# AP Calculus BC Common Core Standards

## 1st Nine Weeks

### Extend the Domain of Trigonometric Functions Using the Unit Circle

**F-TF.3 (+)** Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi-x$, $\pi+x$, and $2\pi-x$ in terms of their values for "x", where "x" is any real number.

### Prove and Apply Trigonometric Identities

**F-TF.8** Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.

**F-TF.9 (+)** Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

### Analyze Functions Using Different Representations

**F-IF.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

**F-IF.7d (+)** Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

### Build New Functions from Existing Functions

**F-BF.5 (+)** Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

### Construct and Compare Linear, Quadratic, and Exponential Models and Solve Problems

**F-LE.4** For exponential models, express as a logarithm the solution to $ab^ct = d$ where "a", "c", and "d" are numbers and the base "b" is 2, 10 or "e"; evaluate the logarithm using technology.

### Analyze Functions Using Different Representations

**CMS IF-1** Demonstrate knowledge of both the definition and the graphical interpretation of limit of values of functions.
- Use theorems and algebraic concepts in evaluating the limits of sums, products, quotients, and composition of function.
- Verify and estimate limits using graphical calculators.

**CMS IF-2** Demonstrate knowledge of both the definition and graphical interpretation of continuity of a function.
- Evaluate limits of functions and apply properties of limits, including one-sided limits.
- Estimate limits from graphs or tables of data.
- Describe asymptotic behavior in terms of limits involving infinity.
- Apply the definition of continuity to a function at a point and determine if a function is continuous over an interval.

**CMS IF-3** Demonstrate knowledge of differentiation using algebraic functions.
- Use differentiation and algebraic manipulations to sketch, by hand, graphs of functions.
- Identify maxima, minima, inflection points, and intervals where the function is increasing and decreasing.
- Use differentiation and algebraic manipulations to solve optimization (maximum-minimum problems) in a variety of pure and applied contexts.

**CMS IF-4** Demonstrate an understanding of the definition of the derivative of a function at a point, and the notion of differentiability.
- Demonstrate an understanding of the derivative of a function as the slope of the tangent line to the graph of the function.
- Demonstrate an understanding of the interpretation of the derivative as instantaneous rate of change.
- Use derivatives to solve a variety of problems coming from physics, chemistry, economics, etc. that involve the rate of change of a function.
- Demonstrate an understanding of the relationship between differentiability and continuity.
- Use derivative formulas to find the derivatives of algebraic and trigonometric functions.

**CMS IF-5** Apply the rules of differentiation to functions.
- Use the Chain Rule and applications to the calculation of the derivative of a variety of composite functions.
- Find the derivatives of relations and use implicit differentiation in a wide variety of problems from physics, chemistry, economics, etc.

---

### Major Clusters:
- areas of intensive focus, where students need fluent understanding and application of the core concepts (approximately 70%).

### Supporting Clusters:
- rethinking and linking; areas where some material is being covered, but in a way that applies core understandings (approximately 20%).

### Additional Clusters:
- expose students to other subjects, though at a distinct level of depth and intensity (approximately 10%).
### 2nd Nine Weeks

#### Analyze functions using different representations

**CMS IF-4** Demonstrate an understanding of the definition of the derivative of a function at a point, and the notion of differentiability.

f. Use formulas to find derivatives of inverse trigonometric functions, exponential functions and logarithmic functions.

**CMS IF-5** Apply the rules of differentiation to functions.

c. Demonstrate an understanding of and apply Rolle’s Theorem, the Mean Value Theorem.

**CMS IF-6** Apply the rules of integration to functions.

a. Apply the definition of the integral to model problems in physics, economics, etc., obtaining results in terms of integrals.

b. Demonstrate knowledge of the Fundamental Theorem of Calculus, and use it to interpret integrals as anti-derivatives.

c. Use definite integrals in problems involving area, velocity, acceleration, and the volume of a solid.

d. Compute, by hand, the integrals of a wide variety of functions using substitution.

#### Apply geometric concepts in modeling situations

**CMS MG-1** Interpret differential equations via slope fields and understand the relationship between slope fields and solution curves for differential equations.

---

**Major Clusters**—areas of intensive focus, where students need fluent understanding and application of the core concepts (approximately 70%).

**Supporting Clusters**—rethinking and linking; areas where some material is being covered, but in a way that applies core understandings (approximately 20%).

**Additional Clusters**—expose students to other subjects, though at a distinct level of depth and intensity (approximately 10%).
# AP Calculus BC Common Core Standards

## 3rd Nine Weeks

**Analyze functions using different representations**

- **CMS-IF-1** Demonstrate knowledge of both the definition and the graphical interpretation of limit of values of functions.
  - c. Evaluate limits using L'Hôpital's rule.
- **CMS IF-6** Apply the rules of integration to functions.
  - e. Use definite integrals in problems involving area between two curves, volume of a solid, and arc length and surface area of a revolution.
  - f. Use advanced techniques to evaluate integrals, including integration by parts, trigonometric integrals, trigonometric substitution and partial fractions.

## 4th Nine Weeks

**Analyze functions using different representations**

- **CMS IF-6** Apply the rules of integration to functions.
  - g. Use definite integrals in problems involving area bounded by polar curves, and finding the length of the curve given in polar or parametric form.

**Write expressions in equivalent forms to solve problems**

- **CMS SSE-1** Define a series and test for convergence of a series in terms of the limit of the sequence of partial sums.
- **CMS SSE-2** Define, restate, and apply Taylor series.
- **CMS SSE-3** Test for convergence of a series using a variety of tests: nth term test, geometric series, p-series, integral test, comparison test, limit comparison test, ratio test, root test, and alternating series test.
- **CMS SSE-4** Test for absolute or conditional convergence of a series.
- **CMS SSE-5** Determine the error of an alternating series.

---

**Major Clusters** - areas of intensive focus, where students need fluent understanding and application of the core concepts (approximately 70%).

**Supporting Clusters** - rethinking and linking; areas where some material is being covered, but in a way that applies core understandings (approximately 20%).

**Additional Clusters** - expose students to other subjects, though at a distinct level of depth and intensity (approximately 10%).