# High School Course Description for **AP Calculus BC**

**Course Title**: Advanced Placement Calculus BC
**Curricular Area**: Mathematics
**Course Number**: MTH563
**Length**: One year – Double Block Period
**Grade Level**: 10-12
**Prerequisites**:
Honors Pre-Calculus with grade of B or better

**Meets a UC a-g Requirement**: "C" Area Mathematics and Increased Honors GPA
**Meets NCAA Requirement**: Yes

**Meets High School Graduation Requirement for**: Mathematics

## Course Description

This course provides students with college level Calculus instruction, a rigorous mathematics curriculum that will allow them to begin earning college credit. The course is designed to serve the needs of the college preparation student. This course covers all of the topics as outlined in the AP Calculus Course Description for Calculus BC as published by the College Board. All students enrolled in this course are expected to take the AP Calculus BC examination in May or complete a college-level project. ***Students earning a 4 or 5 on the AP exam will earn 1 year college Calculus credit.***
(Note: Some universities accept a score of 3, 4, or 5 on the AP exam for college credit. Information about a particular university policy can be found at http://collegesearch.collegeboard.com/apcreditpolicy/index.jsp)

## Alignment

This course is aligned to the College Board standards for Advanced Placement Calculus AB.

## Instructional Materials

Required Textbook(s)

1. Calculus of a Single Variable. Larson, Hostetler, and Edwards; 8th edition 2006

Supplemental Materials

2. *Multiple Choice and Free Response Questions in Preparation for the AP Calculus AB Examination*. Lederman, David 8th ed. 2003
3. *AP Calculus Multiple Choice Questions*; 1969-1997
4. *AP Calculus Free Response Questions*; 1969-1978; 1979-1988; 1989-1998
5. *AP Calculus Free Response Questions*; *Posted by AP Central, 1999-2007*
6. *The Princeton Review: Cracking the AP Calculus AB and BC Exams*; Kahn, David, 2002-2003 edition

Web Sites

7. *Calculus in Motion* http://www.calculusinmotion.com/

Software

7. Geometer Sketchpad

## Exit Criteria

| Activities | Percentage |
|---|---|
| Homework/ Classwork | 20% |
| Tests/ Quizzes | 60% |
| Final Examination | 20% |
| Total: | 100% |

## Development Team

This Course of Study was updated in 2008 by Francisco Villegas (BHS)and Daniel Johnston(CHS)

## First Semester: First Quarter

**Week: 1: Class Basics and Expectations**
Schedule balancing, course expectations/syllabus, Use of textbook and graphing calculators

**Weeks 2-4: Limits and Their Properties**
- Unit 1.1 – A Preview of Calculus
- Unit 1.2 – Finding Limits Graphically and Numerically
- Unit 1.3 – Evaluating Limits Analytically
- Unit 1.4 – Continuity and One-Sided Limits
- Unit 1.5 – Infinite Limits
- Unit 3.5 – Limits at Infinity
- Review and Assessment

**Weeks 5-6: Differentiation**
- Unit 2.1 – The Derivation and Tangent Line Problem
- Unit 2.2 – Basic Differentiation Rules and Rates of Change
- Unit 2.3 – Product and Quotient Rules and Higher-Order Derivations
- Unit 2.4 – The Chain Rule
- Unit 2.5 – Implicit Differentiation
- Unit 2.6 – Related Rates
- Review and Assessment

**Weeks 7-9: Applications of Differentiation**
- Unit 3.1 – Extrema on an Interval
- Unit 3.2 – Rolle's Theorem and the Mean Value Theorem
- Unit 3.3 – Increasing and Decreasing Functions and The First Derivation Test
- Unit 3.4 – Concavity and The Second Derivation Test
- Unit 3.6 – A Summary of Curve Sketching
- Unit 3.7 – Optimization Problems
- Unit 3.9 – Differentials
- Review and Assessment

**Week 10: Integration**
- Unit 4.1 – Antiderivatives and Indefinite Integration
- Unit 4.2 – Area
- Unit 4.3 – Riemann Sums and Definite Integrals

## First Semester: Second Quarter

**Week 11-12: Integration (continued)**
- Unit 4.4 – The Fundamental Theorem of Calculus
- Unit 4.5 - Integration by Substitution
- Unit 4.6 – Numerical Integration
- Review and Assessment

## First Semester: Second Quarter (continued)

**Weeks 13-15: Logarithmic, Exponential and Other Transcendental Functions**

Unit 5.1 – The Natural Logarithmic Function: Differentiation
Unit 5.2 – The Natural Logarithmic Function: Integration
Unit 5.3 – Inverse Functions
Unit 5.4 – Exponential Functions: Differentiation and Integration
Unit 5.5 – Bases Other than *e* and Applications
Unit 5.6 – Inverse Trigonometric Functions: Differentiation
Unit 5.7 – Inverse Trigonometric Functions: Integration
Review and Assessment

