MATHEMATICS
AP Calculus (BC)
Standard: Number, Number Sense and Operations

Organizing Topic	Benchmark	Indicator
Computation and Estimation	A. Develop an understanding of limits and continuity.	1. Recognize the types of nonexistence of limits and why they are nonexistent. 2. Explain why $\lim_{x \to a} f(x) = f(a)$ defines continuity and vice versa. 3. Apply the theorem "differentiability implies continuity" properly when analyzing a function. 4. Rewrite the limit of a Riemann Sum as a definite integral. 5. Analyze the convergence of sequences of real numbers. 6. Determine whether the convergence of a series is absolute or conditional. 7. Recognize the types of nonexistence of limits and why they are nonexistent.

* Pertains only to the BC Curriculum

MATHEMATICS
AP Calculus (BC)
Standard: Measurement

Organizing Topic	Benchmark	Indicator
Measurement Units	A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations.	1. Use differentials for error approximation. 2. Ensure that all decimal answers remain accurate to 3 places throughout the solution of a multi-step problem.
Measurement Unit, Use Measurement Techniques and Tools	B. Estimate and compute length, area, and volume in increasingly complex problem situations.	1. Find the area under a curve on an interval using the definite integral. 2. Find the area between two curves on an interval using the definite integral. 3. Evaluate an antiderivative as the accumulation of area under a given function. $F(x) = \int_0^x f(t)dt$ 4. Find the volume of a solid of revolution about the x-axis, the y-axis, or line parallel to either axis. 5. Find the volume of a solid with known cross sections. *6. Find the area bounded by polar curves. *7. Find the length of a path (including parametrically-defined curves).
Use Measurement Techniques and Tools	C. Demonstrate fluency in alternative coordinate systems.	*1. Convert between polar and rectangular coordinates. *2. Manipulate/graph vector functions *3. Manipulate/graph parametric equations. *4. Manipulate/graph polar equations.

MATHEMATICS
AP Calculus (BC)
Standard: Measurement

Organizing Topic	Benchmark	Indicator
Measurement Units	D. Solve problem situations involving derived measurements.	1. Record the correct units of measure on each application problem (e.g. ft/min, gal/sec^2).

MATHEMATICS
AP Calculus (BC)
Standard: Patterns, Functions and Algebra

Organizing Topic	Benchmark	Indicator
Use Patterns, Functions and Algebra, Analyze Change	A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.	1. Evaluate functions whose limit at certain *x*- values is k. 2. Analyze the roots of the derivative to find the critical numbers of *f(x).* 3. Analyze *f '(x)* to find the slope of a curve and the equation of the tangent to the curve at a point. 4. Analyze the zeros and values of *f '(x)* on intervals to find the absolute and relative maximums and minimums of *f(x).* 5. Analyze the values of *f '(x)* to find where *f(x)* is increasing or decreasing. 6. Analyze the zeros and values of *f ''(x)* to find the points of inflection and concavity of *f(x).* 7. Analyze the first and second derivatives of the position function to find the velocity and acceleration functions, respectively. 8. Evaluate $f'(c)$ to find the instantaneous rate of change of *f(x)* at $x = c$. 9. Evaluate antiderivatives to find distance and velocity from acceleration with initial conditions. 10. Analyze the definite integral to find the average value of a function on an interval.

MATHEMATICS
AP Calculus (BC)
Standard: Patterns, Functions and Algebra

Organizing Topic	Benchmark	Indicator
Use Patterns, Functions and Algebra, Analyze Change		11. Find solutions to growth and decay problems by solving $\frac{dy}{dx} = ky$.
Use Patterns, Functions and Algebra, Algebraic Representations	B. Apply methods to represent, generalize and solve problem situations.	1. Evaluate a limit in indeterminate form by rewriting the function using algebraic manipulation to create an equivalent function. 2. Evaluate a limit at infinity by dividing every term by the highest-powered term in the denominator. 3. Identify and solve for the equation(s) of any asymptotes of the graph of a function. 4. Solve optimization problems by analyzing the derivative. 5. Apply the method of finding a derivative using implicit differentiation. 6. Solve related rates problems using implicit differentiation. 7. Apply the technique of integration by substitution (change of variables) to find the integral. 8. Find the integral using the technique of separable differential equations. *9. Find motion on a plane curve using velocity and acceleration vectors.

