# Unit 4 Application of Differentiation

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

## Transfer Skills

**Applications of Differentiation- Seeing the Big Picture**

## Enduring Understandings

Functions should be analyzed by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.

Simplifying expressions and solving equations allows us to take a

complex situation and make it simple.

Change is fundamental to understanding functions.

## Essential Questions

Is there a way to visualize what a

derivative is?

What does the graph of a function tell

about the equation?

How do the graphs of the first and second derivatives relate to the graph of a function

## Content

**Vocabulary**

Extrema

Absolute Extrema

intervals

increasing/decreasing.

concave up/concave down

first derivative test.

points of inflections.

second derivative test.

horizontal asymptotes

oblique asymptotes

## Skills

Identify and classify all extrema including absolute extrema

Identify intervals where functions are increasing/decreasing.

Apply the first derivative test.

Identify intervals where functions are concave up/concave down.

Locate points of inflections.

Apply the second derivative test.

Find horizontal asymptotes and oblique asymptotes algebraically.

Sketch the graph of a curve.

## Resources

**Text:**

James Stewart Calculus Eighth Edition

Graphing Calculator

**Online Resources:**

Khan Academy

Geogebra

Desmos

## Standards

**NJSLC 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. □

**Interpreting Functions**

**F-IF A. Understand the concept of a function and use function notation**

2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

**B. Interpret functions that arise in applications in terms of the context**

5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.

**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.

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| MA.F-IF | Interpreting Functions |
| MA.A-SSE | Seeing Structure in Expressions |
| MA.K-12.1 | Make sense of problems and persevere in solving them. |
| MA.F-IF.A | Understand the concept of a function and use function notation |
| MA.K-12.2 | Reason abstractly and quantitatively. |
| MA.F-IF.A.2 | Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. |
| 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.F-IF.B.5 | Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. |
| MA.K-12.6 | Attend to precision. |