Math Planned Course - AP Calculus BC

All of the following PSSA anchors are taught in each unit.

Anchor A

M11.A.1.1	**Represent and/or use fractions as decimals and percents (item may ask for 2 of any of these 3 – change percent to fraction, change fraction to decimal, etc.)**
M11.A.1.1.1	**Find the square root of an integer using either a calculator or estimation (integer may or may not be a perfect square – answer may be a range of values)**
M11.A.1.1.2	**Express numbers and/or simplify expressions using scientific notation**
M11.A.1.1.3	**Simplify square roots (e.g., the square root of 24)**
M11.A.1.2	**Apply number theory concepts to show relationships between real numbers in problem solving settings.**
M11.A.1.2.1	**Find the Greatest Common Factor (GCF) for sets of monomials and/or factor polynomial expressions using the greatest common monomial factor.**
M11.A.1.3	**Estimate the value of an irrational number.**
M11.A.1.3.1	**Locate/identify irrational numbers at the approximate location on a number line.**
M11.A.1.3.2	**Compare and/or order any real numbers (rational and irrational may be mixed.)**
M11.A.2.1	**Apply ratio and/or proportion in problem-solving situations.**
M11.A.2.1.1	**Solve problems using operations with rational numbers including rates and percents.**
M11.A.2.1.2	**Solve problems using direct and inverse proportions.**
M11.A.2.1.3	**Identify and/or use proportional relationships in problem solving settings.**
M11.A.2.2.	**Use exponents, roots and/or absolute value to solve problems.**
M11.A.2.2.1	**Simplify/evaluate expressions involving positive and negative exponents, roots and/or absolute value.**
M11.A.2.2.2	**Simplify/evaluate expressions involving multiplying with exponents, powers of powers, and powers of products.**
M11.A.3.1	**Apply the order of operations in computation and in problem-solving situations.**
M11.A.3.1.1	**Simplify expressions using the order of operations to solve problems.**
M11.A.3.2	**Use estimation strategies in problem-solving situations.**
M11.A.3.2.1	**Use estimation to solve problems.**

Anchor B

M11.B.2.1	**Use and/or compare measurements of angles.**
M11.B.2.1.1	**Measure and/or compare angles in degrees.**
M11.B.2.2	**Use and/or develop procedures to determine or describe measures of perimeter, circumference, area, surface area and/or volume.**
M11.B.2.2.1	**Calculate surface area of prisms, cylinders, cones, pyramids and/or spheres using formulas on the reference sheet.**
M11.B.2.2.2	**Calculate the volume of prisms, cylinders, cones, pyramids, and/or spheres using formulas on the reference sheet.**
M11.B.2.2.3	**Estimate area, perimeter or circumference of an irregular figure.**
M11.B.2.2.4	**Find the measurement of a missing length given the perimeter, circumference, area, or volume.**
M11.B.2.3	**Describe how a change in one dimension of a figure affects other measurements of that figure.**
M11.B.2.3.1	**Describe how a change in the linear dimension of a figure affects its perimeter, circumference, area or volume.**

Anchor C

M11.C.1.1	**Identify and/or use parts of circles and segments associated with circles.**
M11.C.1.1.1	**Identify and/or use the properties of a radius, diameter, chord, tangent, and/or secant of a circle.**
M11.C.1.1.2	**Recognize or use the properties of arcs, semicircles, inscribed angles and/or central angles.**
M11.C.1.2	**Recognize and/or apply properties of angles, triangles and quadrilaterals.**
M11.C.1.2.1	**Identify and/or use properties of triangles. (median, altitudes, bisectors, side/angle relationships)**
M11.C.1.2.2	**Identify and/or use properties of quadrilaterals. (parallel sides, diagonals, bisectors, congruent sides/angles, supplementary angles)**
M11.C.1.2.3	**Identify and/or use properties of isosceles and equilateral triangles.**

M11.C.1.4 **Solve problems involving right triangles using the Pythagorean Theorem.**
M11.C.1.4.1 **Find the measure of a side of a right triangle using the Pythagorean Theorem.**
M11.C.3.1 **Solve problems using analytic geometry.**
M11.C.3.1.1 **Calculate the distance and/or midpoint between 2 points on a number line or on a coordinate plane**
M11.C.3.1.2 **Relate slope to perpendicularity and/or parallelism.**

