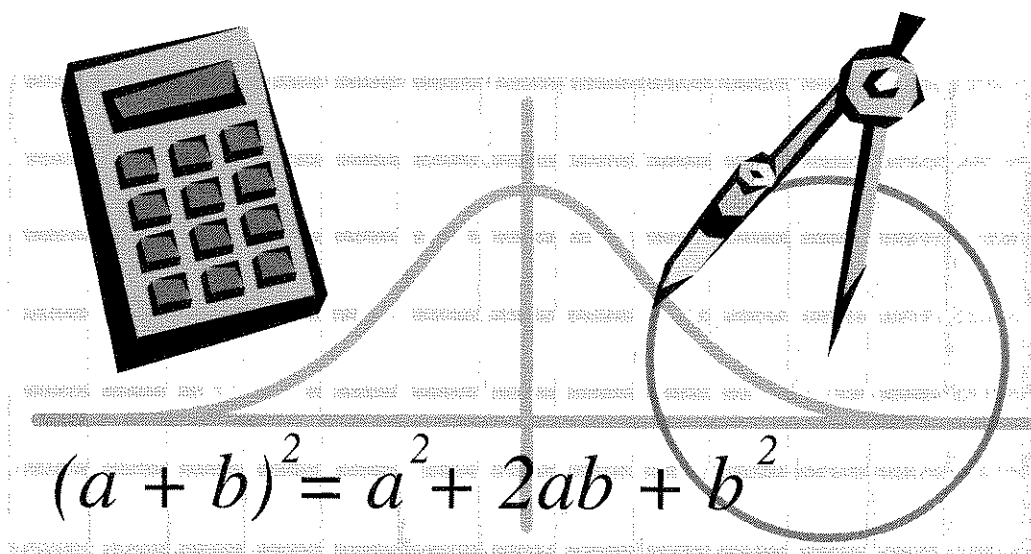


Atlantic City Public Schools

AP Calculus BC

Grades 9 - 12



I. OVERVIEW

Advanced Placement Calculus BC is open to all students who have successfully completed Analysis/Pre-Calculus. The course includes techniques of differentiation and integration and their applications, infinite series, and work with parametric and polar equations, and vectors.

II. RATIONALE

BC Calculus is the fourth course in the honors college preparatory sequence. It is an extremely rigorous course designed to meet the specifications outline in the College Board Course Description for Advanced Placement Calculus BC. It is intended to prepare students for future careers in mathematics, science, and computer science.

III. STANDARDS

The Atlantic City Mathematics Program is aligned too the NJ Core Mathematics Content Standards. The standards are listed below.

- 4.1 All students will develop number sense and will perform standard numerical operations and estimations on all types of numbers in a variety of ways
 - A. Number Sense
 - B. Numerical Operations
 - C. Estimation
- 4.2 All students will develop spatial sense and the ability to use geometric properties, relationships, and measurement to model, describe, and analyze phenomena.
 - A. Geometric Properties
 - B. Transforming Shapes
 - C. Coordinate Geometry
 - D. Units of Measurement
 - E. Measuring Geometric Objects
- 4.3 All students will represent and analyze relationships among variable quantities and solve problems involving patterns, functions, and algebraic concepts and processes.
 - A. Patterns and Relationships
 - B. Functions
 - C. Modeling
 - D. Procedures

- 4.4 All students will develop an understanding of the concepts and techniques of data analysis, probability, and discrete mathematics, and will use them too model situations, solve problems, and analyze and draw appropriate inferences from data.
- A. Data Analysis (Statistics)
 - B. Probability
 - C. Discrete Mathematics-Systematic Listing and Counting
 - D. Discrete Mathematics-Vertex Edge Graphs and Algorithms
- 4.5 All students will use mathematical processes of problem solving, communication, connections, reasoning, representations, and technology to solve problems and communicate mathematical ideas.
- A. Problem Solving
 - B. Communication
 - C. Connections
 - D. Reasoning
 - E. Representations
 - F. Technology

IV. STUDENT OUTCOMES

A. KNOWLEDGE (Information and Concepts)

The student will:

