VIRGINIA BEACH CITY PUBLIC SCHOOLS
CHARTING THE COURSE

Department of Teaching & Learning
Parent/Student Course Information

Advanced Placement Calculus BC
(MA 3178)
One credit, One year

Counselors are available to assist parents and students with course selections and career planning. Parents may arrange to meet with the counselor by calling the school's guidance department.

COURSE DESCRIPTION
AP Calculus BC is more rigorous than AP Calculus AB. It meets the requirements set forth in the syllabus of the College Board. Topics include differentiation and integration techniques; vector functions and parametric equations; polar graphs and area bounded by polar curves; length of a path; work as an integral; improper integrals; and sequences and series. A satisfactory grade on the Advanced Placement BC test usually receives more college credit than a similar grade on the AB test.

PREREQUISITE
Mathematical Analysis

REQUIRED TEXTBOOK
Calculus, Graphical, Numerical, Algebraic, Fourth Edition, Finney, Demana, Waits, and Kennedy, Pearson/Prentice Hall (2012)

RECOMMENDED CALCULATOR
TI-89 or a similar graphing calculator
TI-83 Plus, TI-84 Plus, TI-84 Plus C or TI-84 Plus CE

Virginia Beach Instructional Objectives
AP Calculus BC – MA3178

VBO#	Objective
	Functions, Graphs and Limits
MA.APC.FN.1.1	The student will describe the limiting process, calculate limits using algebra and estimate limits from graphs or tables of data, including one-sided limits.
MA.APC.FN.1.2	The student will analyze graphical behavior to describe asymptotes and asymptotic behavior in terms of limits involving infinity.
MA.APC.FN.1.3	The student will compare relative magnitudes of functions and their rates of change (for example, contrasting exponential growth, polynomial growth and logarithmic growth).
MA.APC.FN.1.4	The student will explain, in geometric terms, the meaning of continuity of a function and be able to describe continuity in terms of limits.
MA.APC.FN.1.5	The student will describe graphs of continuous functions by applying the Intermediate Value Theorem.
	Derivatives
MA.APC.DR.2.1	The student will describe the concept of a derivative and apply the concept graphically, numerically and analytically.
MA.APC.DR.2.2	The student will define the relationship between differentiability and continuity.
MA.APC. DR.2.3	The student will define derivatives as the slope of the tangent line to a curve and as instantaneous rate of change using the limit of average rate of change. The student will approximate rate of change from graphs and tables of values.
MA.APC. DR.2.4	The student will analyze the characteristics of the graph of a function and predict the graph of its first derivative and second derivative.
MA.APC. DR.2.5	The student will apply the Mean Value Theorem in order to find the intervals on which a function is increasing and decreasing and compare the behavior of a function and the values of its first derivative.
MA.APC. DR.2.6	The student will translate verbal descriptions into equations involving derivatives and vice versa.
MA.APC. DR.2.7	The student will represent the relationship between the concavity of a function and the values of its second derivative and identify points of inflection.
MA.APC. DR.2.8	The student will use derivatives to analyze functions, including the concepts of monotonicity, concavity and the intervals on which a function is increasing and decreasing.
MA.APC. DR.2.9	The student will apply the concept of a derivative to solve optimization problems that involve both absolute (global) and relative (local) extrema.
MA.APC. DR.2.10	The student will apply the concept of a derivative to model rates of change, including related rates problems.
MA.APC. DR.2.11	The student will use implicit differentiation to find the derivative of an inverse function.
MA.APC. DR.2.12	The student will interpret the derivative as a rate of change in varied applied contexts, including velocity, speed and acceleration.
MA.APC. DR.2.13	The student will form geometric interpretations of differential equations via slope fields and the relationship between slope fields and solution curves for differential equations.
MA.APC. DR.2.14	The student will compute the derivatives of basic functions, including polynomial and trigonometric.
MA.APC. DR.2.15	The student will compute the derivatives of power, exponential, logarithmic and inverse trigonometric functions.

VBO#	Objective
MA.APC. DR.2.16	The student will compute the derivatives of sums, products and quotients of functions and be able to define the general rules for differentiation of sums, products and quotients of functions.
MA.APC. DR.2.17	The student will compute derivatives of functions using the chain rule and implicit differentiation.
MA.APC.DR.2.18*	The student will apply derivatives to analyze planar curves given in parametric form, polar form and vector form, including velocity and acceleration.
MA.APC.DR.2.19*	The student will use Euler's method to determine a numerical solution of a differential equation.
MA.APC.DR.2.20*	The student will know and apply L'Hopital's Rule to determine limits and convergence of improper integrals and series.
MA.APC.DR.2.21*	The student will find derivatives of parametric, polar and vector functions.
	Integrals
MA.APC.IN.3.1	The student will approximate the area under a non-negative continuous curve using rectangular approximation methods (LRAM, MRAM and MRAM) and interpret the definite integral as the limit of a Riemann sum.
MA.APC.IN.3.2	The student will use trapezoidal sums to approximate definite integrals of functions represented algebraically, graphically and by tables of values.
MA.APC.IN.3.3	The student will interpret the definite integral of the rate of change of a quantity over an interval as the change of the quantity over the interval: $\int_a^b f'(x)\,dx = f(b) - f(a).$
MA.APC.IN.3.4	The student will identify the basic properties of definite integrals (to include additivity and linearity).
MA.APC.IN.3.5	The student will apply integrals to model a variety of physical, biological or economic situations.
MA.APC.IN.3.6	The student will apply integrals to find the area of a region.
MA.APC.IN.3.7	The student will apply integrals to find the volume of a solid with known cross sections.
MA.APC.IN.3.8	The student will apply integrals to find the average value of a function.
MA.APC.IN.3.9	The student will apply integrals to find the distance traveled by a particle along a line.
MA.APC.IN.3.10	The student will apply integrals to find accumulated change from a rate of change.
MA.APC.IN.3.11	The student will use the Fundamental Theorem of Calculus to evaluate definite integrals.
MA.APC.IN.3.12	The student will use the Fundamental Theorem of Calculus to represent a particular antiderivative and perform a graphical analysis of the functions so defined.
MA.APC.IN.3.13	The student will determine antiderivatives following directly from derivatives of basic functions.
MA.APC.IN.3.14	The student will determine antiderivatives by substitution of variables (including change of limits for definite integrals).
MA.APC.IN.3.15	The student will find specific antiderivatives using initial conditions, including applications to motion along a line.
MA.APC.IN.3.16	The student will solve separable differential equations and use them in modeling (including the study of the equation y' = ky and exponential growth).
MA.APC. IN.3.17*	The student will apply integrals to find the area of a region bounded by polar curves.
MA.APC. IN.3.18*	The student will apply integrals to find the length of a curve (including a curve given in parametric form).

