AP Calculus (BC) Syllabus
Course Design and Philosophy

Students do best when they have an understanding of the conceptual underpinnings of calculus. Rather than making the course a long laundry list of skills that students have to memorize, we stress the "why' behind the major ideas. If students can grasp the reasons for an idea or theorem, they can usually figure out how to apply it to the problem at hand. We explain to them that they will study five major ideas during the year: limits, derivatives, indefinite and definite integrals, applications of derivatives and integrals, the calculus of polar and parametric functions, and the application of calculus to the study of Sequences and Series.. As we develop the concepts, we explain how the mechanics go along with the topics.

Teaching Strategies

During the first few weeks, we spend extra time familiarizing students with their graphing calculators while we soar the through the foundations of Calculus like Limits and Derivatives. Students are taught the rule of three: Ideas can be investigated analytically, graphically, and numerically. Students are expected to relate the various representations to each other.

It is important for them to understand that graphs and tables are not sufficient to prove an idea. Verification always requires an analytic argument. Each chapter exam includes one or two questions that involve only graphs or numerical data. I believe it is important to maintain a high level of student expectation. I have found that students will rise to the level that I expect of them. A teacher needs to have more confidence in the students than they have in themselves.

We also stress communication as a major goal of the course. Students are expected to explain problems using proper vocabulary and terms. Like many teachers, I have students explain solutions on the board to their classmates. This lets me know which students need extra help and which topics need additional reinforcement.

Calculator Ideas

The graphing calculator is used to help students develop an intuitive feel for concepts before they are approached through typical algebraic techniques.
I use the calculator as a tool to illustrate ideas and topics. I stress the four required functionalities of graphing technology:

1. Finding a root
2. Sketching a function in a specified window
3. Approximating the derivative at a point using numerical methods
4. Approximating the value of a definite integral using numerical methods

Activities

The following activities demonstrate a couple of ways to help students gain an increased understanding of Calculus.

Mathematical Modeling: A can of soda.

Students are asked to minimize the amount of aluminum required to create a cylindrical can with volume 355 ml, and then asked to comment on why or why not this theoretical matches the cans they buy at the grocery store. Students must use numerical data in their analysis of the can. Students are then asked to submit a revised model which more closely approximates the real life soda can and yet minimizes the amount of aluminum.

Mathematical Investigation: The derivative of e^x.

Students use the TI-83 calculator's NDeriv and table features to discover the derivative rule for $y = e^x$ and all families of curves $y = ae^{kx}$ and write a paper about their findings.

AP Calculus BC Course Outline

Unit 1: Precalculus Review (1 week)

A. Lines

1. Slope as rate of change
2. Parallel and perpendicular lines
3. Equations of lines

B. Functions and graphs

1. Functions
2. Domain and range
3. Families of function
4. Piecewise functions
5. Composition of functions

C. Exponential and logarithmic functions

1. Exponential growth and decay
2. Inverse functions
3. Logarithmic functions
4. Properties of logarithms

D. Trigonometric functions

1. Graphs of basic trigonometric functions
   a. Domain and range

b. Transformations
c. Inverse trigonometric functions
2. Applications

Unit 2: Limits and Continuity (3 weeks)

A. Rates of change
B. Limits at a point
1. Properties of limits
2. Two-sided
3. One-sided
C. Limits involving infinity
1. Asymptotic behavior
2. End behavior
3. Properties of limits
4. Visualizing limits
D. Continuity
1. Continuous functions
2. Discontinuous functions
a. Removable discontinuity
b. Jump discontinuity
c. Infinite discontinuity
E. Instantaneous rates of change

Unit 3: The Derivative (5 weeks)

A. Definition of the derivative
B. Differentiability
1. Local linearity
2. Numeric derivatives using the calculator
3. Differentiability and continuity
C. Derivatives of algebraic functions
D. Derivative rules when combining functions
E. Applications to velocity and acceleration
F. Derivatives of trigonometric functions
G. The chain rule
H. Implicit derivatives
1. Differential method
2. y' method
I. Derivatives of inverse trigonometric functions
J. Derivatives of logarithmic and exponential functions

