MATHEMATICS

Calculus AB and BC

Grades 9-12		
1. Students demonstrate knowledge of the graphical interpretation of limits of values of functions. [The formal definition has been removed from the BC syllabus.] This includes one-sided limits, infinite limits, and limits at infinity. Students know the definition of convergence and divergence of a function [BC only] as the domain variable either approaches a number or infinity. 1.1 Students prove and use theorems evaluation the limits of sums, products, quotients, and composition of functions. 1.2 Students verify and estimate limits using graphical calculators. 1.3 Students prove and use special limits such as the limits of sin(*x*) / *x* and [1 - cos(*x*)]/*x* as *x* tends to 0.	**2. Students demonstrate knowledge of both the formal definition and graphical interpretation of the continuity of a function.**	**3. Students demonstrate understanding and application of the Intermediate Value Theorem and the Extreme Value Theorem.**
4. Students demonstrate understanding of the formal definition of the derivative of a function at a point, and the notion of differentiability. 4.1 Students demonstrate understanding of the derivative of a function as the slope of the tangent line to the graph of the function. 4.2 Students demonstrate understanding of the interpretation of the derivative as instantaneous rate of change. Students can use derivatives to solve a variety of problems coming from physics, chemistry, economics, etc., that	**5. Students know the Chain Rule and its applications to the calculation of the derivative of a variety of composite functions [the proof of the Chain Rule is not part of the AB or BC syllabus].**	**6. Students find the derivatives of parametrically defined functions [BC only] and use implicit differentiation in a wide variety of problems coming from physics, chemistry, economics, etc.**

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involve the rate of change of a function. 4.3 Students understand the relation between differentiability and continuity. 4.4 Students derive derivative formulas and use them to find the derivatives of algebraic, trigonometric, inverse trigonometric, exponential, and logarithmic functions.		
7. Students compute derivatives of higher orders.	**8. Students know and can apply Rolle's Theorem and the Mean Value Theorem, and [BC only] L'Hopital's Rule.**	**9. Students use differentiation to sketch, by hand, graphs of functions. They can identify maxima, minima, inflection points, and intervals where the function is increasing and decreasing.**
10. [Newton's Method has been removed from the AB and BC syllabi.]	**11. Students use differentiation to solve optimization (maximum – minimum problems) in a variety of pure and applied contexts.**	**12. Students use differentiation to solve related rate problems in a variety of pure and applied contexts.**
13. Students know the definition of the definite integral using Riemann sums. They use this definition to approximate integrals.	**14. Students apply the definition of the integral to model problems in physics, economics, etc., obtaining results in terms of integrals.**	**15. Students demonstrate knowledge of the Fundamental Theorem of Calculus [the proof is not in the AB or BC syllabus], and use it to interpret integrals as anti-derivatives.**
16. Students use definite integrals in problems involving area, velocity, acceleration, volume of a solid, area of a surface of revolution [BC only], length of a curve [BC only], and work [BC only].	**17. Students compute, by hand, the integrals of a wide variety of functions using techniques of integration such as:** a. Substitution	**18. Students know the definitions and properties of inverse trigonometric functions, and their appearance as indefinite integrals.**

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19. Students compute, by hand, the integrals of rational functions by combining the above techniques with the algebraic techniques of partial fractions [BC only] and completing the square.	b. Integration by parts [BC only] c. Trigonometric substitution [BC only] **20. Students compute the integrals of trigonometric functions using the above techniques.**	**21. [Simpson's Rule and Newton's Method have been removed from the AB and BC syllabi.]**
22. Students understand improper integrals as limits of definite integrals [BC only].	**23. Students demonstrate understanding of the definitions of convergence and divergence of sequences and series of real numbers [BC only]. They can determine whether a series converges using such tests as the comparison test, ratio test, and alternate series test [BC only].**	**24. Students understand and can compute the radius (interval) of convergence of power series [BC only].**
25. Students differentiate and integrate the terms of a power series in order to form new series from known ones.	**26. Students calculate Taylor polynomials and Taylor series of basic functions, including the remainder term [BC only].**	**S27. Students compute Riemann sums using left, right, and midpoint evaluation points.**
S28. Students understand that the definite integral of a rate of change over an interval is the change of the quantity over the interval.	**S29. Students use Riemann sums and the Trapezoidal Rule to approximate definite integrals of functions represented algebraically, geometrically, and by tables of values.**	**S30. Students use graphing calculators to produce the graph of a function within an arbitrary viewing window, to find the zeros of a function, to compute the derivative of a function numerically, and to compute definite integrals numerically.**
S31. Students solve separable differential equations and use them in modeling	**S32. Students solve differential equations numerically, using Euler's method [BC only].**	**S33. Students solve logistic differential equations and use them in modeling.**