

AP Calculus

Algebra Standard: 2 Understand and apply concepts of algebra and functions.

Power Benchmark 1: Understand patterns, relations and functions.

Course Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
a. Analyzes functions of one variable by investigating rates of change.	<ul style="list-style-type: none"> • Rate of change • Instantaneous rate of change • Limit • Differentiability • Continuity • Tangent line • Derivative • Difference quotient 	<ul style="list-style-type: none"> • Slope • Equation of a line • Domain • Range 	<ul style="list-style-type: none"> • Comparison of relative magnitudes of functions & their rates of change • Derivative presented graphically, numerically, and analytically - • Derivative interpreted as an instantaneous rate of change - • Derivative defined as the limit of the difference quotient - • Relationship between differentiability and continuity - • Slope of a curve at a point - • Tangent line to a curve at a point and local linear approximation - 	
b. Analyzes functions of one variable by investigating limits	<ul style="list-style-type: none"> • Limits • Continuity • Asymptotes • Infinity • Nonexistent limit • Infinite limit • Indeterminate form 	<ul style="list-style-type: none"> • Graphing functions • Recognizing asymptotes 	<ul style="list-style-type: none"> • Limits using algebra - • Limits from graphs or tables of data - • Continuity in terms of limits - • Intermediate Value Theorem - • Extreme Value Theorem - • Asymptotic behavior in terms of limits involving infinity - 	
c. Analyzes derivative functions.	<ul style="list-style-type: none"> • First derivative • Second derivative • Concavity • Point of inflection • Critical points 	<ul style="list-style-type: none"> • Increasing/decreasing functions • Maximum/minimum values 	<ul style="list-style-type: none"> • Mean Value Theorem - • Characteristics and relationships of graphs of f, f', and f'' - 	

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d. Applies derivative functions.	<ul style="list-style-type: none"> Displacement Distance Velocity Speed Acceleration Slope fields Indeterminate form 	<ul style="list-style-type: none"> Derivatives Evaluation of functions Identify type of function from the graph 	<ul style="list-style-type: none"> Analysis of curves - Optimization - Related Rates - Displacement, Velocity, and Acceleration - Slope Fields - Eulers' Method (optional) - L'Hospital's Rule - 	
e. Analyzes functions of one variable by investigating integrals as accumulated change.	<ul style="list-style-type: none"> Definite integral Riemann sum Summation 	<ul style="list-style-type: none"> Formula for area of a trapezoid Area 	<ul style="list-style-type: none"> Trapezoidal Rule - Riemann Sums - Definite integral as a limit of Riemann sums - Definite integral as a limit of Riemann sums - Definite integral as a limit of Riemann sums - 	
f. Applies definite integrals	<ul style="list-style-type: none"> Cross section Disk method Washer method Shell method Average value 	<ul style="list-style-type: none"> Formula for volume of a cylinder Formula for surface area of a cylinder Integration techniques Fundamental Theorem of Calculus Area formulas 	<ul style="list-style-type: none"> Area of region - Volume of a solid with known cross sections - Volume of a solid using disk method and shell method - Average value of a function - Distance traveled by a particle along a line - Distance traveled by a particle along a line - Length of curve (optional) - 	

Algebra Standard: 2 Understand and apply concepts of algebra and functions.				
Power Benchmark 2: Represent and analyze mathematical situations and structures using algebraic symbols				
Course Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
a. Uses symbolic algebra to represent and calculate derivatives	<ul style="list-style-type: none"> • Product rule • Quotient rule • Chain rule • Implicit differentiation • Logarithmic differentiation 	<ul style="list-style-type: none"> • Logarithmic properties • Trigonometric properties 	<ul style="list-style-type: none"> • Derivatives of power exponential, logarithmic, trigonometric, and inverse trigonometric functions - • Basic rules for the derivative of sums, products, and quotients of functions. - • Chain rule - • Implicit differentiation - 	
b. Uses symbolic algebra to represent and derive indefinite integrals (antiderivatives)	<ul style="list-style-type: none"> • Differential equation • Antiderivative • Separation of variables • Initial condition 	<ul style="list-style-type: none"> • Logarithmic properties • Trigonometric properties • Derivatives 	<ul style="list-style-type: none"> • Separable differential equations - • Antiderivatives of power exponential, logarithmic, and trigonometric functions - • Antiderivates by substitution of variables - • Specific antiderivatives using initial conditions - 	
c. Uses symbolic algebra to represent and derive definite integrals	<ul style="list-style-type: none"> • Fundamental Theorem of Calculus • Bounds • Definite integral 	<ul style="list-style-type: none"> • Indefinite integral 	<ul style="list-style-type: none"> • Fundamental Theorem of Calculus - • Substitution of variables including change of limits - • Properties of definite integrals - • Derivative of an integral form - 	

Communication Standard: 8 Communicates and reasons mathematically				
Power Benchmark 1: Expresses ideas using mathematical terms and representations.				
Course Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
a. Uses calculus terms to describe various problems and situations	<ul style="list-style-type: none"> (See other benchmarks) 	<ul style="list-style-type: none"> Proper sentence structure Usage of nouns, adjectives, verbs, etc. No dangling participles 	<ul style="list-style-type: none"> Appropriate use of calculus terms in describing limits, rates of change, and accumulated change - 	
Power Benchmark 2: Uses tools (such as technology) to enhance mathematical learning				
Course Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
a. Uses the graphing calculator to explore functions including limits	<ul style="list-style-type: none"> Local extrema Global extrema Limits Rate of change End behavior Increments 	<ul style="list-style-type: none"> Graphing functions with an appropriate window Can access the table function and set appropriate increments Can find zeros, maximum values, and minimum values of a function 	<ul style="list-style-type: none"> Graphs used to determine limits, local and global extrema, and end behavior - Tables used to determine limits and rate of change - 	
b. Uses the graphing calculator for calculus computation	<ul style="list-style-type: none"> Numerical derivatives Numerical integration 	<ul style="list-style-type: none"> Can find intersection point(s) of two functions 	<ul style="list-style-type: none"> Compute numerical derivatives and integrations - Graph numerical derivatives - Graph numerical derivatives - Trapezoidal Rule Program - Riemann Program - 	