East Penn School District
Secondary Curriculum

A Planned Course Statement
for

Analytic Geometry and Calculus (BC) AP

Course # **360** Grade(s) 12
Department: Math

Length of Period (mins.) 41 Total Clock Hours: 126

Periods per Cycle: 6 Length of Course (yrs.) 1

Type of Offering: _____ required ✓ elective

Credit: 1

Adopted: 6/28/10

Developed by:

Todd Burkhardt

Course Title: **Analytic Geometry and Calculus (BC) AP**

Description of Course

This course is intended for students with an exceptional knowledge of analytic geometry, elementary functions, algebra, geometry and trigonometry. Students who satisfactorily complete this course will be eligible to take the Advanced Placement Mathematics (BC) examination for possible college credit. Calculus (BC) is considerably more extensive than Calculus (AB) and represents the equivalent of a full year of college calculus. Topics to be studied include differentiation and applications, integration and applications, transcendental functions, methods of integration, polar coordinates, vectors and equations, infinite series and differential equations. ****This course is a prerequisite for Advanced Calculus AP(weighted**). This course requires almost daily use of graphing calculators. It is strongly recommended that students have their own graphing calculator.

Goals:

- To provide students with extensive Calculus studies in differentiation and applications, integration and applications, transcendental functions, methods of integration, polar coordinates, vectors and equations, infinite series and differential equations.
- To prepare students to take the AP Calculus BC exam.

Requirements:

Algebra III/ Geometry Honors **AND** Algebra III/ Trigonometry Honors (recommended 92% or better)

Text: Anton, Bivens, and Davis. (2009). Calculus with Early Transcendentals 9th Brief Edition

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Key to Levels of Achievement (Listed with each learning objective)

Awareness (A):	Students are introduced to concepts, forms, and patterns.
Learning (L):	Students are involved in a sequence of steps and practice activities which involved further development and allow evaluation of process.
Understanding (U):	Students demonstrate ability to apply acquired concepts and skills to individual assignments and projects on an independent level.
Reinforcement (R):	Students maintain and broaden understanding of concepts and skills to accomplish tasks at a greater level of sophistication.

Course Objectives –

Unit	Num	Objective	Level	Content	Evaluation	Standard
Chapter 1-Functions	1	Students will be able to identify the properties of elementary functions and apply these to analytic geometry.	R	• Plotting points and lines • Slope of a line • Sketching quadratic and cubic equations • Distance between points • Describing a line Point/slope form Slope/intercept form Two point form Standard form • Absolute value function Algebraically Geometrically • Functions and use functional notation including domain and range. • Zeros of a function • Sums, differences, products, and quotients of functions • Composite functions • Odd and even functions • Inverse functions • Set and interval notation • Trigonometric and Inverse Trigonometric Functions • Radian measure • Trigonometric identities • Parametrically defined functions	• Quizzes • Use of graphing calculator • Test	2.211.f 2.4.11b,c,e 2.5.11b,c,d 2.8.11e,g,h,j k,l,m,n, o,p,q,r 2.9.11i
Chapter 2-Limits & Continuity	2	Students will be able to define and use the concepts of limits (Sections 2.1-2.3, 4.5).	L	• Definition and computation of the limit of an algebraic expression in one variable • Limit notation and calculations • Limits of sums, differences, products, and quotients • Limits of composite functions • Use of limits to analyze horizontal and vertical asymptotes • Use of L'Hopital's Rule to determine the limit of an expression of indeterminate form (Section 4.5)	• Quizzes • Use of graphing calculator • Test • Assignments	2.2.11f 2.4.11b,c 2.5.11b,c,d 2.11.11e

