Unit 6 Basic Integration and Applications

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

Transfer Skills

In this unit students learn the inverse operation of the derivative: the anti derivative. Geometrically students begin to explore finding the area under a curve using Riemann sums. Students are introduced to integral notation and solving basic differential equations.

Enduring Understandings

Derivatives and anti-derivatives have an inverse relationship to each other.

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

The anti-derivative has both theoretical and real life applications.

Essential Questions

How are the rules for differentiation used to develop the basic rules of integration?

How can we use the measure of area under a curve to discuss net change of a function over time?

How is the anti-derivative related to the accumulation function?

Content

Vocabulary:

Antiderivative, particular solution, general solution, constant of integration, indefinite integral, variable of integration, definite integral, limits of integration, Riemann sum(left, right, midpoint), trapezoidal rule, under the curve, average value, net distance, total distance

Red Hot Topics:

* Memorizing trigonometric antiderivatives

* Finding area of rectangles

* Finding area of trapezoids

Skills

Find anti-derivatives/indefinite integrals of polynomial-type and trigonometric functions.

Approximate the area between a curve and the x-axis using Riemann and Trapezoidal Sums from graphs and tables of values.

Learn and apply the Fundamental Theorem of Calculus, Part 1.

Understand and apply the properties of definite integrals and apply the First Fundamental Theorem numerically and graphically.

Problems of rectilinear motion will be reviewed and integration through numerical, graphical and analytical methods will be incorporated into these problems to find the total distance an object travels over a period of time.

Understand the definite integral to be the total accumulation of change of a function over an interval of time.

Apply the Fundamental Theorem of Calculus to find the average value of a function on an interval.

Resources

Single Variable Calculus with Vector Functions by James Stewart Chapters 5 and Chapter 6 (Average Value)

AP Calculus AB AP Central at collegeboard.com

Khan Academy: www.khanacademy.org

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.A.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.
MA.F-IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
MA.K-12.7	Look for and make use of structure.