G-E-T High School Curriculum
Align, Explore, Empower
Scope and Sequence
AP Calculus

Unit 1 - (Limits and Continuity)	(About 4 weeks)

We'll start to explore how limits will allow you to solve problems involving change and to better understand mathematical reasoning about functions.

In this unit, students will Learn…

- How limits help us to handle change at an instant
- Definition and properties of limits in various representations
- Definitions of continuity of a function at a point and over a domain
- Asymptotes and limits at infinity

Standards for AP Calculus
EU 1.1: The concept of a limit can be used to understand the behavior of functions.
LO 1.1A(a): Express limits symbolically using correct notation.
LO 1.1A(b): Interpret limits expressed symbolically.
LO 1.1B: Estimate limits of functions.
LO 1.1B: Estimate limits of functions.
LO 1.1D: Deduce and interpret behavior of functions using limits.
EU 1.2: Continuity is a key property of functions that is defined using limits.
LO 1.2A: Analyze functions for intervals of continuity or points of discontinuity.
LO 1.2B: Determine the applicability of important calculus theorems using continuity.

Unit 2 - (Differentiation: Definition and Properties) (About 4 weeks)
We'll apply limits to define the derivative, become skillful at determining derivatives, and continue to develop mathematical reasoning skills.
In this unit, students will be … ● Defining the derivative of a function at a point and as a function ● Connecting differentiability and continuity ● Determining derivatives for elementary functions ● Applying differentiation rules

Standards for AP Calculus
EU 2.1: The derivative of a function is defined as the limit of a difference quotient and can be determined using a variety of strategies. LO 2.1A: Identify the derivative of a function as the limit of a difference quotient. LO 2.1B: Estimate the derivative. LO 2.1C: Calculate derivatives.

Unit 3 - (Differentiation: Chain, Implicit, and Inverse) (About 4 weeks)
You'll master using the chain rule, develop new differentiation techniques, and be introduced to higher-order derivatives.
In this unit, students will learn… ● The chain rule for differentiating composite functions ● Implicit differentiation ● Differentiation of general and particular inverse functions ● Determining higher-order derivatives of functions

Standards for AP Calculus
LO 2.1D: Determine higher order derivatives. LO 2.1C: Calculate derivatives.

Unit 4- (Contextual Application of Differentiation) (About 5 weeks)

You'll apply derivatives to set up and solve real-world problems involving instantaneous rates of change and use mathematical reasoning to determine limits of certain indeterminate forms.

In this unit, students will …

- Identifying relevant mathematical information in verbal representations of real-world problems involving rates of change
- Applying understandings of differentiation to problems involving motion
- Generalizing understandings of motion problems to other situations involving rates of change
- Solving related rates problems
- Local linearity and approximation
- L'Hospital's rule

Standards for AP Calculus

EU 2.2: A function's derivative, which is itself a function, can be used to understand the behavior of the function.

LO 2.2A: Use derivatives to analyze properties of a function.

LO 2.2B: Recognize the connection between differentiability and continuity.

EU 2.3: The derivative has multiple interpretations and applications including those that involve instantaneous rates of change.

LO 2.3B: Solve problems involving the slope of a tangent line.

LO 2.3C: Solve problems involving related rates, optimization, rectilinear motion,

LO 2.3D: Solve problems involving rates of change in applied contexts.

EU 2.4: The Mean Value Theorem connects the behavior of a differentiable function over an interval to the behavior of the derivative of that function at a particular point in the interval.

LO 2.4A: Apply the Mean Value Theorem to describe the behavior of a function over an interval.

Unit 5- (Analytical Applications of Differentiation) (About 6 weeks)

After exploring relationships among the graphs of a function and its derivatives, you'll learn to apply calculus to solve optimization problems.

In this unit, students will use …

- Mean Value Theorem and Extreme Value Theorem
- Derivatives and properties of functions
- How to use the first derivative test, second derivative test, and candidates test
- Sketching graphs of functions and their derivatives
- How to solve optimization problems
- Behaviors of Implicit relations

Standards for AP Calculus

EU 2.2: A function's derivative, which is itself a function, can be used to understand the behavior of the function.

LO 2.2A: Use derivatives to analyze properties of a function.

LO 2.2B: Recognize the connection between differentiability and continuity.

EU 2.3: The derivative has multiple interpretations and applications including those that involve instantaneous rates of change.

LO 2.3B: Solve problems involving the slope of a tangent line.

LO 2.3C: Solve problems involving related rates, optimization, rectilinear motion,

LO 2.3D: Solve problems involving rates of change in applied contexts.

EU 2.4: The Mean Value Theorem connects the behavior of a differentiable function over an interval to the behavior of the derivative of that function at a particular point in the interval.

LO 2.4A: Apply the Mean Value Theorem to describe the behavior of a function over an interval.

Unit 6 - (Integration and Accumulation) (About 7 weeks)

You'll learn to apply limits to define definite integrals and how the Fundamental Theorem connects integration and differentiation. You'll apply properties of integrals and practice useful integration techniques.

In this unit, students will be …

- Using definite integrals to determine accumulated change over an interval
- Approximating integrals using Riemann Sums
- Accumulation functions, the Fundamental Theorem of Calculus, and definite integrals
- Antiderivatives and indefinite integrals
- Properties of integrals and integration techniques

Standards for AP Calculus

EU 3.1: Antidifferentiation is the inverse process of differentiation.

LO 3.1A: Recognize antiderivatives of basic functions.

EU 3.2: The definite integral of a function over an interval is the limit of a Riemann sum over that interval and can be calculated using a variety of strategies.

LO 3.2A(a): Interpret the definite integral as the limit of a Riemann sum.

LO 3.2A(b): Express the limit of a Riemann sum in integral notation.

LO 3.2B: Approximate a definite integral.

LO 3.2C: Calculate a definite integral using areas and properties of definite integrals.

EU 3.3: The Fundamental Theorem of Calculus, which has two distinct formulations, connects differentiation and integration.

LO 3.3A: Analyze functions defined by an integral.

LO 3.4A: Interpret the meaning of a definite integral within a problem.

Unit 7 - (Differential Equations) (About 4 weeks)

You'll learn how to solve certain differential equations and apply that knowledge to deepen your understanding of exponential growth and decay.

In this unit, students will be …

- Interpreting verbal descriptions of change as separable differential equations
- Sketching slope fields and families of solution curves
- Solving separable differential equations to find general and particular solutions
- Deriving and applying a model for exponential growth and decay

Standards for AP Calculus

LO 2.3E: Verify solutions to differential equations.

LO 2.3F: Estimate solutions to differential equations.

Unit 8 - (Applications of Integration) (About 5 weeks)

You'll make mathematical connections that will allow you to solve a wide range of problems involving net change over an interval of time and to find areas of regions or volumes of solids defined using functions.

In this unit, students will …

- Determining the average value of a function using definite integrals
- Modeling particle motion
- Solving accumulation problems
- Finding the area between curves
- Determining volume with cross-sections, the disc method, and the washer method

Standards for AP Calculus
LO 3.4B: Apply definite integrals to problems involving the average value of a function. LO 3.4C: Apply definite integrals to problems involving motion. LO 3.4D: Apply definite integrals to problems involving area, volume, LO 3.4E: Use the definite integral to solve problems in various contexts. EU 3.5: Antidifferentiation is an underlying concept involved in solving separable differential equations. Solving separable differential equations involves determining a function or relation given its rate of change. LO 3.5A: Analyze differential equations to obtain general solutions. LO 3.5B: Interpret, create, and solve differential equations from problems in context.

Any additional time will be spent reviewing for the AP exam.