Unit 3 Rules of Differentiation

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

Transfer Skills

Students should be able to use different definitions of derivative, estimate derivatives from tables and graphs, and apply various derivative rules and properties.

Enduring Understandings

The derivative of a function can be determined using a variety of strategies.

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

Essential Questions

Why is the derivative important?

What is the connection between differentiability and continuity?

Content

Vocabulary:

definition of derivative, difference quotient, tangent line, normal line, average rate of change, instantaneous rate of change, derivative, power rule, product rule, quotient rule, chain rule, trigonometric rules, exponential rules, logarithmic differentiation, inverse trigonometric rules, differentiable, first derivative test

Red Hot Topics:

* Rational Exponents

* Simplifying expressions

* Writing linear equations

* Average rate of change

Skills

Apply the product rule of differentiation analytically, graphically, and numerically.

Apply the quotient rule of differentiation analytically, graphically, and numerically and derive the differentiation rules for tangent, cotangent, secant, and cosecant.

Apply the chain rule of differentiation analytically, graphically, and numerically and derive the differentiation rule for an inverse function.

Analytically determine the derivative of exponential functions whose bases are e and natural logarithmic functions.

Numerically determine and interpret the value of the derivative of a function using the graphing calculator.

Understand the relationship between differentiability and continuity.

Apply L'Hopital's Rule to evaluate limits.

Resources

Single Variable Calculus with Vector Functions by James Stewart Chapter 3 and Chapter 4 (L'Hopital)

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-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.7	Look for and make use of structure.