Unit 4: Applications of the Derivative (4 weeks)

A. Extreme values
1. Local (relative) extrema
2. Global (absolute) extrema
B. Using the derivative
1. Mean value theorem
2. Rolle's theorem
3. Increasing and decreasing functions

C. Analysis of graphs using the first and second derivatives
    1. Critical values
    2. First derivative test for extrema
    3. Concavity and points of inflection
    4. Second derivative test for extrema
D. Optimization problems
E. Linearization models
F. Related rates

Unit 5: The Definite Integral (3 weeks)

A. Approximating areas
    1. Riemann sums
    2. Trapezoidal rule
    3. Definite integrals
B. The Fundamental Theorem of Calculus (part 1)
C. Definite integrals and antiderivatives
    1. The Average Value Theorem
D. The Fundamental Theorem of Calculus (part 2)

Unit 6: Differential Equations and Mathematical Modeling (3-4 weeks)

A. Antiderivatives
B. Integration using u-substitution
C. Separable differential equations
    1. Growth and decay
    2. Slope fields
    3. General differential equations

Unit 7: Applications of Definite Integrals (3 weeks)

A. Summing rates of change
B. Particle motion
C. Areas in the plane
D. Volumes
    1. Volumes of solids with known cross sections.
    2. Volumes of solids of revolution
        a. Disk method
        b. washer method

This schedule leaves 4–6 weeks for flexibility with teaching and AP Test preparation.

Major Text

Larson, Ron, Hostettler, Robert Edwards, Bruce *Calculus with Analytic Geometry.* 8th ed Houghton-Mifflin, 2006.

Daily Work (25% of the grade)

Assignments will be given daily, and each assignment will either be due that day or the following day in class. If you do a majority of the problems, show your work, and turn it in on time, you will receive excellent grades on your daily assignments.

Level Skill Drills/Tests (30% of the grade)

Each day we will begin class with a warm-up of review problems to keep your math skills strong. After 10 of these warm-ups there will be a test worth 100 points. IF you stay on top of the warm-ups and PARTICIPATE in discussion, the tests will be easy.

Quizzes/Tests/Projects (45% of the grade)

Tests: These are pretty self-explanatory. They come at the end of a unit and are usually worth 100 points.

Projects: The IB program requires portfolio projects

IV**.** Assessment

Grading. Your grade will be determined by averaging the scores in each of the areas above to attain a percentage. This percentage will be translated into a grade based on the following scale:

92-100	A
90-91	A-
88-89	B+
82-87	B
80-81	B-
78-79	C+
72-77	C
70-71	C-
68-69	D+
60-67	D
Below 60	F

Skill Drills and Extra Credit

You will notice that the percentages already add up to 100% for the first three categories. Beyond this, you are required to complete **two** skill drill packets every 6 weeks. Here is how it works:

2 packets in ---------> 20 extra test points
1 packet in ---------> -10 test point penalty
0 packets in ---------> -40 test points penalty

V. Make-Up Policy and Attendance:

Late homework You may turn in homework late for 1/2 credit by coming to see me before or after school. **Late work will only be accepted during the week it was originally assigned.**

Excused Absence Policy for assignments You may only turn in assignments missed for excused absences. You will have the number of days missed plus one extra to make up the work without penalty. It is *your* responsibility to ask me for missing assignments.

Excused Absence Policy for tests If you have an excused absence the day of a test, you must be prepared to make up the test the day you get back to class. If you miss class prior to test day and arrive on test day, **you will be expected to take the test anyway, so be prepared!**

Final thoughts: At the moment, everyone has the potential to get an 'A'. I strongly suggest that you stay on top of the homework and skill drills, because they can make or break you in this class. If you do the homework consistently and thoroughly, you will do better on the quizzes and tests. A 100% homework average can also save you if you do blow a few tests. Let's all work hard this trimester and have a good time!

STUDENT SIGNATURE:_____

PARENT SIGNATURE:_____