Anchor D
M11D.1.1 **Analyze and/or use patterns or relations.**
M11.D.1.1.1 **Analyze a set of data for the existence of a pattern and represent the pattern algebraically and/or graphically.**
M11.D.1.1.2 **Determine if a relation is a function given a set of points or a graph.**
M11.D.1.1.3 **Identify the domain, range or inverse of a relation.**
M11.D.2.1 **Represent and/or analyze mathematical situations using numbers, symbols, words, tables and/or graphs.**
M11.D.2.1.1 **Solve compound inequalities and/or graph their solution sets on a number line.**
M11.D.2.1.2 **Identify or graph functions, linear equations or linear inequalities on a coordinate plane.**
M11.D.2.1.3 **Write, solve and/or apply a linear equation.**
M11.D.2.1.4 **Write and/or solve systems of equations using graphing, substitution and/or elimination.**
M11.D.2.1.5 **Solve quadratic equations using factoring.**
M11.D.2.2 **Simplify expressions involving polynomials.**
M11.D.2.2.1 **Add, subtract, and/or multiply polynomial expressions.**
M11.D.2.2.2 **Factor algebraic expressions, including difference of squares and trinomials.**
M11.D.2.2.3 **Simplify algebraic fractions.**
M11.D.3.1 **Describe and/or determine change.**
M11.D.3.1.1 **Identify, describe, and/or use constant or varying rates of change.**
M11.D.3.1.2 **Determine how a change in one variable relates to a change in a second variable.**
M11.D.3.2 **Compute and/or use the slope of a line.**
M11.D.3.2.1 **Apply the formula for the slope of a line to solve problems.**
M11.D.3.2.2 **Given the graph of a line, 2 points on the line, or the slope and a point on a line, write or identify the linear equation in point-slope, standard, and/or slope-intercept form.**
M11.D.3.2.3 **Compute the slope and/or y-intercept represented by a linear equation or graph.**
M11.D.4.1 **Interpret and/or use linear, quadratic and/or exponential functions and their equations, graphs or tables.**
M11.D.4.1.1 **Match the graph of a given function to its table or equation.**

Anchor E
M11.E.1.1 **Appropriately display and/or use data in problem-solving settings.**
M11.E.1.1.1 **Create and/or use appropriate graphical representations of data, including box-and-whisker plots, stem-and-leaf plots, scatter plots, line/double line, bar/double bar and circle graphs.**
M11.E.1.1.2 **Answer questions based on displayed data .**
M11.E.4.2 **Analyze and/or interpret data on a scatter plot and/or use a scatter plot to make predictions.**
M11.E.4.2.1 **Draw, find and/or write an equation for a line of best fit for a scatter plot.**
M11.E.4.2.2 **Make predictions using the equations or graphs of best-fit lines of scatter plots.**

Addition embedded topic as needed
Anchor E
M11.E.2.1 **Use measures of central tendency to describe a set of data.**

M11.E.2.1.1 Calculate or select the appropriate measure of central tendency of a set of data given or represented on a table, line plot, or stem-and-leaf plot.
M11.E.2.1.2 Calculate and/or interpret the range, quartiles and interquartile range of sets of data.
M11.E.2.1.3 Describe how outliers affect measures of central tendency.
M11.E.3.1 Apply probability and/or odds to practical situations.
M11.E.3.1.1 Find probabilities for independent, dependent or compound events and represent as a fraction, decimal or percent.
M11.E.3.1.2 Find, convert and/or compare the probability and/or odds of a simple event.
M11.E.3.2 Apply counting techniques in problem-solving settings.
M11.E.3.2.1 Determine the number of permutations and/or combinations or apply the fundamental counting principle.
M11.E.4.1 Make predictions using data displays and probability.
M11.E.4.1.1 Estimate or calculate to make predictions based on a circle, line, or bar graph or given situation.
M11.E.4.1.2 Use probability to predict outcomes.

ISTE's Educational Technology Standards *USED EVERYDAY*

1. **Creativity and Innovation**

2. **Communication and Collaboration**

3. **Research and Information Fluency**

4. **Critical Thinking, Problem Solving, and Decision Making**

5. **Digital Citizenship**

6. **Technology Operations and Concepts**

AP Calculus BC includes the AB Material – AP Material 90 Days; BC Material 60Days {due to AP Exam}

Math Planned Course - AP Calculus BC

Unit: **Functions, Graphs, and Limits**

Content Standard: **Work with functions represented in a variety of ways: graphical, numerical, analytical, or verbal. Understand the connections among these representations.**

State Curriculum Standard:
2.1 Numbers, number systems, and number relationships.
2.2 Computation and estimation.
2.3 Measurement and estimation.
2.4 Mathematical reasoning and connections.
2.5 Mathematical problem solving and communication.
2.7 Probability and predictions.
2.8 Algebra and functions.
2.9 Geometry.
2.10 Trigonometry.
2.11 Concepts of Calculus.