1. find the definition of derivative, use the derivative to find rates of change, and use the rules of differentiation, ie. product, quotient, and chain rules. [4.3.12.B, 4.5.12.F]
2. learn implicit differentiation and discover how to use differentiation to find related rates, extrema on an interval, and the mean value theorem. [4.3.12.B, 4.5.12.F]
3. use the first derivative and second derivative analysis to find inflection points and to determine concavity of a curve. [4.3.12.B, 4.5.12.F]
4. approximate the area under a curve using the rules of integration. [4.3.12.B, 4.5.12.E, 4.5.12.F]
5. construct antiderivatives using the Fundamental Theorem of Calculus [4.13.12.E, 4.5.12.A, 4.5.12.E]

6. use integration by substitution.
[4.5.12.E, 4.3.12.B]
7. use numerical integration
[4.3.12.B, 4.5.12.F]
8. understand the value of e .
[4.5.12.C, 4.5.12.E, 4.3.12.B]
9. apply the properties of logarithms through both differentiation and integration. [4.3.12.B, 4.5.12.C, 4.5.12.D]
10. use inverse functions to determine whether one function is the inverse function of another function. [4.3.12.B, 4.5.12.C, 4.5.12.D]
11. differentiate and integrate natural exponential functions
[4.3.12.B, 4.5.12.E, 4.5.12.D]
12. solve problems involving exponential growth and decay and the numerous applications to exist. [4.1.12.B, 4.3.12.C, 4.5.12.A, 4.5.12.F]
13. use various methods including Slope Fields, Euler's Method, and Separation of Variables to solve Differential Equations.
[4.3.12.A, 4.5.12.B]
14. find the area between two curves and the area of a region between intersecting curves using integration. [4.3.12.B, 4.5.12.F]
15. find the areas of solids using the Disc Method, Washer Method, and by cross-sectional area. [4.3.12.B, 4.5.12.F]
16. review procedures for fitting and integrand to one of the basic integration rules. [4.3.12.B, 4.5.12.D, 4.5.12.F]
17. find an antiderivative and the tabular method to perform integration by parts. [4.5.12.A, 4.5.12.F]
18. solve trigonometric integrals involving the powers of sine, cosine, secant, and tangent. [4.3.12.B, 4.5.12.A, 4.5.12.F]
19. understand the concept of a partial fraction decomposition
[4.5.12.C, 4.5.12.D]
20. understand L'Hopital's Rule and indeterminate forms.
[4.5.12.C, 4.5.12.D]

21. find improper integrals.
[4.5.12.A, 4.5.12.B]
22. understand the basic properties of a series and be able to determine convergence or divergence. [4.5.12.A, 4.5.12.B]
23. determine the nature of a series and then use the appropriate test to determine whether the series converges or diverges.
[4.3.12.B, 4.5.12.A]
24. use Taylor and Maclaurin polynomial approximations of elementary functions. [4.3.12.B, 4.5.12.C]
25. understand the properties of power series and how to use a power series to represent a function. [4.3.12.A, 4.3.12.B, 4.5.12]
26. understand how conics, parametric equations, and polar coordinates are applied in calculus. [4.3.12.A, 4.5.12.B]
27. understand vectors in a plane. [4.5.12, 4.5.13.B]

B. Attitudes

The student will:

1. develop a desire to pursue the study of mathematics in the future.
[4.5A, 4.5C]
2. develop an understanding and appreciation for the application of mathematics in real life situations and its relationship to other disciplines.
[4.5B, 4.5C, 4.2D, 4.3C]
3. develop a desire to persist and solve mathematical problems from beginning to end.
[4.5A]
4. develop an appreciation for the history of mathematics
[4.5C]
5. develop an appreciation for mathematics as an integrated whole.
[4.5C, 4.3D]

C. CLASSROOM EXPECTATIONS

The student will:

1. develop pride in and a feeling of self worth.
2. develop a respect and be active in the learning process.
3. learn to respect those that think, dress, and act differently.
4. encourage and nurture academic achievement through high expectations.
5. promote an appreciation for the strengths of cultural diversity.
6. be prepared to learn on a daily basis.