**Weeks 16-17: Differential Equations**

Unit 6.1 – Slope Fields and Euler's Method
Unit 6.2 – Differential Equations: Growth and Decay
Unit 6.3: - Separation of Variables and the Logistic Function
Review and Assessment

**Week 18: Application of Integration**

Unit 7.1 – Area of a Region Between Two Curves
Unit 7.2 – Volume: The Disk Method/ The Washer Method & Known Cross Sections
*Unit 7.3 – Volume: The Shell Method (optional- may be used on AP Exam)*

**Week 19: Semester Final Examinations**

Students complete the AP Calculus BC District Semester Examination

## Second Semester: Third Quarter

**Week 1: Application of Integration** *(continued)*

Unit 7.4 – Arc Length and Surfaces of Revolution
*Unit 7.5 – Work (Optional)*
*Unit 7.6 – Moments, Centers of Mass, and Centroids (Optional)*
*Unit 7.7 – Fluid Pressure and Fluid Force (Optional)*
Unit 8.1 – Basic Integration Rules
Review and Assessment

**Weeks 2-3: Integration Techniques, L'Hopital's Rule, and Improper Integrals**

Unit 8.1 – Basic Integration Rules
Unit 8.2 – Integration by Parts
Unit 8.5 – Partial Fractions
Unit 8.7 – Indeterminate Forms and L'Hopital's Rule
Unit 8.8 – Improper Integrals
Review and Assessment

## Second Semester: Third Quarter *(Continued)*

**Weeks 4-7: Infinite Series**

Unit 9.1 – Sequences
Unit 9.2 – Series and Convergence
Unit 9.3 – The Integral Test and *p*-series
Unit 9.4 – Comparisons of Series
Unit 9.5 – Alternating Series
Unit 9.6 – The Ration and Root Tests
Unit 9.7 – Taylor Polynomials and Approximations
Unit 9.8 – Power Series
Unit 9.9 – Representation of Functions by Power Series
Unit 9.10 – Taylor and Maclaurin Series
Review and Assessment

**Weeks 9-10: Conics, Parametric Equations, and Polar Coordinates**

Unit 10.2 – Plane Curves and Parametric Equations
Unit 10.3 – Parametric Equations and Calculus
Unit 10.4 – Polar Coordinates and Polar Graphs
Unit 10.5 – Area and Arc Length in Polar Coordinates
Review and Assessment

## Second Semester: Fourth Quarter

**Weeks 11-12: Vectors and the Geometry of Space**
**Vector-Valued Functions**

Unit 11.1 – Vectors in the Plane
Unit 12.1 – Vector-Valued Functions
Unit 12.2 – Differentiation and Integration of Vector-Valued Functions
Unit 12.3 – Velocity and Acceleration
Review and Assessment

**Week 13-14: Review and AP Testing**

**Week 15: Applications of Differentiation**

Unit 3.8 – Newton's Method

**Weeks 16-17: Applications of Integrations**

*(Optional Prior to AP Exam- Cover Remaining Now as Time Permits)*

Unit 7.3 – Volume: The Shell Method
Unit 7.5 – Work
Unit 7.6 – Moments, Centers of Mass, and Centroids
Unit 7.7 – Fluid Pressure and Fluid Force

**Weeks 18- 19: Final Exams- AP Calculus AB District Final Examination**

**Learning Experiences and Instruction**

Homework topics are presented graphically, numerically, analytically, and verbally and the connection between these representations is emphasized.

Direct Instruction is the primary method of instruction:

*Technology Integration to Advance Instruction and Student Comprehension:*

- Geometer Sketchpad Software
- TI-89 Graphing Calculator
- Applicable Web Application: *Calculus in Motion*

**Support for English Language Learners**:
Teachers will supplement with universal access materials from SB 472 training including word walls, visual aides, and graphic organizers. Additional instruction in academic and content vocabulary is provided to increase access to rigorous curriculum for limited English speakers.

**Support for Special Education Students**:
Extremely high math-functioning RSP students may be appropriately placed in this course. Teachers will supplement with universal access materials from SB 472 training including word walls, visual aides, and graphic organizers. Core teacher collaboration with Resource Teacher on assessment, progress reporting, and semester grades is required.

**GATE Students**:
This course is an appropriate instructional model for GATE students, incorporating a rigorous curriculum with instructional support for student success.