Unit	Num	Objective	Level	Content	Evaluation	Standard
				• Indeterminate forms (0^0, 1^{oo}, oo^{oo}) (Section 4.5) • Defining improper integrals with respect to the definition of the definite integral (Section 8.8) • Determining the convergence or divergence of an improper integrand (Section 8.8)		
		Students will analyze the continuity of a function (Sections 2.5-2.6).	L	• Definition and determination of continuity at a point c • Determination of the domain for which a given function is continuous • Removable and nonremovable discontinuity	• Quizzes • Use of Graphing calculator • Test	2.2.11f 2.4.11b,c 2.5.11b,c,d
Chapter 3&4-The Derivative	3	Students will be able to use the definition of the derivative and the rules of differentiation.	L	• Definition of the derivative of a function as a limit (Section 3.1-3.2) • Use of the definition to compute the derivative of various functions (Section 3.3) • Differentiability of a given function • Use of the derivative to find the slope of a tangent line • Derivatives of sums, differences, products and quotients • Derivatives of a composite function the "Chain Rule" (Section 3.5) • Derivative of an inverse function (Section 4.1) • Recognition of a relation requiring implicit differentiation (Section 3.6) • Computation of derivatives implicitly • Definition of "differential" (Section 3.8) • Derivatives of differential notation	• Quizzes • Graded assignments • Test • Use of graphing calculator	2.2.11f 2.4.11b,c 2.5.11b,c,d 2.8.11s,t

Unit	Num	Objective	Level	Content	Evaluation	Standard
				• Increment of a function • Exponential functions and their derivatives (Sections 4.2-4.3) • Logarithmic functions and their derivatives • Trigonometric functions and their derivatives (Section 3.4) • Inverse trigonometric functions and their derivatives (Section 4.4)		
Chapter 5-Derivative Application	4	Students will be able to apply the concept of derivatives to curve sketching and modeling.	L	• Equation of tangent and normal lines • Linear approximation (Section 3.8) • Related rates (Section 3.7) • Average and instantaneous rates of change • Curve analysis: including …(Sections 5.2-5.3, 5.5) Vertical and horizontal asymptotes Intercepts Intervals of increase/decrease/concavity Extreme (relative and absolute) Inflection points Points of nondifferentiability • Applied extrema problems (Section 5.6) • Rolle's Theorem (Section 5.8) • Mean Value Theorem (for derivatives) • The Intermediate Value Theorem • Newton's Method (Section 5.7)	• Quizzes • Use of graphing calculator • Graded assignments • Test • Related Rates or Max/Min project	2.2.11f 2.4.11b,c 2.5.11b,c,d 2.8.11t 2.9.11i 2.10.11a,c
Chapter 6 and Chapter 8 - Integration	5	Students will be able to use techniques of integration.	L	• Integration of xa (power rule) (Section 6.2) • Integration using u substitution (Section 6.3) • Integration of Trigonometric Functions • Integration by Parts (Section 8.2) • Integration by Trig substitution (Section 8.3-8.4)	• Quizzes • Graded assignments • Use of graphing calculator • Test	2.2.11f 2.4.11b,c 2.5.11b,c,d

Unit	Num	Objective	Level	Content	Evaluation	Standard
		Students will be able to solve problems using the indefinite integral.	L	• Integration by completing the square • Integration by partial fractions (Section 8.5) • Definition and computation the indefinite integral • Initial value problems and the constant of integration (Section 6.2) • Estimation of the area under a curve using a finite number of rectangles (left hand/right hand) (Section 6.4)	• Quizzes • Graded worksheets • Test	2.4.11b,c 2.5.11b,c,d
		Students will be a able to utilize limits as a means of determining the area under a curve.	L	• Using limits, determining the exact area under a curve (Section 6.5) • Estimation of the area using the trapezoidal and midpoint rules (Section 8.7) • Discussion of the number of subdivisions required in order to get a certain precision-optional. • The Fundamental Theorem of Calculus (Section 6.6, 6.8) • Functions defined by integration • Integrals involving In(x) and exp(x) (Section 6.9)	• Quizzes • Graded worksheets • Use of graphing calculator	2.4.11b,c 2.5.11b,c,d 2.10.11c
		Students will apply the Definite Integral to analyze functions.	L		• Quizzes • Graded worksheets • Test	
Chapter 9- Differential Equations	6	Students will be able to solve separable and logistic differential equations, model real world problems with them, and graph them as well		• Integrating separable differential equations (Section 9.1) • Euler's method and slope fields	• Quizzes • Graded worksheets • Use of graphing calculator	2.2.11f 2.4.11b,c 2.5.11b,c,d 2.9.11i
Chapter 7- Application of the Definite Integral	7	Students will apply the Definite Integral to solve Practical Problems.	L	• Area under a curve (or between curves) (Section 7.1) • Volumes of solids (Section 7.2-7.3) of rotation around a horizontal of vertical axis formed	• Quizzes • Graded worksheets • Test • Research project	2.4.11b,c 2.5.11b,c,d 2.9.11i 2.10.11e