Pacing: **24 Days**

Course Content	Student Performance	Resources	Assessments
A. Analysis of Graphs B. Limits of Functions Including One-Sided Limits	• With the aid of technology, produce graphs of functions • Analyze the interplay between the geometric and analytic information • Use of calculus both to predict and to explain the observed local and global behavior of a function • Demonstrate an intuitive understanding of the limiting process • Calculate limits using algebra • Estimate limits from graphs or tables of data	• Graphing calculators • Computer graphing software • Spreadsheets • Review graphs of elementary functions	• Explorations • Quizzes • Tests • Journal • Presentations • Research project • Mid-term • Final exam **<u>Enrichment:</u>** • Graphs of fractals and transcendental functions • Videos

			• Internet

Course Content	Student Performance	Resources	Assessments

C. Continuity as a Property of Functions	• Relate an intuitive understanding of continuity:
	  • Close values of the domain lead to close values of the range
	  • Domain to close values of the range
	• Explain continuity in terms of limits
	• Demonstrate geometric understanding of graphs of continuous functions
	• Explore and examine Intermediate Value Theorem and Extreme Value Theorem
		• Graphing calculators
		• Computer graphing software
		• Spreadsheets
		• Previous years AP tests, both multiple choice and free response
		• AP Prep materials
			• Tests
			• Quizzes
			• Create graphs/functions having various levels of continuity/discontinuity
			• Contrast/compare:
			• Exponential growth
			• Polynomial growth
			• Logarithmic growth
			• Explorations
			• Journal

D. Asymptotic and Unbounded Behavior	• Demonstrate understanding of asymptotes in terms of graphical behavior • Describing asymptotic behavior in terms of limits involving infinity • Comparing relative magnitudes of functions and their rates of change	• Videos • Internet • Graphing calculators • Computer graphing software • Spreadsheets	• Presentations • Research project
E. Parametric, Polar, Vector Functions	• Analyze planar curves including parametric, polar, vectors including velocity and acceleration	• Previously released AP exams • AP calculus list serve	
F. L'Hopital's Rule	• Find limits of indeterminate forms using L'Hopital's Rule		

Math Planned Course - AP Calculus BC

Unit: **Derivatives**

Content Standard: **Work with functions represented in a variety of ways: graphical, numerical, analytical, or verbal. Understand the connections among these representations.**

State Curriculum Standard:
2.1 Numbers, number systems, and number relationships.
2.2 Computation and estimation.
2.3 Measurement and estimation.
2.4 Mathematical reasoning and connections.
2.5 Mathematical problem solving and communication.
2.7 Probability and predictions.
2.8 Algebra and functions.
2.9 Geometry.
2.10 Trigonometry.
2.11 Concepts of Calculus.

Pacing: **24 Days**

Course Content	Student Performance	Resources	Assessments
A. Concept of the Derivative B. Derivative at a Point	• Interpret the derivative as an instantaneous rate of change • Derive and define the derivative as the limit of the difference quotient • Deduce the relationship between differentiability and continuity • Examine the slope of a curve at a point, including examples at which there are vertical tangents and points at which there are no tangents • Estimate and determine the tangent line to a curve at a point • Construct a local linear approximation and compare to the actual value • Approximate the instantaneous	• Graphing calculators • Computer graphing software • Spreadsheets • Videos • Internet • Review slope • Review linear equations • AP Prep materials	• Explorations • Quizzes • Tests • Journal • Presentations • Research project • Mid-term • Final exam • Generate equations of lines tangent to a curve at a given

	rate of change as the limit of average rate of change		point • Cooperative learning

