Unit 3 Differentiation

Content Area: **Mathematics**
Course(s): **Calculus Honors**
Time Period: **Marking Period 2**
Length: **10 Blocks**
Status: **Published**

Transfer Skills

Differentiation- Deriving on the highway

In this unit, students will differentiate all types of functions in order to find instantaneous rates of change.

Enduring Understandings

Calculus can be used to solve real world problems.

Algebra is the foundation of all levels of mathematics.

The derivative is used to represent the instantaneous rate of change.

Essential Questions

What is a derivative?

What role do derivatives play in calculus?

How are limits and derivatives related?

How are differentiability and continuity related?

What is the relationship between derivatives and tangent lines?

What is the difference between average and instantaneous velocity?

Content

Notes:

* Interpretations of the derivative can include all or some of the topics (depending on time)

* You can use the graphs of the derivatives to discover the differentiation rules

Vocabulary

Derivative

Constant Rule

Power Rule
Sum/Difference Rules
Trig Function Rules
Natural Log

Exponentials
Exponential Rules
Product Rule
Quotient Rule
Chain Rule

Tangent Line

Normal Line

Skills

Find the derivative of functions using the following rules:

- Constant Rule
- Power Rule

- Sum/Difference Rules
- Product Rule
- Quotient Rule
- Chain Rule
- Trig Function Rules
- Natural Log
- Exponential Rules

- Find the derivative of composite functions using the chain rule

Find higher order derivatives

Write equations of tangent and normal lines

Resources

Text:

James Stewart Calculus Eighth Edition

Graphing Calculator

Online Resources:

Khan Academy

Geogebra

Desmos

Standards

NJSLS 2016

Seeing Structure in Expressions

A-SSE B. Write expressions in equivalent forms to solve problems

3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity

represented by the expression. ★

c. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15^t can be rewritten as (1.151/12)^(12t) ≈1.01212^t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

Interpreting Functions

F-IF B. Interpret functions that arise in applications in terms of the context

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.★

Trigonometric Functions

F-TF B. Model periodic phenomena with trigonometric functions

6. (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.

The Real Number System

N -RN A. Extend the properties of exponents to rational exponents.

2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Mathematics | Standards for Mathematical Practice

1 Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for

entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

2 Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

5 Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6 Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate

accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

MA.F-IF	Interpreting Functions
MA.N-RN	The Real Number System
MA.A-SSE	Seeing Structure in Expressions
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.N-RN.A	Extend the properties of exponents to rational exponents.
MA.K-12.2	Reason abstractly and quantitatively.
MA.N-RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
MA.F-IF.B	Interpret functions that arise in applications in terms of the context
MA.A-SSE.B	Write expressions in equivalent forms to solve problems
MA.K-12.5	Use appropriate tools strategically.
MA.A-SSE.B.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
MA.K-12.6	Attend to precision.
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.A-SSE.B.3c	Use the properties of exponents to transform expressions for exponential functions.
MA.F-IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
MA.F-TF	Trigonometric Functions
MA.F-TF.B.6	Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.