Unit	Num	Objective	Level	Content	Evaluation	Standard
				by perpendicular slices to a given axis • Displacement and distance traveled in a specific time interval (Section 6.7) – rectilinear motion • Area bounded by polar curves (Section 11.3) • Arclength of a function (including parametric curves) • Surface area of a function (optional) • Average value (Mean Value Theorem for Integrals) • Work (force and displacement) (Section 7.6) optional		
Chapter 10-Infinite Sequences and Series	8	Students will study Infinite Sequences and Series	L	• Defining an infinite sequence (Section 10.2-10.3) • Defining the limit of the general term of a sequence as n-->oo • Analysis of some recursively defined sequences – optional • Defining an Infinite series (Sections 10.4) • Defining the sum of an infinite series • Analysis of Convergence and Divergence of geometric series • Establishing conditions necessary for the convergence of a series (Sections 10.5-10.7) • Writing proofs of convergence or divergence of infinite series Divergence Test Integral Test, p-series, Harmonic series Basic and Limit Comparison Tests Ratio and Root tests Conditional vs. Absolute Convergence	• Graded Assignments • Quizzes • Test • Use of Graphing Calculator	2.5.11a,b,c,d 2.2.11f 2.6.11c,d,f 2.8.11c 2.11.11d

Unit	Num	Objective	Level	Content	Evaluation	Standard
Specific Series **Chapter 10** **continued**	8		L	• Defining Alternating Series and establishing tests Determine the error bound for alternating series (Section 10.7) • Representing Transcendental Functions with MacLauren and Taylor Series (Sections 10.1, 10.8-10.10) • Series expansions • Taylor polynomials with remainder and Lagrange error • Defining Power Series • Determining the interval and radius of convergence of a given power series • Manipulating a power series by addition, term by term differentiating and integrating, and substitution • Representing functions with rational exponents using the binomial series (optional)	• Graded Assignments • Quizzes • Test • Use of Graphing Calculator • Project	2.5.11a,b,c,d 2.2.11f 2.6.11c,d,f 2.8.11c 2.11.11d
Polar and Parametric Functions **Chapter 11**	9	Students will apply integration techniques to polar and parametric curves	L	• Converting between polar and rectangular coordinates (Section 11.1-11.2) • Graphing a function in polar coordinates • Symmetry and intercepts of parametrically defined curves • Writing the equation of tangent lines to polar curves • Computing the area of a region bounded by a polar curve or polar curves (Section 11.3) • Computing the area of a region bounded by parametrically defined curves-optional	• Graded Assignments • Quizzes • Test • Use of Graphing Calculator	2.5.11a,b,c,d 2.2.11f 2.9.11i 2.11.11e
Chapter 12 and 13 **Vector Valued Functions**	10	Students will study Vector-Valued Functions as a means of expressing movement along a path	L	• Identifying the notation of a vector-valued function recognizing that parametric equations are the components of a	• Quizzes • Explorations • Test	2.5.11a,b,c,d 2.4.11a,b,e 2.9.11i 2.11.11e

Unit	Num	Objective	Level	Content	Evaluation	Standard
				vector-valued function (Section 13.1) • Computing the limit of a vector valued function at a point (x,y,z) (Section 13.2)-optional • Computing the derivative and the integral of a vector-valued (parametrically defined) function • Determining the expression for a velocity vector (the tangent vector) • Computing the Arclength of a vector valued function (Section 13.3) • Parametric tracing of the curve • Derivation of the velocity and acceleration vectors for a given vector-valued function • Analysis of the horizontal and vertical components of the velocity vector and how they affect the movement of the particle Determine the speed of a given particle Determine the distance a particle travels during a time interval (arclength) • Projectile motion of a particle defined (Section 13.6-13.7) • Normal and tangential components of a vector-optional • Determining the vector form of curvature (Section 13.5)-optional		