

Unit 2: More Derivatives
AP/ECE Calculus
8 Class Meetings

Revised November 2019

Essential Questions

- How are chain rule and implicit differentiation helpful in solving real world problems?

Enduring Understandings with Unit Goals

EU 1: The derivative of the composition of functions can be found using the chain rule

- Use the chain rule to find the derivative of composed functions

EU 2: Implicitly defined functions can be differentiated

- Use implicit differentiation to derive implicitly defined functions

EU 3: There are many natural phenomena when quantities grow or decay at a rate proportional to their size.

- Use formulas to calculate population growth, half-life, and compound interest

EU 4: Rates of change of certain Functions can be determined by other rates of change

- Use related rates to solve problems

Standards

AP Calculus Curricular Requirements – College Board

- **CR1a** The course is structured around the enduring understandings within Big Idea 2: Derivatives.
- **CR2a** The course provides opportunities for students to reason with definitions and theorems.
- **CR2b** The course provides opportunities for students to connect concepts and processes.
- **CR2c** The course provides opportunities for students to implement algebraic/computational processes.
- **CR2d** The course provides opportunities for students to engage with graphical, numerical, analytical, and verbal representations and demonstrate connections among them.
- **CR2e** The course provides opportunities for students to build notational fluency.
- **CR2f** The course provides opportunities for students to communicate mathematical ideas in words, both orally and in writing.
- **CR3a** Students have access to graphing calculators.
- **CR3b** Students have opportunities to use calculators to solve problems.
- **CR3c** Students have opportunities to use a graphing calculator to explore and interpret calculus concepts.
- **CR4** Students and teachers have access to a college-level calculus textbook.

Unit 2: More Derivatives

AP/ECE Calculus

8 Class Meetings

MSMHS Academic, Civic, and Social Competencies

Competency 1. Read and write effectively for a variety of purposes.

Competency 2. Speak effectively with a variety of audiences in an accountable manner.

Competency 3: Make decisions and solve problems independently and collaboratively.

Competency 5. Contribute to a positive learning environment with respect and responsibility.

Unit Content Overview

1. Chain Rule

- Apply the chain rule to find derivatives of composite functions

2. Implicit Differentiation

- Find the derivative of implicitly defined functions
- Use implicit differentiation to write equations of tangent lines

3. Exponential Growth and Decay

- Population growth and half life
- Newton's Law of Cooling
- Compound Interest

4. Related Rates

- Solve related rates problems

5. L'Hopital's Rule

- Finding limits in an indeterminate form

6. Linearization and Newton's Method

- Use linearization to approximate the value of a function at a given point
- Use Newton's Method to approximate solutions to polynomial functions

Interdisciplinary Connections

- Language Arts – Word problems
- Marine Science – Word problems

Unit 2: More Derivatives
AP/ECE Calculus
8 Class Meetings

Daily Learning Objectives with *TWPS Activities*

Students will be able to...

- Use the chain rule to find the derivative of composed functions
- Find derivatives of implicitly defined functions
- Use formulas for population and compound interest to solve real world problems
- Determine the rate at which functions are changing based on other given rates
- Evaluate limits with an indeterminate form using L'Hopital's rule
- Approximate a value of a function based on its linearization
- Use Newton's method to solve polynomial functions

Instructional Strategies/Differentiated Instruction

- **HLP:** Academically Productive Talk
- **HLP:** Writing to Learn (TWPS)
- **HLP:** Effective Feedback
- Lecture with notes
- Guided notes
- Accountable Talk
- Student-led instruction
- Independent problem-solving
- Collaborative problem-solving
- Cross-curricular problem solving (independent and collaborative)
- Homework

Unit 2: More Derivatives
AP/ECE Calculus
8 Class Meetings

Assessments

FORMATIVE ASSESSMENTS:

- Warm-ups
- White board examples
- Mid-class check-ins
- Student explanations of asymptotes and continuity
- Exit Slips
- Homework
- Accountable Talk Discussions
- Daily Think-Write-Pair Share (TWPS)
- AP Exam Prep questions – collected and graded
- MSMHS Rubric 5: Civic and Social Responsibility
- Implicit and Related Rates Performance Task
 - MSMHS Rubric 3: Problem Solving

SUMMATIVE ASSESSMENTS:

- Quiz on EU 1, 2 and 3
- Unit Test
- Implicit Differentiation Performance Task

Unit Task

Unit Task Name: Implicit Differentiation FRQ

Description: Students will use information learned in this unit about how to use the chain rule (EU 1) functions can be implicitly defined (EU 2), and how to solve problems involving more than one rate (EU 4) in order to answer AP free response questions to prepare for the AP exam. Students will be expected to use their knowledge learned in the unit to define key terms and demonstrate their understanding of the mathematical content. They will be required to justify their answers in alignment with AP expectations.

Evaluation: MSMHS Rubric 3: Problem Solving

Unit 2: More Derivatives

AP/ECE Calculus

8 Class Meetings

Unit Resources

- Finney, Ross L., Demana, Franklin D., Waits, Bert K., Kennedy, Daniel. *Calculus: Graphical, Numerical, Algebraic*. Fourth ed., Prentice Hall, 2012.
- Stewart, James. *Single Variable Calculus: Early Transcendentals*. Cengage Learning, 2016.
- MSMHS School-wide Rubrics
- Internet databases
- Laptops
- Graphing Calculators