Unit 7: Derivatives

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 4**
Length: **7 weeks**
Status: **Published**

Brief Summary of Unit

Students will learn how to find dervivatives algebraically and apply derivatives to real world applications. Students will also apply their knowledge of derivatives in graphical analysis.

Standards

LA.K-12.NJSLSA.L4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.
LA.K-12.NJSLSA.L5	Demonstrate understanding of word relationships and nuances in word meanings.
MA.9-12.II.A.1	Derivative presented graphically, numerically, and analytically
MA.9-12.II.A.2	Derivative interpreted as an instantaneous rate of change
MA.9-12.II.A.3	Derivative defined as the limit of the difference quotient
MA.9-12.II.A.4	Relationship between differentiability and continuity
MA.9-12.II.B	Derivative at a point
MA.9-12.II.B.1	Slope of a curve at a point. Examples are emphasized, including points at which there are vertical tangents and points at which there are no tangents.
MA.9-12.II.B.2	Tangent line to a curve at a point and local linear approximation
MA.9-12.II.B.3	Instantaneous rate of change as the limit of average rate of change
MA.9-12.II.B.4	Approximate rate of change from graphs and tables of values
MA.9-12.II.C	Derivative as a function
MA.9-12.II.C.1	Corresponding characteristics of graphs of f and f'
MA.9-12.II.C.2	Relationship between the increasing and decreasing behavior of f and the sign of f'
MA.9-12.II.C.4	Equations involving derivatives. Verbal descriptions are translated into equations involving derivatives and vice versa.
MA.9-12.II.D.1	Corresponding characteristics of the graphs of f, f', and f''
MA.9-12.II.D.2	Relationship between the concavity of f and the sign of f''
MA.9-12.II.D.3	Points of inflection as places where concavity changes
MA.9-12.II.E.2	Optimization, both absolute (global) and relative (local) extrema
MA.9-12.II.E.3	Modeling rates of change, including related rates problems
MA.9-12.II.E.4	Use of implicit differentiation to find the derivative of an inverse function
MA.9-12.II.E.5	Interpretation of the derivative as a rate of change in varied applied contexts, including

	velocity, speed, and acceleration
MA.9-12.II.F.3	Chain rule and implicit differentiation
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.
TEC.K-12.8.1	All students will use computer applications to gather and organize information and to solve problems.
TEC.K-12.8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual society, and the environment.
WORK.K-12.9.1	All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace.
WORK.K-12.9.2	All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace.

Transfer

- Students will apply derivatives to real life scenarios such as velocity, marginal profit, marginal revenue and marginal cost.
- Students will connect the concept of derivatives to data analysis.
- Students will connect the concept of derivatives to graphical analysis.

Essential Questions

- Do all functions have a derivative?
- How is a derivative a limit?
- How is a derivative an instantaneous rate of change?
- What algebraic procedures can be used to find a derivative?

Essential Understandings

- Do all functions have a derivative?
- How is the first derivative of a function related to the optimization of the function.
- How are calculus rules of power rule, product rule, quotient rule and chain rule used to find the derivative of a function? What determines which rule should be used?
- How are Related Rates utilized to find the instantaneous rate of change of a variable with time?

- How do we find higher order derivatives?
- How is an average rate of change represented mathematically (secant lines)
- How is an instantaneous rate of change represented mathematically (tangent lines)
- How is the limit definition used to find a derivative?
- How is the second derivative of a function related to the concavity of the funciton.
- What can the slope of a curve tell us about the graphical behavior of a function?
- What is the slope of a curve?
- When is implicit differentiation necessary to find a derivative?

Students Will Know

- How the first derivative test is used to find relative maximum/minimum for a function.
- How the second derivative of a function can determine the concavity of a graph at a point.
- How to apply the general chain rule to a function
- How to find a derivative when a variable is changing with time.
- How to use and apply implicit differentiation.
- The derivatives of sums, differences, products and quotients of functions.
- The limit definition of a derivative.
- The process for finding the slope of a secant line to a curve.
- The process for finding the slope of the tangent to a curve at the point of tangency.
- The proper notation for a derivative.
- What determines if the graph of a function is increasing or decreasing.
- Why the first derivative of function can show optimization of a function.

Students Will Be Skilled At

- Finding optimization points for a function.
- The formulas necessary to find derivatives algebraically (power rule, product rule, quotient rule, sum and difference)
- Finding higher order derivatives.
- Finding related rates.
- Graphical and algebraic understanding of secant and tangent lines.
- The computation and application of chain rule and implicit differentiation.
- Understanding the relationship between demand, revenue and profit.
- Understanding the relationship between position, velocity and acceleration.
- Using derivatives to help graph functions through descriptions of increasing/decreasing and concavity.

Evidence/Performance Tasks

Assessments

- Formative: Daily assessments using examples from class notes, NJSLA test bank problems, and/or Albert/AP Classroom assessments
- Summative: Teacher-created assessments, NJSLA test bank problems, Big Ideas Math online platform problems, Albert/AP Classroom and/or Big Ideas Math unit assessments
- Benchmark: IXL or teacher created diagnostic assessments in addition to unit assessments from Big Ideas Math
- Alternative Assessments: Student-centered activities such as scavenger hunts, various projects involving real world applications, and differentiated learning tasks in Khan Academy, DeltaMath, and IXL

- Answer essential questions
- Class discussion of daily topic
- Classwork and homework that assess the essential questions
- Provide alternative means of assessments for certain students
- Teacher Observation
- Tests and quizzes that assess the essential questions
- Written assignments that assess the essential questions that involves providing explanations

Learning Plan

- Applications of tangent lines
- Chain Rule to find derivative
- Differentiate functions to find velocity and marginal
- Equation of a secant line to show average rate of change over an interval
- Find slope of a tangent to a curve at the point of tangency to estimate slope of a curve
- Graph Analysis of a function: Use the second derivative to discuss the concavity of a function
- Graph analysis of a function: Use the second derivative to find points of inflection
- Graph Analysis of the function: Use the first derivative to find relative extrema
- Graph Analysis of the function: Use the first derivative to find the intervals of increasing and decreasing in a function
- Higher order derivative of a function (acceleration)
- Implicit differentiation to find the derivative of an equation
- Limit definition
- Power Rule to find derivative (Algebra skills to rewrite equation to use power rule)
- Product Rule to find derivative
- Quotient Rule to find derivative
- Related Rates to find the derivative for a variable changing with respect to time

Materials

Core instructional materials: Core Book List including PreCalculus with Limits 5E, Larson & Battaglia, Cengage

Supplemental materials: Khan Academy, Edia, and DeltaMath

- District approved textbook
- Khan Academy
- Teacher created activiites
- Teacher created notes

Suggested Strategies for Modifications

Possible accommodations/modification for PreCalc Honors