D. SKILLS AND BEHAVIORS

The student will:

1. develop and apply various strategies to solve problems from everyday and mathematics situations as well as career-based problems.
[4.5A, 4.5B, 4.5C, 4.5E, 4.5F, 4.2D, 3.2D, 4.3C, 4.4D]
2. develop the ability to communicate mathematically through a variety of forms of expression including oral, written, and visual.
[4.5A, 4.5B, 4.5C, 4.5D, 4.5E]
3. use physical models and manipulatives to model and investigate problem situations and mathematics concepts.
[4.5A, 4.5E, 4.5F]
4. use calculators and other appropriate forms of technology to gather, analyze, and display mathematical data, and to facilitate and enhance their mathematical thinking, understanding, and power.
[4.5A, 4.5B, 4.5C, 4.5E, 4.5F, 4.1C, 4.1B, 4.2B, 4.4A]
5. demonstrate organization by keeping a complete and detailed notebook.
6. work independently and in cooperative groups to enhance mathematical thinking.
[4.5A, 4.5A, 4.5B, 4.5D]

7. recognize that there may be multiple ways to solve a problem, weigh their relative merits, and select and use appropriate problem solving strategies.
[4.5A, 4.5B, 4.5E, 4.5F, 4.1C, 4.2D, 4.3D]
8. reflect on and clarify their thinking so as to present convincing arguments for their conclusions.
[4.5A, 4.5B, 4.5D, 4.5E]

E. TECHNOLOGICAL LITERACY

The student will:

1. demonstrate the ability to enter data, use mathematical or logical functions to manipulate data, to generate charts and graphs, and to interpret the results [8.12.1.A.3]
2. exhibit legal and ethical behaviors when using information and technology, and discuss consequences of misuse [8.12.1.B.2]
3. understand the nature and impact of technology as well as its costs and trade-offs in terms of productivity [8.12.2.A.1, 8.12.2.A.2, 8.12.2.A.3]

F. CAREER EDUCATION AND CONSUMER, FAMILY, AND LIFE SKILLS

The student will:

1. understand the necessary pathways for entering the world of work as well as continuing education, such as college, post-secondary vocational-technical education, specialized certification and/or registered apprenticeships [9.1.A.1, 9.1.A.2, 9.1.A.3, 9.1.A.4]
2. understand the importance of mathematics and how to use mathematics in order to be functional members of society.
[9.2.12.A.1, 9.2.12.A, 9.2.12.A.4, 9.2.12.C.1, 9.2.12.E]

V. STRATEGIES

Instruction in BC Calculus is accomplished through:

- large group interactive lecture/discussion
- independent reading of text
- problem exercises designed

Appropriate classroom time will be given to allow students to:

- work collaboratively on problem solving exercises
- work in individual and small group
- present original work to other students and receive critiques of their work; to critique the work of other students

Graphing calculators are used throughout the course to assist and reinforce concept development.

VI. EVALUATION

Students will be evaluated by multiple criteria which may include:

- Chapter/Unit Test & Quizzes; these will consist of recall questions, short constructed response questions and open-ended questions requiring students to explain their thinking in arriving at their solution/conclusion.
- Notebooks; specific criteria will be determined by the teacher and will include note taking and homework
- Out-of-class graded assignments such as enrichment projects
- Oral presentations
 - informal- participation in class discussions
 - formal- presentation of special assignments/projects
- Class participation as determined by the teacher
- Open-Ended Questions based upon the High School Proficiency Assessment.

The marking period grades for the course will be determined as follows:

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| • Formal Assessment (Tests/Quizzes) | 50% |
| • Homework, notebook, project, class participation, special graded assignments, and alternative assessments (as determined by teacher) | 50% |

The number of/and frequency of tests/quizzes and other assessments will be determined by the teacher.

The final grade for AP Calculus BC will be determined by the following:

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| • Four quarter grades each worth 22.5% | 90% |
| • One final exam | 10% |

Final exams are departmental tests and will consist of multiple choice and open-ended questions.