Course Content	Student Performance	Resources	Assessments
C. Derivative as a Function D. Second Derivatives	• Approximate rate of change from graphs and tables • Deduce relationship between increasing/decreasing behavior of *f* and sign of *f* • Explain Mean Value Theorem and its geometric consequences • Solve equations involving derivatives • Translate verbal descriptions into equations involving derivatives and vice versa • Analyze corresponding characteristics of graphs of *f, f, and f* • Deduce relationship between concavity of *f* and sign of *f* • Define points of inflection as places where concavity changes	• Graphing calculators • Computer graphing software • Spreadsheets • Videos • Internet • Review slope • Review linear equations • AP Prep materials	• Explorations • Quizzes • Tests • Journal • Presentations • Research project • Mid-term • Final exam • Generate equations of lines tangent to a curve at a given point • Cooperative learning

Course Content	Student Performance	Resources	Assessments

E. Applications of Derivatives
 	
F. Computation of Derivatives
	• Analyze attributes of curves:
	  • Monotonicity
	  • Concavity
	• Examine optimization:
	  • Absolute (global) extrema
	  • Relative (local) extrema
	• Assess/determine models of rates of change, including related rates problems
	• Utilize implicit differentiation to find derivative of an inverse function
	• Apply derivative as a rate of change in varied applied contexts:
	  • Velocity
	  • Speed
	  • Acceleration
	• Utilize definition to determine derivatives of:
	  • Exponential functions
	  • Logarithmic functions
	  • Trigonometric functions
	  • Inverse trigonometric functions
	  • Parametric functions
	  • Polar functions
	  • Vector functions
	• Develop/utilize basic rules of derivatives:
	  • Product
	  • Quotient
	  • Chain rule
		• AP Prep materials
		• Videos
		• Internet
		• Trigonometric identities
			• Quizzes
			• Tests
			• Journal
			• Presentations
			• Research project
			• Cooperative learning

	• Implicit differentiation		

Unit: **Integrals**

Content Standard: **Understand meaning of definite integral both as limit of Riemann sums and as net accumulation of rate of change. Understand relationship between derivative and definite integral as expressed in both parts of Fundamental Theorem of Calculus. Use integrals to solve variety of problems.**

State Curriculum Standards:

2.1 Numbers, number systems, and number relationships.
2.2 Computation and estimation
2.3 Measurement and estimation
2.4 Mathematical reasoning and connections
2.5 Mathematical problem solving and communications
2.7 Probability and prediction
2.8 Algebra and functions
2.9 Geometry
2.10 Trigonometry
2.11 Concepts of Calculus

Pacing Guide: **47 days**

Math Planned Course - AP Calculus BC

Course Content	Student Performance	Resources	Assessments

A. Interpretations and Properties of Definite Integrals	• Compute Riemann sums using left, right, midpoint evaluations
	• Illustrate definite integral as a limit of Riemann sums over equal subdivisions
	• Infer definite integral of rate of change of quantity over an interval interpreted as change of quantity over the interval
	• Derive basic properties of definite integrals:
	  • Additivity
	  • Linearity
		• Graphing calculators
		• Computer graphing software
		• Spreadsheets
		• Review graphs of elementary functions
		• Measuring tapes
		• Videos
		• Internet
			• Explorations
			• Quizzes
			• Tests
			• Journal
			• Presentations
			• Research project
			• Determine the area of an irregularly shaped figure

Course Content	Student Performance	Resources	Assessments
B. Applications of Integrals	• Utilize variety *f* applications to model physical, biological, or economic situations • Adapt their knowledge and techniques to solve other similar application problems • Use integral of a rate of change to give accumulated change • Use method of setting up an approximating Riemann sum and representing its limit as definite integral • Calculate area of region • Calculate volume of solid with know cross sections • Compute average value of function • Compute distance traveled by particle along line		

Math Planned Course - AP Calculus BC

Course Content	Student Performance	Resources	Assessments
C. Fundamental Theorem of Calculus D. Techniques of Anti-Differentiation	• Use Fundamental Theorem to evaluate definite integrals • Use Fundamental Theorem to represent particular anti-derivative, analytical and graphical analysis of functions • Compute anti-derivatives following directly from derivatives of basic functions • Compute anti-derivatives by substitution of variables, including change of limits • Calculate area of region • Calculate volume of solid with know cross sections • Compute average value of function • Compute distance traveled by particle along line	• Graphing calculators • Computer graphing software • Spreadsheets • Review graphs of elementary functions • Videos • Internet	• Explorations • Quizzes • Tests • Journal • Presentations • Research project • Determine area of an irregularly shaped figure

