# Unit #3: Applied Differentiation

Content Area: **Mathematics**
Course(s): **Calculus A**
Time Period: **Semester 1**
Length: **5 weeks**
Status: **Published**

## Standards

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| MA.F-IF.B.4 | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. |
| MA.F-IF.B.5 | Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. |
| MA.F-IF.C.7 | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. |
| MA.F-IF.C.7c | Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. |
| MA.F-IF.C.7d | Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. |

## Enduring Understandings

Students will understand how to find extreme points of a function.

Students will extend graphical analysis to incorporate concepts from calculus.

Students will be able to apply the meaning of extreme points of a function in contexts such as business optimization problems.

Analysis of the critical elements of functions is essential to calculus.

Functions can be analyzed graphically by their limiting behavior and rates of change.

## Essential Questions

What are absolute and relative extrema of a function?
How do you find the relative extrema of a function?
How do you identify where a function is increasing or decreasing?
How do you identify where a function is concave up or concave down?
How do you apply the Mean Value Theorem?
How can we make our graphs from pre-calculus more exact using calculus?
How do you solve min/max word problems using calculus?
What does the differential (dy) of a function represent?

What is propagated error and how can it be used in manufacturing context?
How can calculus be used to solve optimization problems in the business sector?
How do we use calculus to solve optimization and related rate problems?
How are derivatives used to analyze the behavior of a function?

## Knowledge and Skills

- Understand and apply the definition of extrema (absolute and relative).
- Understand and use Rolle's Theorem.
- Understand and use Mean Value Theorem.
- Determine intervals on which a function is increasing or decreasing.
- Apply the First Derivative Test to find relative extrema of a function.
- Determine intervals on which a function is concave upward or concave downward.
- Find points of inflection of the graph of a function.
- Apply the Second Derivative Test to find relative extrema of a function.
- Determine limits at infinity.
- Determine the horizontal asymptotes, if any, of the graph of a function.
- Analyze and sketch the graph of a function.
- Solve applied minimum/maximum problems.
- Understand the concept of a tangent line approximation.
- Calculate the value of the differential, dy.
- Estimate a propagated error using a differential.
- Find the differential of a function using differentiation formulas.

## Transfer Goals

Recognize and solve practical or theoretical problems involving mathematics, including those for which the solution approach is not obvious, by using mathematical reasoning and strategic thinking.

In this unit students will be able to apply the differentiation methods that they've learned to a variety of real life contexts, including optimization and business related problems.

## Resources

Calculus of a Single Variable (6th Edition)

Authors: Edwards, Hostetler, Larson

Sections: 3.1 - 3.4

Sections: 3.5 - 3.6

Sections: 3.7, 3.9 - 3.10

Graphing Calculator

www.desmos.com

https://www.edx.org/school/davidson-next

http://www.larsoncalculus.com/calc10/content/interactive-examples/