Unit 6 review

Unit 6 test

### **Unit 7: Optimization (maximizing & minimizing)**

Lesson 1: Optimization problems

Lesson 2: More optimization problems

Lesson 3: Still more optimization problems

Cumulative review

Unit 7 test

### **Unit 8: Derivatives of inverse, exponential, and logarithm functions**

Lesson 1: Fundamentals of inverse functions and their derivatives

Lesson 2: Derivatives of inverse trig functions

Lesson 3: Derivatives of exponential functions

Lesson 4: Derivatives of logarithm functions

Cumulative review

Unit 8 review

Unit 8 test

### **Unit 9: Antiderivatives (Indefinite integrals)**

Lesson 1: Basic integration rules, integrating polynomials

Lesson 2: More integration practice

Lesson 3: Integrating trig functions

Lesson 4: Integration using the chain rule in reverse

Lesson 5: Applications of integration, evaluation of integration constants

Lesson 6: Indefinite integrals with a graphing calculator

Unit 9 review

Unit 9 test

## **Semester summary**

Semester review

Semester test

## **Enrichment Topics**

**Topic A:** Special sine and cosine limits

**Topic B:** Formal definition of continuity

**Topic C:** Verification of the power rule

**Topic D:** Verification of the product and quotient rules

**Topic E:** Verification of rules for derivative of sine and cosine functions

**Topic F:** Verification of the Chain Rule

**Topic G:** Verification of derivatives of exponential functions

**Topic H:** Verification of derivatives of logarithm functions

**Topic I:** Verification of derivatives of inverse trig functions

**Topic J:** An argument in support of the Fundamental Theorem of Calculus

**Topic k:** Why the absolute value for the integral of  $1/x$ ?

**Topic L:** Partial fractions