Unit 1 Limits and Continuity

Content Area: **Mathematics**
Course(s): **AP Calculus AB**
Time Period: **September**
Length: **Approximately 10 blocks**
Status: **Published**

Enduring Understandings

The concept of a limit can be used to understand the behavior of functions.

Continuity is a key property of functions that is defined using limits.

Essential Questions

How does the math that you previously studied relate to the math that you are going to be studying?

How do limits guarantee the continuity of a function?

When do limits fail to exist?

How are limits connected to the existence of vertical and horizontal asymptotes?

What is the difference between calculating a limit and evaluating a function at a point?

What are connections among theses presentations of functions; graphically, numerically, analytically or verbally?

Content

Vocabulary:
Domain, range, independent, dependent variable, graph, function, absolute value, increasing, decreasing, linear , quadratic, polynomial, coefficients, degree, cubic , power, root,, reciprocal , rational, algebraic, trigonometric, exponential, logarithmic , translations, composite , limit, right-hand limit, left-hand limit, vertical asymptote, continuous at a point, discontinuity, removable discontinuity, jump discontinuity, horizontal asymptote, infinite limits, limits at infinity, intermediate value theorem.

Red Hot Topics:
* Rational Exponents
* Simplifying expressions
* Writing linear equations
* Average rate of change

Skills

Numerically, graphically, and algebraically classify and analyze functions.

Evaluate, if it exists, the value of a limit from a graphical approach, including one-sided limits.

Evaluate limits analytically, including direct substitution, cancellation and rationalization, applying the properties of limits.

Evaluate limits of exponential functions analytically.

Evaluate limits of trigonometric functions analytically.

Graphically and analytically, apply the three part definition of continuity to determine if a function is continuous at a point.

Understand and apply the intermediate value theorem.

Distinguish between infinite limits and limits at infinity, and use them to identify asymptotes.

Standards

Mathematical Practice For AP Calculus 1: Reasoning with Definitions and Threorems

- Use definitions and theorems to build arguments,
- Justify conclusions or answers, and prove results;
- Confirm that hypotheses have been satisfied in order to apply the conclusion of a theorem;
- Apply definitions and theorems in the process of solving a problem; interpret quantifiers in definitions and theorems;
- Develop conjectures based on exploration with technology;
- Produce examples and counterexamples to clarify understanding of definitions, to investigate whether converses of theorems are true or false, or to test conjectures.

Mathematical Practice For AP Calculus 2: Connecting Concepts

- Relate the concept of a limit to all aspects of calculus;
- Use the connection between concepts (e.g., rate of change and accumulation) or processes (e.g., differentiation and its inverse process antidifferentiation) to solve problems;
- Connect concepts to their visual representations with and without technology;
- Identify a common underlying structure in problems involving different contextual situations.

Mathematical Practice For AP Calculus 3: Implementing algebraic/computational processes

- Select appropriate mathematical strategies;
- Sequence algebraic/computational procedures logically;
- Complete algebraic/computational processes correctly;
- Apply technology strategically to solve problems; attend to precision graphically, numerically, analytically, and verbally and specify units of measure;
- Connect the results of algebraic/computational processes to the question asked.

Mathematical Practice For AP Calculus 4: Building notational fluency

- Know and use a variety of notations (e.g., f '(x), y', dy/dx);
- Connect notation to definitions (e.g., relating the notation for the definite integral to that of the limit of a Riemann sum);
- Connect notation to different representations (graphical, numerical, analytical, and verbal);
- Assign meaning to notation, accurately interpreting the notation in a given problem and across different contexts.

Mathematical Practice For AP Calculus 5: Connecting Multiple Representations

- Associate tables, graphs, and symbolic representations of functions;
- Develop concepts using graphical, symbolical, or numerical representations with and without technology;
- identify how mathematical characteristics of functions are related in different representations;
- Extract and interpret mathematical content from any presentation of a function (e.g., utilize information from a table of values);
- Construct one representational form from another (e.g., a table from a graph or a graph from given information);
- Consider multiple representations of a function to select or construct a useful representation for solving a problem.

Mathematical Practice For AP Calculus 6: Communicating

- Clearly present methods, reasoning, justifications, and conclusions;
- Use accurate and precise language and notation;
- Explain the meaning of expressions, notation, and results in terms of a context (including units);
- Explain the connections among concepts;
- Critically interpret and accurately report information provided by technology;
- Analyze, evaluate, and compare the reasoning of others

MA.F-IF.B.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
MA.F-IF.C.8b	Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02) to the t power, y = (0.97) to the t power, y = (1.01) to the 12t power, y = (1.2) to the t/10 power, and classify them as representing exponential growth or decay.