MATHEMATICS
AP Calculus (BC)
Standard: Patterns, Functions and Algebra

Organizing Topic	Benchmark	Indicator
Use Patterns, Functions and Algebra, Algebraic Representations	B. Apply methods to represent, generalize and solve problem situations.	*10. Find the tangent line to parametrically defined curves. *11. Find the work required with either force or displacement as a variable. *12. Solve and apply logistic differential equations. *13. Find the integral using the technique of trig substitution. *14. Find the integral using the technique of integration by parts. *15. Find the integral using the technique of integration by partial fractions (only linear factors in the denominator). *16. Evaluate geometric, alternating, and p-series types of special series. *17. Manipulate power series by addition, substitution, term-by-term differentiation and integration. *18. Find the radius of and interval of convergence of a power series.

MATHEMATICS
AP Calculus (BC)
Standard: Patterns, Functions and Algebra

Organizing Topic	Benchmark	Indicator
Use Patterns, Functions and Algebra, Algebraic Representations	C. Apply formulas and theorems appropriately to problem situations.	1. Apply formulas developed via the Squeeze Theorem where applicable to find limits. 2. Apply the Intermediate Value Theorem to find a zero. 3. Apply the Power Rule to solve for the derivative of a polynomial. 4. Apply formulas for the derivatives of the six trigonometric ratios. 5. Apply the Product Rule to find the derivative of the product of two or more functions. 6. Apply the Quotient Rule to find the derivative of the quotient of two functions. 7. Apply the Chain Rule to find the derivative of composite functions. 8. Solve for the value at which the instantaneous rate of change is the same as the average rate of change on an interval using the Mean Value Theorem. 9. Employ established rules and techniques to find the derivatives of inverse functions (including logarithmic, exponential, and trigonometric functions). 10. Approximate the value of the definite integral using rectangles (Riemann Sum) and trapezoids (Trapezoidal Rule).

MATHEMATICS
AP Calculus (BC)
Standard: Patterns, Functions and Algebra

Organizing Topic	Benchmark	Indicator
Use Patterns, Functions and Algebra, Algebraic Representations	C. Apply formulas and theorems appropriately to problem situations.	11. Evaluate a definite integral using the Fundamental Theorem of Calculus. 12. Evaluate the derivative using the Second Fundamental Theorem of Calculus. 13. Employ basic integration formulas to find the antiderivative. 14. Find the volume of a solid of revolution using the Disc/Washer Method. 15. Find the volume of a solid of revolution using the Shell Method. 16. Find the volume of a solid using the method of Known Cross Sections. *17. Find the numerical solution of differential equations using Euler's Method. *18. Determine the convergence of improper integrals using l'Hopital's Rule. *19. Find the convergence of a series by employing the comparison test, ratio test, root test, l'Hopital's Rule and/or the integral test. *20. Use Maclaurin series expansion to represent $\frac{1}{1-x}$, *sin(x)*, and e^x. *21 Represent a function using a Taylor series.

MATHEMATICS
AP Calculus (BC)
Standard: Patterns, Functions and Algebra

Organizing Topic	Benchmark	Indicator
Use Patterns, Functions and Algebra, Algebraic Representations	C. Apply formulas and theorems appropriately to problem situations.	*22 Represent functions using Taylor polynomials with remainder and Lagrange error approximation.
Use Patterns, Functions and Algebra, Algebraic Representations, Analyze Change	D. Analyze and compare functions and their graphs.	1. Evaluate limits by inspecting the graph of the function. 2. Evaluate limits at infinity as the value of a horizontal asymptote. 3. Demonstrate the understanding of the derivative as the slope of a curve at a point. 4. Describe the characteristics of a function based on the analysis of its first and second derivatives. 5. Sketch a precise graph of $f(x)$ by inspecting the graphs of $f'(x)$ and $f''(x)$. 6. Estimate the instantaneous rate of change of $f(x)$ at a point on the graph of $f(x)$. 7. Evaluate differential equations by looking at their Slope Fields and vice versa. *8. Sketch the graph of a parametrically defined curve. *9. Sketch the graph of a curve defined in polar coordinates. *10. Sketch the graph of a vector function.

MATHEMATICS
AP Calculus (BC)
Standard: Data Analysis and Probability

Organizing Topic	Benchmark	Indicator
Data Collection	E. Demonstrate expertise with the graphing calculator.	1. Visually compare the graphs of *f(x)*, *f '(x)*, and *f ''(x)* to describe the impact of each upon the other. 2. Find roots, intersection, extremes, slope at a point, and area under the curve for any function. 3. Explore the direction, extremes, concavity, and inflection points of a function. *4. Explore the convergence or divergence of a graph of *f(x)*.
Data Collection, Statistical Methods	A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.	1. Construct a scatter plot to analyze and interpret a table of data. 2. Estimate the limit of a function by analyzing a table of values of *f(x)*. 3. Estimate the instantaneous rate by analyzing a table of values of *f(x)*. 4. Estimate the area under a curve by analyzing a table of values of *f(x)*.