Unit 5 Implicit Differentiation

Content Area: **Mathematics**
Course(s): **Calculus Honors**
Time Period: **Marking Period 3**
Length: **11 Blocks**
Status: **Published**

Transfer Skills

Implicit Differentiation- We're Related!

In this unit, students will enhance their understanding of differentiation by finding the derivative of implicit functions. Additionally, students will apply differentiation to real world problems.

Enduring Understandings

Geometry is a building block for Calculus.

Calculus is the language of Physics.

Calculus is a tool for creating a mathematical model for physical situations

Essential Questions

Why is implicit differentiation necessary in certain situations?

How are related rates and implicit differentiation related?

How can related rates be used to show the relationship between area and volume?

Content

Vocabulary:

Implicit

Explicit

Related Rates

Optimization

Area

Volume

Surface Area

Rolle’s Theorem

Mean Value Theorem

- Power Rule
- Chain Rule
- Product Rule
- Quotient Rule

Skills

Distinguish between functions written in implicit form and explicit form.

Find derivative of a function expressed implicitly.

When differentiating implicitly, utilize:

- Power Rule
- Chain Rule
- Product Rule
- Quotient Rule

Solve related rates and optimization applications

Resources

Text:

James Stewart Calculus Eighth Edition

Graphing Calculator

Online Resources:

Khan Academy

Geogebra

Desmos

Standards

NJSLS 2016

Seeing Structure in Expressions

A-SSE A. Interpret the structure of expressions

1. Interpret expressions that represent a quantity in terms of its context.★

b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)^n as the product of P and a factor not depending on P

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. ★

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.A-SSE	Seeing Structure in Expressions
MA.N-RN	The Real Number System
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.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
MA.N-RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
MA.A-SSE.A.1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.
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.