Unit 5 Applications of Derivatives Part II

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

Transfer Skills

Students will be able to apply the intermediate value theorem, mean value theorem, Rolle's Theorem and the Extreme Value Theorem. Along with this, students will be able to apply the concept of the derivative to particle motion.

Enduring Understandings

The derivative has both theoretical and real life applications.

The derivative provides useful information about the behavior of functions and the shapes of graphs.

Understanding the rate of change of a function allows you to predict future behavior.

Essential Questions

How can the derivative be used to solve optimization problems?

How do rates of change relate in real-life settings?

The derivative is a key element connecting the concepts of position, velocity, and acceleration in physics.

Content

Vocabulary:

Optimization, Extreme Value Theorem, Rolle's Theorem, Mean Value Theorem, average velocity, average acceleration, instantaneous velocity, instantaneous acceleration, total distance, net distance

Red Hot Topics:

* Finding the zeros of functions.

* Evaluating functions

* Solving equations

Skills

Review relationships between f and f ' to understand and apply the Extreme Value Theorem, and, extending these f ".

Distinguish between the instantaneous rate of change of a function at a point and the average rate of change of a function on an interval, extending these ideas to understand and apply the Mean Value Theorem and Rolle's Theorem.

Apply major theorems numerically, graphically, and verbally.

Learn and apply the basic ideas—average velocity, average acceleration, instantaneous velocity, instantaneous acceleration—of motion and how they relate to calculus.

Extend concepts of particle motion to find net and total distance of a moving particle over a given interval.

Solve optimization—applied maximum and minimum—problems.

Resources

Single Variable Calculus with Vector Functions by James Stewart Chapter 4

AP Calculus BC 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.K-12.4	Model with mathematics.
MA.F-IF.B	Interpret functions that arise in applications in terms of the context
MA.F-IF.B.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
MA.K-12.5	Use appropriate tools strategically.
MA.F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.