

Unit 6: AP Additional Concepts

AP/ECE Calculus

28 Class Meetings

Revised June 2019

Essential Questions

- How can integrals help us to find the average value of a quantity?
- How can a function be determined from its' derivative?

Enduring Understandings with Unit Goals

EU 1: The average value of a function can be found using integrals.

- Apply the Average Value Theorem to definite integrals

EU 2: Differential equations can be solved to find the original function.

- Use slope fields to solve differential equations
- Solve using separation of variables.

EU 3: There is a relationship between derivatives of functions and their inverses.

- Calculate derivatives of function's inverses.

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.

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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. Average Value of a Function

- Use integrals to determine the average value of any function

2. Slope Fields and Euler's Method

- Draw slope fields
- Analyze slope fields to determine original function

3. Differential Equations

- Solve differential equations by separation of variables

4. Inverse Functions

- Find derivatives of inverse functions

Interdisciplinary Connections

- Physics – Particle motion problems
- Language Arts – Word problems

Daily Learning Objectives with *TWPS Activities*

Students will be able to...

- Determine the average value of a function using integrals
- Draw a slope field and sketch the original function
- Solve differential equations using separation of variables
- Use properties of inverse functions to evaluate derivatives

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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

Assessments

FORMATIVE ASSESSMENTS:

- Accountable Talk Discussions
- Daily Think-Write-Pair Share (TWPS)
- White board examples
- Mid-class check-ins
- Exit Slips
- Homework
- AP Exam Prep questions – collected and graded
- MSMHS Rubric 5: Civic and Social Responsibility
- Slope Fields and Differential Equations Performance Task
 - MSMHS Rubric 3: Problem Solving

SUMMATIVE ASSESSMENTS:

- Unit Test
- Slope Fields and Differential Equations Performance Task

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Unit Task

Unit Task Name: Slope Fields and Differential Equations

Description: Students will use information learned in this unit about how to find the average value of a function (EU 1) and solve differential equations (EU 2) 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 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