Course Content	Student Performance	Resources	Assessments
E. Applications of Anti-Differentiation	• Compute specific anti-derivatives using initial conditions, including applications to motion along a line • Solve separable differential equations and using them in modeling • Explore equation and exponential growth • Solve logistic differential equations and use them in modeling	• Graphing calculators • Computer graphing software • Spreadsheets • Previously released AP exams • AP Calculus list serve • Internet • Videos	• Explorations • Quizzes • Tests • Journal • Presentations • Research project • Determine area of an irregularly shaped figure
F. Arc Length	• Use integration to calculate lengths of curves in a plane		
G. Integrals as Net Change	• Solve problems in which rate is integrated to find net change over time in variety of applications		
H. Areas in the Plane	• Use integration to calculate areas of regions in plane		
I. Volumes	• Use integration (by slices or shells) to calculate volumes of solids • Use integration to calculate surface areas of solids of revolution		

	• Key ideas		

Unit: **Applications and Techniques of Integration**

Content Standard: **Understand meaning of definite integral both as limit of Riemann sums and as net accumulation of rate of change.**
Understand relationship between derivative and definite integral as expressed in both parts of Fundamental Theorem of Calculus.
Use integrals to solve variety of problems.

State Curriculum Standards:

2.6 Numbers, number systems, and number relationships.
2.7 Computation and estimation
2.8 Measurement and estimation
2.9 Mathematical reasoning and connections
2.10 Mathematical problem solving and communications
2.7 Probability and prediction
2.8 Algebra and functions
2.9 Geometry
2.10 Trigonometry
2.11 Concepts of Calculus

Course Content	Student Performance	Resources	Assessments

J. Relative Rates of Growth
 	
K. Improper Integrals
 	
L. Partial Fractions and Integral Tables
	• Use little-oh and big-oh notation in determining, investigating, comparing rates of growth of functions
	
	• Use limits to evaluate improper integrals
	
	• Use direct comparison test and limit comparison test to determine convergence or divergence of improper integrals
	
	• Evaluate integrals using:
	  • Partial fractions
	  • Integral tables
	  • Trigonometric substitutions
		• Graphing calculators
		
		• Computer graphing software
		
		• Spreadsheets
		
		• Previously released AP exams
		
		• AP Calculus list serve
		
		• AP materials
		
		• Videos
		
		• Internet	

Unit: **Differential Equations and Mathematical Modeling**

Content Standard: **Understand meaning of the anti-derivative.**
Understand that the solution to a differential equation given an initial condition is a function.

State Curriculum Standards:
2.11 Numbers, number systems, and number relationships.
2.12 Computation and estimation
2.13 Measurement and estimation
2.14 Mathematical reasoning and connections
2.15 Mathematical problem solving and communications
2.7 Probability and prediction
2.8 Algebra and functions
2.9 Geometry
2.10 Trigonometry
2.11 Concepts of Calculus

Pacing Guide: **12 days**

Math Planned Course - AP Calculus BC

Course Content	Student Performance	Resources	Assessments
A. Anti-Derivatives and Slope Fields	• Construct anti-derivatives using Fundamental Theorem of Calculus • Find anti-derivatives of polynomials, exponential, and selected trigonometric functions of as well as linear combinations of these functions • Solve initial value problems • Construct slope fields using technology and interpret slope fields as visualizations of differential equations • Solve logistical differential equation and use them in modeling	• Graphing calculators • Computer graphing software • Spreadsheets • Previously released AP exams • AP Calculus list serve • AP materials • Videos • Internet	• Quizzes • Tests • Explorations • Journal • Presentations • Research project

Course Content	Student Performance	Resources	Assessments
B. Integration by Substitution C. Integration by Parts	• Compute indefinite/definite integrals by method of substitution • Solve differential equation, in which variables are separable • Use integration by parts to evaluate indefinite/definite integrals • Use tabular integration or method of solving for the unknown integral in order to evaluate integrals that	•	• Explorations • Quizzes • Tests • Journal • Presentations • Write paragraph describing any difficulties encountered while integrating by parts

D. Exponential Growth and Decay E. Numerical Methods	require repeated use of integration by parts • Solve problems involving exponential growth and decay in variety of applications • Use Euler's method and improved Euler's method to find approximate solutions to differential equations with initial values		• Model an exponential growth or decay function from raw data

Unit: **Infinite Series**

Content Standard: **A series is defined as a sequence of partial sums, and convergence is defined in terms of limit of sequence of partial sums. Technology can be used to explore convergence or divergence.**

