

# AP Calculus AB

## Course Long Plan

### Brief Description of Course

Our study of AP Calculus builds upon a strong Pre-Calculus program. We require our students to complete a summer packet which reviews algebra, trigonometry, exponential and logarithmic functions. In Calculus our main topics of study are limits, differentiation and its applications, and integration with its applications. We use the TI 83-plus graphing calculator throughout the year to aid in the finding of zeroes, points of intersection of graphs, derivatives at a point, and the results of definite integrals. Calculator usage is permitted on some assessments, yet others are completed strictly without. Our overall objective is to prepare the students to take the AP exam in May. Some students move on to our Calculus II program and then take the BC exam.

### Unit Information

UNIT ONE: Review of Pre-Calculus via our summer packet (8 days)

Content and/or Skills Taught:

1. Review of algebra, trigonometry, exponential and logarithmic functions.
2. Emphasis on the graphs of the above as well as domain and range.
3. Review of piecewise and parametric equations.
4. Review on graphing calculator how to find the zeroes of a function and how to find points of intersection of graphs.

Major Assignments and/or Assessments: My students complete several projects which emphasize identifying functions (and their transformations) as well as their domain/range. Some of these projects are done in groups and some individually. During this chapter we also have assessments involving our graphing calculators (emphasizing the importance of a proper window, finding zeroes of a function, and experimenting with the different modes).

UNIT TWO: Limits and Continuity (17 days)

Content and/or Skills Taught:

1. Definition of limit.
2. Properties of limits.
3. Sandwich Theorem.
4. Finding limits numerically, with graphs, and using algebra.
5. Limits at infinity/ horizontal asymptotes.
6. Types of discontinuities.
7. Rates of change (average vs. instantaneous).
8. Tangents, secants, normal lines.

Major Assignments and/or Assessments: My students maintain a journal to record all

major theorems which we learn throughout the year. I often have them quiz each other in pairs to verify that they retain our list of theorems. They also make posters which contain examples of different functions, some having limits and some including the exceptions where limits may not exist. They present these to the class.

### UNIT THREE: Derivatives (35 days)

Content and/or Skills Taught:

1. Formal definition of derivative.
2. Finding derivative numerically and using graphs.
3. Relating graphs of  $f(x)$  and  $f'(x)$ .
4. Continuity vs. differentiability.
5. Rules for differentiation. (sums, diff, prod, quot)
6. Velocity, acceleration.
7. Derivatives in economics.
8. Derivatives of trigonometric functions.
9. Chain rule.
10. Implicit differentiation.
11. Differentiation of inverse trig. functions.
12. Differentiation of exponential and logarithmic functions.

Major Assignments and/or Assessments: Besides our homework from the textbook, this chapter promotes great discussions about comparing  $f(x)$  with  $f'(x)$ . Students complete a small group project involving a matching of 60 notecards (20 have graphs of  $f(x)$ , 20 have their derivatives, and 20 have graphs of  $f''(x)$ .) As we continue to complete assignments, I have my students explain their solutions at the board.

### UNIT FOUR: Applications of Derivatives (31 days)

Content and/or Skills Taught:

1. Finding extreme values (local and global).
2. Mean value theorem for derivatives.
3. Increasing/decreasing functions.
4. Concavity.
5. First and Second derivative tests.
6. Optimization problems.
7. Newton's method.
8. Linear approximations.
9. Differentials.
10. Related rates.
11. L'Hopital's Rule.

Major Assignments and/or Assessments: During this unit students complete a large packet of problems involving implicit differentiation and related rates. They work in groups, each group being responsible for presenting solutions to a section of the packet.

### UNIT FIVE: The Definite Integral (23 days)

Content and/or Skills Taught:

1. Finding approximations (left-hand, right-hand, midpoint, trapezoidal)

2. Riemann sums
3. Definite vs indefinite integrals.
4. Finding antiderivatives.
5. Mean value theorem for integrals.
6. First and Second Fundamental Theorems of Calculus.
7. Simpson's Rule

Major Assignments and/or Assessments: Our journal filled with theorems continues to grow. At this time of the year I like to have one-on-one discussions with each student. During these meetings I quiz the students on all of the major theorems (cumulatively from day 1), differentiation and integration rules, and the different ways to approximate the area under curves.

#### UNIT SIX: Applications of Integration (34 days)

Content and/or Skills Taught:

1. Slope fields.
2. More antiderivatives.
3. Separable differential equations.
4. Integration by substitution.
5. Integration by parts.
6. Exponential growth and decay.
7. Logistic growth models.
8. Euler's method.
9. Using integrals as net change.
10. Finding areas between curves. (dx and dy)
11. Finding volumes. (disc and shell methods)
12. Cross sections.
13. Arc Lengths.

Major Assignments and/or Assessments: Now that all elements of the curriculum have been taught, students work on a huge free response project. They present their findings to the class, and we then discuss the correct solutions. This takes several weeks and occurs just before the AP Exam.

#### **Alternate Approaches**

#### **Textbooks/Course Materials**

##### **Textbooks**

Author: Finney, Ross L.

Second Author: Demana, Franklin

Title: Calculus: Graphical Numerical Algebraic

Publisher: Pearson Prentice Hall

Published Date: January, 2002

##### **Other Course Materials**

Material Type: Other

Description: Packets of accumulated problems: Throughout the year I have my students complete packets which I have prepared. One packet is filled with multiple choice questions for which no calculator may be used. A second packet offers multiple choice questions for which a graphing calculator may be used. A third packet consists of free response questions, some may require a calculator, and some do not. The purpose of

these packets is to promote some great discussions about the concepts. Certainly part of Calculus requires some memorization, yet to truly understand this subject, students must show that they know how to APPLY what they have learned.

## **Websites**

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