VBO#	Objective
MA.APC. IN.3.19*	The student will determine antiderivatives by parts and simple partial fractions (nonrepeating linear factors only).
MA.APC. IN.3.20*	The student will solve logistic differential equations and use them in modeling.
	Polynomial Approximations and Series
MA.APC.4.1*	The student will determine whether an infinite series converges or diverges and compare series to test for convergence.
MA.APC.4.2*	The student will determine the sum of a convergent geometric series and solve real world problems modeled by geometric series.
MA.APC.4.3*	The student will analyze harmonic series to determine partial sums and analyze the error bound of an alternating series.
MA.APC.4.4*	The student will analyze the terms of a series as areas of rectangles and their relationship to improper integrals, including the integral test and its use in testing the convergence of p-series.
MA.APC.4.5*	The student will construct a power series using Taylor polynomial approximation with graphical demonstration of convergence.
MA.APC.4.6*	The student will generate a Maclaurin series when $x = 0$ and the general Taylor series generated by a function at a specific value $x = a$.
MA.APC.4.7*	The student will find a Maclaurin series for the functions containing $f(x) = e^x$, $f(x) = \sin x$, $f(x) = \cos x$ and $f(x) = \frac{1}{1-x}$.
MA.APC.4.8*	The student will manipulate Taylor series and use shortcuts to computing Taylor series, including substitution, differentiation, antidifferentiation and the formation of a new series from a known series.
MA.APC.4.9*	The student will determine functions defined by power series and the radius and interval of convergence of power series.
MA.APC.4.10*	The student will determine the Lagrange error bound for Taylor polynomials.

*Topics covered in Calculus BC class only

Dr. Aaron C. Spence, Superintendent
Virginia Beach City Public Schools
2512 George Mason Drive, Virginia Beach, VA 23456-0038

Produced by the Department of Media and Communications for the Department of Teaching and Learning.
For further information please call (757) 263-1070.

Notice of Non-Discrimination Policy

Virginia Beach City Public Schools does not discriminate on the basis of race, color, religion, national origin, sex, sexual orientation/gender identity, pregnancy, childbirth or related medical condition, disability, marital status, age, genetic information or veteran status in its programs and activities and provides equal access to the Boy Scouts and other designated youth groups. School Board policies and regulations (including, but not limited to, Policies 2-33, 4-4, 4-6, 4-43, 5-7, 5-19, 5-20, 5-44, 6-7, 7-48, 7-49, 7-57 and Regulations 4-4.1, 4-4.2, 4-6.1, 4-43.1, 5-44.1, 7-11.1, 7-17.1 and 7-57.1) provide equal access to courses, programs, counseling services, physical education and athletic, vocational education, instructional materials and extracurricular activities.

To seek resolution of grievances resulting from alleged discrimination or to report violations of these policies, please contact the Title VI/Title IX Coordinator/Director of Student Leadership at (757) 263-2020, 1413 Laskin Road, Virginia Beach, Virginia, 23451 (for student complaints) or the Section 504/ADA Coordinator/Chief Human Resources Officer at (757) 263-1133, 2512 George Mason Drive, Municipal Center, Building 6, Virginia Beach, Virginia, 23456 (for employees or other citizens). Concerns about the application of Section 504 of the Rehabilitation Act should be addressed to the Section 504 Coordinator/Executive Director of Student Support Services at (757) 263-1980, 2512 George Mason Drive, Virginia Beach, Virginia, 23456 or the Section 504 Coordinator at the student's school. For students who are eligible or suspected of being eligible for special education or related services under IDEA, please contact the Office of Programs for Exceptional Children at (757) 263-2400, Laskin Road Annex, 1413 Laskin Road, Virginia Beach, Virginia, 23451.

Alternative formats of this publication which may include taped, Braille, or large print materials are available upon request for individuals with disabilities. Call or write The Department of Teaching and Learning, Virginia Beach City Public Schools, 2512 George Mason Drive, P.O. Box 6038, Virginia Beach, VA 23456-0038. Telephone 263-1070 (voice); fax 263-1424; 263-1240 (TDD) or email him at Emmanuel.Cenizal@VBSchools.com

vbschools.com
your virtual link to Hampton Roads' largest school system

VIRGINIA BEACH CITY PUBLIC SCHOOLS
CHARTING THE COURSE

(Revised August 2017)