State Curriculum Standard:
2.1 Numbers, number systems, and number relationships.
2.2 Computation and estimation
2.3 Measurement and estimation
2.4 Mathematical reasoning and connections
2.5 Mathematical problem solving and communications
2.7 Probability and prediction
2. Algebra and functions
2.9 Geometry
2.10 Trigonometry
2.11 Concepts of Calculus

Math Planned Course - AP Calculus BC

Course Content	Student Performance	Resources	Assessments
A. Power Series B. Taylor Series C. Taylor's Theorem	• Apply properties of geometric series • Differentiate, integrate, or substitute into a known power series in order to find additional power series representations • Use derivatives to find Maclaurin series or Taylor series generated by differentiable function • Approximate a function with Taylor polynomial • Analyze truncation error of series using graphical methods or Remainder Estimation Theorem • Use Euler's formula to relate functions sin x, and cos x	• Graphing calculators • Computer graphing software • Spreadsheets • Previously released AP exams • AP Calculus list serve • AP materials • Internet • Videos	• Explorations • Quizzes • Tests • Journal • Presentations • Research project

Course Content	Student Performance	Resources	Assessments

D. Radius of Convergence	• To determine convergence or divergence of series of numbers or radius of convergence of power series, students will use:
	  • nth-term test
	  • Geometric
	  • Direct comparison test
	  • Ratio test
	  • P-series
	  • Alternating series		

	• Integral • Root • Limit comparison		

Unit: **Projects**

Content Standard: **Spiral review**

State Curriculum Standard:
2.1 **Numbers, number systems, and number relationships**
2.1 **Computation and estimation**
2.2 **Measurement and estimation**
2.3 **Mathematical reasoning and connections**
2.4 **Mathematical problem solving and communications**
2.7 **Probability and prediction**
2.8 **Algebra and functions**
2.9 **Geometry**
2.10 **Trigonometry**
2.11 **Concepts of Calculus**

Pacing Guide: **30 days**

Math Planned Course - AP Calculus BC

Course Content	Student Performance	Resources	Assessments
A. All Topics from AP Calculus BC	• Use calculus concepts learned to create projects • Complete co-curricular assignments	• Graphing calculators • Computer graphing software • Spreadsheets • Previously released AP exams • AP Calculus list serve • AP materials • Internet • Videos	• Explorations • Quizzes • Tests • Journal • Presentations • Research project • Physic lab • Podcasts • Short movie • Song

Unit III: **Integrals**

Content Standard: **Understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of a rate of change.**
Understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.
Use integrals to solve a variety of problems.

State Curriculum Standard: **2.1 Numbers, Number Systems, and Number Relationships.**
2.2 Computation and Estimation.
2.3 Measurement and Estimation.
2.4 Mathematical Reasoning and Connections.
2.5 Mathematical Problem Solving and Communication.
2.8 Algebra and Functions.
2.9 Geometry.
2.10 Trigonometry.
2.11 Concepts of Calculus.

Pacing: 47 days

Math Planned Course - AP Calculus BC

Course Content	Student Performance	Resources	Assessments
B. Fundamental Theorem of Calculus	• Compute the distance traveled by a particle along a line • Use of the Fundamental Theorem to evaluate definite integrals • Use the Fundamental Theorem to represent a particular anti-derivative and the analytical and graphical analysis of functions	• Graphing calculators • Computer graphing software • Spreadsheets • Review graphs of elementary functions	• Explorations • Quizzes • Tests • Journal • Presentations • Research project • Determine the area of an irregularly shaped figure
C. Techniques of Anti-differentiation	• Compute anti-derivatives following directly from derivatives of basic functions • Compute anti-derivatives by substitution of variables, including change of limits	• Videos • Internet	

Unit III: **Integrals**

Content Standard: **Understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of a rate of change.**
Understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.
Use integrals to solve a variety of problems.

State Curriculum Standard: **2.1 Numbers, Number Systems, and Number Relationships.**
2.2 Computation and Estimation.
2.3 Measurement and Estimation.
2.4 Mathematical Reasoning and Connections.
2.5 Mathematical Problem Solving and Communication.
2.8 Algebra and Functions.
2.9 Geometry.
2.10 Trigonometry.
2.11 Concepts of Calculus.

