

AP Calculus AB—Syllabus

Course Overview

AP Calculus AB is the year long equivalent of a full year of Calculus 1. The goal is to expose students to the essential topics of Calculus and to prepare them to pass the AP Calculus test. This course provides a balance of exploration and theory, providing a multi-representational approach to functions and stressing the connections between these representations. The textbook we'll use is the AP version of a Calculus textbook, which completely aligns to the AP Calculus AB course description. It also includes regular Standardized Test practice questions and AP Examination Preparation questions.

Primary Textbook: Finney, Demana, Waits, Kennedy. *Calculus--Graphical, Numerical, Algebraic: AP Edition*. Boston: Pearson Prentice Hall.

Course Outline

Chapter and Topics

Estimated Time Frame

Ch 1: Prerequisites for Calculus

July, August, September

- 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

Test on 1.1—1.3 upon return to school

Test on 1.4—1.6

Ch 2: Limits and Continuity

September, October

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

Test on Ch 2

Ch 3: Derivatives

October, November

- 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
- 3.6 Chain Rule
- 3.7 Implicit Differentiation
- 3.8 Derivatives of Inverse Trigonometric Functions
- 3.9 Derivatives of Exponential and Logarithmic Functions

Test on 3.1—3.5

Test on 3.6—3.9

Semester Exam

Ch 4: Applications of Derivatives

November, December

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

Test on 4.1—4.3

Test on 4.4—4.6

Ch 5: The Definite Integral

January, February

5.1 Estimating with Finite Sums

5.2 Definite Integrals

5.3 Definite Integrals and Antiderivatives

5.4 Fundamental Theorem of Calculus

5.5 Trapezoidal Rule

Test on 5.1—5.3

Test on 5.4—5.5

Ch 6: Differential Equations and Mathematical Modeling

February, March

6.1 Slope Fields and Euler's Method

6.2 Antidifferentiation by Substitution

6.3 Antidifferentiation by Parts

6.4 Exponential Growth and Decay

6.5 Logistic Growth

Test on 6.1—6.3

Test on 6.4—6.5

Ch 7: Applications of Definite Integrals

April, May

7.1 Integrals as Net Change

7.2 Areas in the Plane

7.3 Volumes

7.4 Lengths of Curves

7.5 Applications from Science and Statistics

Test on 7.1—7.3

June

Test on 7.4—7.5

Final Exam

Teaching Strategies: Students will begin working on pre-requisite skills and Chapter 1 Precalculus topics during the summer months. We will review and answer questions the first few days and then assess their learning. We will also review calculator techniques the first few months. Students will learn how to experiment with their calculator, look for patterns, analyze tables and graphs, and interpret results. It is important for students to make the connection between functions, their graphs, and tables and to learn how to check their answers using both algebraic and calculator techniques. However, calculators will only be allowed used to support an answer, not to prove an answer or idea. Algebraic techniques will be required for proof or verification.

The AP Calculus textbook we'll use stresses a balanced approach among *The Rule of Four*: analytic/algebraic, numerical, graphical, and verbal methods of representing problems. Students will employ a variety of techniques to solve problems. We will initially obtain our solutions analytically, support the results both graphically and numerically (with and without use of the graphing calculator), and then interpret the meaning of our results within the context of the problem. The text offers tabular representations of data to help emphasize the concept that a function is a correspondence between numerical variables, thus helping students to build a strong connection between the numbers and their graphs. Additionally, students will use their graphing calculators to produce graphs and tables of functions enabling them to find the zeros, analyze end behavior, confirm limits, estimate slopes, compute the derivative of a function numerically, and compute definite integrals numerically. Students will be proficient expressing themselves symbolically, verbally, graphically, as well as in written word.

We will work together as a class at times, with partners, or individually. I will present information in a variety of ways: direct instruction; partner investigation; tutorial; learning from the book with the help of a reading guide, or small group presentations. We will take notes daily and keep a notebook with notes and homework to be used as a resource. Students will be allowed to use one page of test notes on tests and quizzes for the 1st semester, providing it is their own work. I think it's important to give that responsibility to students to bring their own formulas and not expect the teacher to hand them out for assessments. During the 2nd semester we will go without the notes so students get a realistic idea of what it takes to memorize essential information for tests.

I will have students check their own answers with a step-by-step answer key daily. The key is there for them to learn from and be sure they are correct in their thinking. It will include margin notes so they can see how each step is accomplished. I will collect and grade their work on a daily basis, grading on timeliness, completion, use of proper notation, and form *after* they check and correct their work with the key. Collecting work everyday emphasizes the importance of keeping up with daily assignments, allows for regular feedback, and builds a strong work ethic. I want them to get sufficient feedback before the test so they can make adjustments as needed.

I will answer questions from the homework at the beginning of every class. Sometimes I'll ask students to do certain problems for the class so they can get used to communicating their ideas verbally, symbolically, and in writing. At times we'll have partners present a portion of new material on the overhead and explain it to the class. One partner will man the overhead and transparency and the other show graphing calculator techniques. They will take turns doing the teaching. Each group will take a turn presenting to the class. At the end, we'll make a copy of the notes from each transparency and distribute them to the entire class.

All homework assignments require answering questions in complete logical statements, whether it's a full English sentence, an algebraic statement, or using some other symbolic language. Students will learn to communicate complete thoughts and ideas in several different ways and to support their writing with diagrams and labeled graphs.

Though we will use the AP Calculus textbook as our primary text, I will supplement from other textbooks and material from other sources, as needed.

Student Evaluation: The grading system will be based on homework and test/quiz scores: 50% for homework and 50% for tests/quizzes. This emphasizes the need to do and keep up with the daily work and rewards effort-based learning. We will have a quiz and test every chapter, a semester exam, and a final exam, plus several projects throughout the year. We will practice questions from the AP test as well, though they will be graded on completion, not correctness. I will give them daily written feedback as I grade their homework assignments and provide opportunities for them to self-evaluate. Use of step-by-step answer keys help them to self-assess their own work and learn from the work of another. They will also engage in peer review at times, so they can experience reading another student's work, learn the importance of clear, logical arguments, and give valuable feedback for improvement. We will also share trouble shooting techniques as well as alternative methods of solving problems. I want to create a comfortable, collaborative setting where students feel free to share their ideas, remain open to new ways of thinking, and take risks in their learning.