VII. REQUIRED RESOURCES

1. The text for this course is:
Calculus of a Single Variable, D.C. Heath and Company, Lexington, MA, 2008. . ISBN: 0-618-50304-8
2. Other primary sources:
Advanced Placement Exams as released by The College Board
Teacher created resource binder
3. Other resources:
Principles and Standards for School Mathematics. National Council of Teachers of Mathematics. New York. 2000.

Montgomery Township Public School District

District Laptop Carts
4. Calculators
TI-89 graphing calculator
5. Monthly Assessments
AP Test

VIII. SCOPE AND SEQUENCE

Unit	Textbook Section	Time
1.	Limits and Continuity	12 days
1.1	Introduction to Limits	
1.2	Properties of Limits	
1.3	Evaluation of Limits	
1.4	Continuity of Limits	
1.5	Infinite Limits	
2.	Derivatives	13 days
2.1	Derivative and the Tangent Line	
2.2	Basic Differentiation Rules	
2.3	Product and Quotient Rules	
2.3	Higher-Order and Trigonometric Derivatives	
2.4	The Chain Rule	
2.5	Implicit Differentiation	
2.6	Related Rates of Change	

3.	Applications of Differentiation	13 days
3.1	Maxima, Minima, and Critical Numbers	
3.2	Mean Value Theorem	
3.3	Increasing and Decreasing Functions	
3.3	First Derivative Test	
3.4	Concavity and the Second Derivative Test	
3.5	Limits at Infinity	
3.6	Curve Sketching Techniques	
3.7	Optimization Problems	
3.8	Newton's Method	
3.9	Differentials	
3.10	Business and Economics Applications	
4.	Integration	14 days
4.1	Antiderivatives and Basic Integration Rules	
4.2	Area of a Plane Region	
4.3	Riemann Sums and Definite Integrals	
4.4	The Fundamental Theorem of Calculus	
4.5	Integration by Substitution	
4.6	Numerical Integration	
5.	Logarithmic, Exponential, and Other Transcendental Functions	13 days
5.1	Natural Logarithmic Function and the Number e	
5.2	Natural Logarithmic Function and Integration	
5.3	Inverse Function	
5.4	Exponential Functions: Differentiation and Integration	
5.5	Bases Other than e and Applications	
5.6	Differential Equations: Growth and Decay	
5.7	Inverse Trigonometric Functions and Differentiation	
5.8	Inverse Trigonometric Functions and Integration	
6.	Applications of Integration	7 days
6.1	Area of a Region Between Two Curves	
6.2	Volume of Solids of Revolution – Disks and Washers	
6.2	Solids with Known Cross Section	
6.3	Arc lengths	

7.	Integration Techniques	20 days
7.1	Basic Integration Rules	
7.2	Integration by Parts	
7.3	Trigonometric Integrals	
7.5	Partial Fractions (non-repeated linear functions only)	
7.7	Indeterminate Forms and L'Hopital's Rule	
7.8	Improper Integrals	
8.	Infinite Series	20 days
8.2	Series and Convergence	
8.3	The Integral Test and p-Series	
8.4	Comparisons of Series	
8.5	Alternating Series	
8.6	The Ratio Test	
8.7	Taylor Polynomials and Approximations	
8.8	Power Series	
8.9	Representation of Functions by Power Series	
8.10	Taylor and Maclaurin Series	
9.	Parametric Equations	15 days
10.1	Plane Curves and Parametric Equations	
10.2	Parametric Equations and Calculus (including arc length)	
10.3	Polar Equations and Polar Graphs	
10.4	Area in Polar Coordinates	
10.	Vectors in the Plane	5 days
12.2	Differentiation and Integration of Vector-Valued Functions, Two-Dimensional Only	
12.3	Velocity and Acceleration	
11.	Practice AP Tests	12 days
	Review of AP Tests released by The College Board	
12.	Projects	20 days
13.	Testing Days, Final Exams, and Special Schedules	16 days