Pacing: 47 days

Course Content	Student Performance	Resources	Assessments
D. Applications of Anti-differentiation	• Compute specific anti-derivatives using initial conditions, including applications to motion along a line • Solve separable differential equations and using them in modeling • Explore the equation and exponential growth • Solve logistic differential equations and use them in modeling	• Graphing calculators • Computer graphing software • Spreadsheets • Review graphs of elementary functions • Videos • Internet	• Explorations • Quizzes • Tests • Journal • Presentations • Research project • Determine the area of an irregularly shaped figure
E. Arc Length	• Students will be able to use integration to calculate lengths of curves in a plane		

Unit III: **Integrals**

Content Standard: **Understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of a rate of change.**
Understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.
Use integrals to solve a variety of problems.

State Curriculum Standard: **2.1 Numbers, Number Systems, and Number Relationships.**
2.2 Computation and Estimation.
2.3 Measurement and Estimation.
2.4 Mathematical Reasoning and Connections.
2.5 Mathematical Problem Solving and Communication.
2.8 Algebra and Functions.
2.9 Geometry.
2.10 Trigonometry.
2.11 Concepts of Calculus.

Pacing: 47 days

Course Content	Student Performance	Resources	Assessments
F. Integrals as Net Change	• Students will be able to solve problems in which a rate is integrated to find the net change over time in a variety of applications	• Graphing calculators • Computer graphing software • Spreadsheets • Previously released AP exams • AP calculus List Serve	• Explorations • Quizzes • Tests • Journal • Presentations • Research project • Determine the area of an irregularly shaped figure
G. Areas in the Plane	• Students will be able to use integration to calculate areas of regions in a plane	• Videos • Internet	•
H. Volumes	• Students will be able to use integration (by slices or shells) to calculate volumes of solids • Students will be able to use integration to calculate surface areas of solids of revolution • Key ideas		•

Unit III: **Applications and Techniques of Integration**

Content Standard: **Understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of a rate of change.**
Understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.
Use integrals to solve a variety of problems.

State Curriculum Standard: **2.1 Numbers, Number Systems, and Number Relationships.**
2.2 Computation and Estimation.
2.3 Measurement and Estimation.
2.4 Mathematical Reasoning and Connections.
2.5 Mathematical Problem Solving and Communication.
2.8 Algebra and Functions.
2.9 Geometry.
2.10 Trigonometry.
2.11 Concepts of Calculus.

Pacing: 47 days

Course Content	Student Performance	Resources	Assessments
I. Relative Rates of Growth	• Students will be able to use little-oh and big-oh notation in determining, investigating, and comparing the rates of growth of functions		
J. Improper Integrals	• Students will be able to use limits to evaluate improper integrals • Students will be able to use the direct comparison test and the limit comparison test to determine the convergence or divergence of improper integrals	• Graphing calculators • Computer graphing software • Spreadsheets • Previously released AP exams • AP calculus List Serve • AP Materials • Internet • Videos	

K. Partial Fractions and Integral Tables	• Students will be able to evaluate integrals using:
	  • Partial fractions
	  • Integral tables
	  • Trigonometric substitutions		

Unit IV: **Differential Equations and Mathematical Modeling**

Content Standard: **Understand the meaning of the anti-derivative.**
Understand that the solution to a differential equation given an initial condition is a function.

State Curriculum Standard: **2.1 Numbers, Number Systems, and Number Relationships.**
2.2 Computation and Estimation.
2.3 Measurement and Estimation.
2.4 Mathematical Reasoning and Connections.
2.5 Mathematical Problem Solving and Communication.
2.8 Algebra and Functions.
2.9 Geometry.
2.10 Trigonometry.
2.11 Concepts of Calculus.

Pacing: 12 Days

Course Content	Student Performance	Resources	Assessments
A. Anti-derivatives and	• Students will be able to construct anti-	• Graphing calculators	• Quizzes

	Slope Fields	derivatives using the Fundamental Theorem of Calculus • Students will be able to find anti-derivatives of polynomials, exponential, and selected trigonometric functions of as well as linear combinations of these functions • Students will be able to solve initial value problems • Students will be able to construct slope fields using technology and interpret slope fields as visualizations of differential equations • Solving logistical differential equation & using them in modeling	• Computer graphing software • Spreadsheets • Previously released AP exams • AP calculus List Serve • AP Materials • Internet • Videos	• Tests
B.	Integration by Substitution	• Students will be able to compute indefinite and definite integrals by the method of substitution • Students will be able to solve a differential equation, in which the variables are separable	• Videos • Internet	• Explorations • Journal • Presentations • Research project

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2.11 Concepts of Calculus.

