

MATHEMATICS DEPARTMENT

BC CALCULUS (H/AP): COURSE #341

Contact Information

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The Department's Educational Philosophy

The study of mathematics will enhance the ability of all students to problem solve and to reason. Through a strong standardized departmental program that emphasizes problem solving, communicating, reasoning and proof, making connections, and using representations, students will develop self-confidence and a positive attitude towards mathematics.

Our curriculum matches that of the Massachusetts Mathematics Curriculum Framework, and we are philosophically aligned with the National Council of Teachers of Mathematics Standards.

Guiding Principles

- Mathematical ideas should be explored in ways that stimulate curiosity, create enjoyment of mathematics, and develop depth of understanding.
- Effective mathematics programs focus on problem solving and require teachers who have a deep knowledge of the discipline.
- Technology is an essential tool in a mathematics education, and all students should gain facility in using it where advantageous.
- All students should have a high-quality mathematics program.
- Assessment of student learning in mathematics should take many forms to inform instruction and learning.
- All students should understand the basic structure of mathematics.
- All students should recognize that the techniques of mathematics are reflections of its theory and structure.
- All students should gain facility in applying mathematical skills and concepts.
- All students should understand the role of inductive and deductive reasoning in mathematics and real life situations.

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Course Frequency: Full-year course, five times per week

Credits Offered: Five

Prerequisites: A final grade of at least 80 in Trigonometry/Analytic Geometry H

Background to the Curriculum

This course uses the text, Calculus, Graphical, Numerical, and Algebraic, by Finney, Demana, Waits, and Kennedy, 1999 edition. It follows the BC syllabus for Calculus as outlined by the Educational Testing Service. Since its introduction in the mid 1960s, the course has used various editions of Thomas' Calculus, which then became Thomas/Finney Calculus, and ultimately the text now used. The text is followed closely, and the class completes the text. Additional material along the lines of preparation for the Advanced Placement exam is introduced, mostly during the second semester. Students are provided with old examinations – both the Multiple Choice and Free Response sections – as well as material obtained at recent ETS conferences.

Core Topics/Questions/Concepts/Skills

Limits and continuity

Differentiation: concepts, mechanics

Differentiation: applications

Definite Integration: concepts, mechanics

Definite Integration: applications to exponential growth, population growth, business

Definite Integration: applications to engineering and science

The Fundamental Theorem of Calculus

Convergence of infinite sequences and series

Taylor Polynomials and applications

Calculus of vector functions, parametric functions, polar functions

Course-End Learning Objectives

<u>Learning objective</u>	<u>Corresponding state standards, where applicable</u>
<ol style="list-style-type: none">1] find the equations of linear, exponential, logarithmic, trigonometric functions2] use regression analysis for lines, quadratics, exponentials, and logarithmic curves3] use functions and graphs and find their domain and range4] work with parametric equations5] compute all types of limits6] work with continuous and discontinuous functions7] differentiate between average and instantaneous rates of change8] find the derivative of algebraic functions by definition9] understand the concept of differentiability graphically10] compute a numerical derivative using NDER on a graphing calculator11] compute the derivatives of algebraic and transcendental functions12] find tangent and normal lines to curves13] use the product rule, quotient rule, and chain rule14] differentiate implicitly15] find velocity, acceleration, and jerk of a particle given its position16] find extreme values of functions17] apply the Mean Value Theorem18] solve word problems involving optimization19] solve word problems involving related rates20] use Linearization to approximate functional values21] use Newton's Method22] estimate with finite sums23] find definite integrals geometrically, as well as by the Fundamental Theorem of Calculus24] compute a definite integral using FNINT on a graphing calculator25] evaluate anti-derivatives of algebraic and transcendental functions26] approximate a definite integral numerically27] use slope fields28] solve Separable Differential Equations29] integrate by parts30] solve problems involving exponential growth and decay	There are no state standards for college level math courses.

<ul style="list-style-type: none">31] solve problems involving population growth32] use Euler's Method33] understand and apply the definite integral as "Net Charge"34] find areas, volumes, and arc length by definite integration35] apply the definite integral to unfamiliar situations36] use L'hospital's rule37] compare rates of growth38] compute Improper Integrals39] integrate using partial fractions40] integrate using trigonometric substitutions41] use Integral tables42] use the hyperbolic trig functions43] use power Series44] find Taylor Series and use Taylor's Theorem45] determine radius of convergence of series46] determine convergence and divergence of infinite sequences and series47] find the derivative of parametric functions48] use vectors and vector-valued functions49] model projectile motion50] graph in polar coordinates51] find areas, arc length, and slope of equations given in polar coordinates	
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Assessment

Students are generally assessed by in-class tests and quizzes, administered regularly throughout a marking period. Generally, two quizzes are equivalent to a test. The students' attitude, effort, and quality of homework will also impact their term grade to a small degree. Teachers informally assess students every day by asking pivotal questions, as well as those involving mechanics or concepts, and the students' term grades may be positively affected to a small degree based on their responses.

A standardized midyear examination is given. Most students take the AP exam and are then exempt from the final exam.

Technology Learning Objectives Addressed in This Course

(This section is for faculty and administrative reference; students and parents may disregard.)

<u>Course activity: skills &/or topics taught</u>	<u>Standard(s) addressed through this activity</u>
1] Graphing calculator to fit curves to data 2] Graphing calculator to find numerical derivatives, and numerical integrals 3] Graphing calculator to solve problems not solvable by traditional methods	

Materials and Resources

In addition to the text, teachers use old AP exams for reference, and some test questions are taken from them. Many old AP exams are given to students in the spring to prepare for the upcoming test. Extra optional review sessions are held either after school or in the evening or on the weekends to help students prepare for the Advanced Placement exam.