Course Outline

Updated 06/13

Advanced Placement Calculus A/B
Syllabus #884797v1

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Textbook: Finney, Demana, Waits and Kennedy. *Calculus—Graphical, Numerical, Algebraic*. Second edition. Pearson, Prentice Hall, 2003.

By successfully completing this course, you will be able to:
Work with functions represented in a variety of ways and understand the connections among these representations.

- Understand the meaning of the derivative in terms of a rate of change and local linear approximation, and use derivatives to solve a variety of problems.
- Understand the relationship between the derivative and the definite integral.
- Communicate mathematics both orally and in well-written sentences to explain solutions to problems.
- Model a written description of a physical situation with a function, a differential equation, or an integral.
- Use technology to help solve problems, experiment, interpret results, and verify conclusions.
- Determine the reasonableness of solutions, including sign, size, relative accuracy, and units of measurement.
- Develop an appreciation of calculus as a coherent body of knowledge and as a human accomplishment.

Technology Requirement

I will use a Texas Instruments 83 graphing calculator in class regularly. Students must have a graphing calculator as well. I recommend the TI-83 or TI-84 or the TI-89. You may not use a calculator with a QWERTY keyboard, internet access or stylus design on the AP Exam.

We will use the calculator in a variety of ways including:

- Conduct explorations.
- Graph functions within arbitrary windows.

- Finding a root
- Using numerical methods, solve equations and approximate the derivative at a point or approximate the value of a definite integral.
- Analyze and interpret results.
- Justify and explain results of graphs and equations.

[C5]

AP Standards Notation

C2—The course teaches all topics associated with Functions, Graphs, and Limits; Derivatives; Integrals; and Polynomial Approximations and series as delineated in the Calculus Topic Outline in the AP Calculus Course Description.

C3—The course provides students with the opportunity to work with functions represented in a variety of ways—graphically, numerically, analytically, and verbally—and emphasizes the connections among these representations.

C4—The course teaches students how to communicate mathematics and explain solutions to problems both verbally and in written sentences.

C5—The course teaches students how to use graphing calculators to help solve problems, experiment, interpret results, and support conclusions.

Course Timeline

Chapter 1 Prerequisites for Calculus 11 days

1.1 Lines
1.2 Functions and Graphs
1.3 Exponential Functions
1.4 Parametric Equations
1.5 Functions and Logarithms
1.6 Trigonometric Functions
Review and Test

Chapter 2 Limits and Continuity 10 days

2.1 Rates of Change and Limits
2.2 Limits Involving Infinity
2.3 Continuity
2.4 Rates of Change and Tangent Lines
Review and Test

Student Activity: Investigation of Limits **[C2], [C3], [C4], [C5]**
Student Activity: Sandwich Theorem **[C3], [C5]**

Chapter 3 Derivatives **30 days**

3.1 Derivative of a Function
3.2 Differentiability
3.3 Rules for Differentiation
3.4 Velocity and Other Rates of Change
3.5 Derivatives of Trigonometric Functions
Review and Test
3.6 Chain Rule
3.7 Implicit Differentiation
3.8 Derivatives of Inverse Trigonometric Functions
3.9 Derivatives of Exponential and Logarithmic Functions
Review and Test

Student Activity: Derivatives Activity: Falling objects **[C2], [C3], [C4], [C5]**
Student Activity: Graphing Derivatives **[C2], [C3], [C4], [C5]**

Chapter 4 Applications of Derivatives **25 days**

4.1 Extreme Values of Functions
4.2 Mean Value Theorem
4.3 Connecting f' and f" with the Graph of f
4.4 Modeling and Optimization
4.5 Linearization and Newton's Method
4.6 Related Rates
Review and Test

Student Activity: Optimum Can **[C2], [C3], [C4]**
Student Activity: Optimum Can **[C2], [C3], [C4]**
Student Activity: Local Linearization **[C3], [C4], [C5]**

Chapter 5 The Definite Integral **26 days**

5.1 Estimating with Finite Sums
5.2 Definite Integrals and Reimann Sums
5.3 Definite Integrals and Antiderivatives
5.4 Fundamental Theorem of Calculus
5.5 Trapezoidal Rule
Review and Test

Chapter 6 Differential Equations and Mathematical Modeling **22 days**

6.1 Antiderivatives and Slope Fields

6.2 Integration by Substitution
6.4 Exponential Growth and Decay
6.5 Population Growth
6.6 Numerical Methods
Review and Test

Student Activity: Slope Fields Single Variable Activity **[C3], [C4], [C5]**

Chapter 7 Applications of Definite Integrals 21 days

7.1 Integral as Net Change
7.2 Areas in the Plane
7.3 Volumes (discs, washers, cylindrical shells and cross sections)
7.4 Lengths of Curves
7.5 Science and Statistics Applications and Modeling
8.1 L'Hopital's Rule (connects derivatives and limits)
Review and Test

Student Activity: Speed vs. Time **[C2], [C3], [C4]**
Student Activity Set: Modeling Volumes of Solids **[C2], [C3], [C4], [C5]**

Final Review and AP Exam Preparation 12 days

A. Multiple-choice practice (Items from released exams as well as other resources, such as course websites)

1. Test taking strategies are emphasized
2. Individual and group practice are both used

B. Free-response practice (Released items from the AP Central website)

1. Rubrics are reviewed so students see the need for complete answers
2. Students collaborate to formulate team responses
3. Individually written responses are crafted, with emphasis on attention to full explanations. **[C4]**

"After the AP Exam" Topics 10 days

6.3 Integration by Parts
8.2 Improper Integrals
8.4 Partial Fractions

Teaching Strategies

We will begin on day one with instruction on prerequisites (chapter 1). During the week following, we will integrate AP-specific information about the nature of the test, calculator usage, etc. Students will be required to obtain a graphing calculator that is appropriate for the test to use for exploration and discovery during this course. **[C5]**

During a regular class session, time will be divided between small groups of students working together to check their work and collaborate on problems, and direct instruction to model different methods, to help with understanding, and to keep students focused and moving forward. Students will be called on regularly to demonstrate their solution to a complex problem. **[C3, C4]**

A video projector and the internet are connected to a computer in the classroom, so a variety of technology resources can be employed, including online graphing calculators, online videos, scanned diagrams and graphic charts and explanations. This technology will be especially employed during the studies of functions, graphs, solid modeling, derivatives and integrals. **[C2, C3, C5]**

Student Evaluation

Beginning in October, students will be assigned free-response questions at regular intervals to submit for an AP-level grade. This grade will constitute quiz scores in the first semester.

At the end of January, students will take a Multiple-choice AP test (released exam), which will inform them of their progress and help encourage students to continue in the second semester and to sign up for the exam.

Grading

Tests: 40%
Assignments: 20%
Quizzes: 10%
Final Exam: 20%
Guided Assessment (labs, barbeque, in-class activities, etc.): 10%

Student Activities

During the first few weeks, we spend extra time familiarizing students with their graphing calculators. Students are taught the rule of four: Ideas can be investigated analytically, graphically, numerically, and verbally. Students are expected to relate the various representations to each other. **[C3, C5]**

- Analytic/algebraic analysis (traditional equation and variable manipulation)
- Graphical analysis (where a graph is known, but again, not an equation)
- Numerical analysis (where data points are known, but not an equation)
- Verbal/written methods of representing problems (classic story problems as well as written justification of one's thinking in solving a problem—such as on our state assessment) **[C3]**