Pacing: 12 Days

Course Content		Student Performance	Resources	Assessments
C.	Integration by Parts	• Students will be able to use integration by parts to evaluate indefinite and	• Graphing calculators • Computer graphing software • Spreadsheets	• Explorations • Quizzes • Tests

		definite integrals • Students will be able to use tabular integration or the method of solving for the unknown integral in order to evaluate integrals that require repeated use of integration by parts	• Previously released AP exams • Videos • Internet	• Journal • Presentations • Self Assessment: Have students write a paragraph describing any difficulties they encountered while integrating by parts • Model an exponential growth or decay function from raw
D.	Exponential Growth and Decay	• Students will be able to solve problems involving exponential growth and decay in a variety of applications	•	• data
E.	Numerical Methods	• Students will be able to use Euler's method and the improved Euler's method to find approximate solutions to differential equations with initial values	•	•

Unit V: **Infinite Series**

Content Standard: **A series is defined as a sequence of partial sums, and convergence is defined in terms of the limit of the sequence of partial sums. Technology can be used to explore convergence or divergence.**

State Curriculum Standard: **2.1 Numbers, Number Systems, and Number Relationships.**
2.2 Computation and Estimation.
2.3 Measurement and Estimation.
2.4 Mathematical Reasoning and Connections.
2.5 Mathematical Problem Solving and Communication.
2.8 Algebra and Functions.
2.9 Geometry.
2.10 Trigonometry.
2.11 Concepts of Calculus.

Pacing: 20 days

Course Content	Student Performance	Resources	Assessments
A. Power Series	• Students will be able to apply the properties of geometric	• Graphing calculators • Computer graphing software	• Explorations • Quizzes

	series • Students will be able to differentiate, integrate, or substitute into a known power series in order to find additional power series representations	• Spreadsheets • Previously released AP exams • AP calculus List Serve • AP Materials • Internet • Videos	• Tests • Journal • Presentations • Research project
B. Taylor Series	• Students will be able to use derivatives to find the Maclaurin series or Taylor series generated by a differentiable function		
C. Taylor's Theorem	• Students will be able to approximate a function with a Taylor polynomial • Students will be able to analyze the truncation error of a series using graphical methods or the Remainder Estimation Theorem • Students will be able to use Euler's formula to relate the functions sin x, and cos x		

Unit V: **Infinite Series**

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2.2 Computation and Estimation.
2.3 Measurement and Estimation.
2.4 Mathematical Reasoning and Connections.
2.5 Mathematical Problem Solving and Communication.
2.8 Algebra and Functions.
2.9 Geometry.
2.10 Trigonometry.
2.11 Concepts of Calculus.

Pacing: 20 days

Course Content	Student Performance	Resources	Assessments
D. Radius of Convergence	• To determine the	• Graphing calculators	• Explorations

	convergence or divergence of a series of numbers or the radius of convergence of a power series students will be able to use: • nth-Term Test • Geometric • Direct Comparison Test • Ratio Test • P-Series • Alternating Series • Integral • Root • Limit Comparison	• Computer graphing software • Spreadsheets • Previously released AP exams • AP calculus List Serve • AP Materials • Internet • Videos	• Quizzes • Tests • Journal • Presentations • Research project

Unit VI: **Projects**

Content Standard: **Spiral Review**

State Curriculum Standard: **2.1 Numbers, Number Systems, and Number Relationships.**
2.2 Computation and Estimation.
2.3 Measurement and Estimation.
2.4 Mathematical Reasoning and Connections.
2.5 Mathematical Problem Solving and Communication.
2.8 Algebra and Functions.
2.9 Geometry.
2.10 Trigonometry.
2.11 Concepts of Calculus.

Pacing: 30 days

Course Content	Student Performance	Resources	Assessments
A. All topics from AP Caclulus BC	• Student will use the calculus concepts that	• Graphing calculators • Computer graphing software	• Explorations • Quizzes

	they learned to create projects. • Student will complete co-curricular assignments.	• Spreadsheets • Previously released AP exams • AP calculus List Serve • AP Materials • Internet • Videos	• Tests • Journal • Presentations • Research project • Physic Lab • Podcast • Short Movie • Song