AP Calculus BC
Syllabus

Primary Textbook: Calculus, Ron Larson, Robert Hostetler, Bruce Edwards, Seventh Edition. Houghton Mifflin Company, 2002

Resources:
Barron's How to Prepare for the AP Calculus Advanced Placement Examination
Cracking the AP Calculus Exam: The Princeton Review (2002-2003) by David Kahn
D & S's Multiple-Choice and Free-Response Questions in Preparation for the AP Calculus (AB) Examination (C2, C5)
Paul Foerster's Calculus Concepts and Applications (C2, 3, 4, 5)
A Watched Cup Never Cools; Ellen Kamischke (1999) (C3, C4)
Graphing calculators (TI-83, TI-84, TI-89) (C5)
Larson's HM Testing v6.1
AP Central Released Exams and Teacher Resources (C2, 3, 4, 5)
Advanced Placement Correlations and Preparation: Calculus (C2, C3, C4, C5)
http://apcentral.collegeboard.com/calculusab
http://www.skylit.com.calculus/fr.html
http://www.bmurphy.addr.com/calculus/links.html
www.calculus-help.com
http://mathexeter.edu/rparris/winplot.html

Teaching Strategies:
During the first few weeks we spend extra time familiarizing students with the **graphing calculators**. Students help each other in this undertaking. (C4,5) As we cover topics, we try giving students the opportunity to work with concepts analytically, numerically, graphically, and verbally. For example, when we work with the limit of sinx/x as x approaches 0, we let students look at the **graph** of this function and let them see what the limit approaches. We may then have them explore on a **table** (numerical) what the function approaches as x approaches 0. We let them **analyze** (algebraic and geometric) the limit by using the Squeeze Theorem. If they are working in groups, they are **communicating** their ideas to each other. We give our students many opportunities to solve problems in

a variety of ways. They may do so **algebraically** (analytically), **numerically** (tables), **graphically** (geometrically) or **verbally** (descriptively). (C3, C4, C5)

Students work in groups on a regular basis. Sometimes I assign the groups, sometimes the may pick their own. I assign homework daily, although I only collect it as we finish each section. I emphasize that students show all their steps in solving a problem and that they **justify** their answers where applicable. (C4)

I like to introduce many concepts with **exploration** lessons. Students tend to understand the concepts better if they have **discovered** a certain "rule". Paul Foerster's Explorations are great for this. His Rubber-Band Chain Rule Problem (Exploration 17) gives students an opportunity to work **numerically** (with tables) **graphically** and **analytically** (algebraically), thus facilitating an understanding of the Chain Rule. I also use some of the Concepts Worksheets from the Finney DeMana Waits Kennedy ancillary materials for their text Calculus: Graphical, Numerical, Algebraic. (C3, C4, C5)

At the beginning of the fourth quarter, after **all** concepts have been introduced, I divide the class into as many groups as we have chapters that have been covered. Each group decides on the chapter they will **present**, pointing out the main ideas, **discussing** interesting problems, emphasizing the harder concepts. Each student individually is responsible for a part of the chapter. Each student will earn a grade for the section she presents. Each student is an active learner in this project. (C4)

Throughout the year my students work on Free Response questions, sometimes as class work or homework assignments, often as quizzes. As they turn in their responses I give them the rubrics so that they may see what they did correctly right away. The next day, when they receive their graded papers, they **discuss** the solutions with each other and sometimes with the class. In general, I am very generous with positive comments, smiley faces, and stickers on good answers. If students approach an answer in substantially different ways I make it a point to have these students discuss their work. (C4)

Student Evaluation:
I give quizzes and tests often. The chapter tests always include questions from the previous chapters, so that students are continually reviewing the material. I include real AP multiple choice and Free Response questions whenever they have covered the material.

Curriculum Topics			
First Quarter			
Textbook Correlation	**Topic**	**Number of Days**	**CR**
1.2	**Finding Limits Graphically and Numerically** **Estimating Limits from graphs or tables of data**	**1**	**2,3,5**
1.3	**Evaluating Limits Analytically** ***Quiz 1.2-1.3***	**1**	**2,3**
1.4	**Definition of Continuity** **Continuity and One-Sided Limits** **Intermediate Value Theorem** **Finding Limits of Piece-Wise Functions**	**2**	**3**
1.5	**Infinite Limits** **Finding Vertical Asymptotes Using Limits** ***Chapter1 Test***	**2**	**2,3**
2.1	**Find the derivative and the Slope of the Tangent Line Using the Definition of the Derivative** **Derivative Presented Graphically, numerically, and Analytically** **Relationship between Differentiability and Continuity**	**1**	**2,3,5**
2.2	**Find the derivative of a function using the Power Rule** **Find the Derivative of the Sine and Cosine** **Use derivatives to find Rates of Change**	**2**	**2**
2.3	**Find Derivative Using Product and Quotient Rules** **Find Derivatives of the Remaining Trig Functions** **Find High Order Derivatives** ***Quiz 2.1-2.3***	**2**	**2**

2.4	**Find the Derivative of a Composite Function Using the Chain Rule** **Find the Derivative of a function Using the General Power Rule**	**2**	**2**
2.5	**Use Implicit Differentiation to Find the Derivative of a Relation** ***Quiz 2.4-2.5***	**2**	**2**
2.6	**Find a Related Rate** **Use related Rates to Solve Real Life Problems** ***Chapters 1-2 Test***	**3**	**3,5**
3.1	**Find Extrema on a Closed Interval**	**1**	**2,5**
3.2	**Understand and Use Rolle's and Mean Value theorems and their Geometric Interpretations**	**2**	**3**
3.3	**Determine Intervals on Which a Function Is Increasing/Decreasing; Justify** **Apply the First Derivative Test to Find Relative Extrema; Justify**	**2**	**2, 4,5**
3.4	**Determine Intervals in Which a Function Is Concave Up/Down** **Find Point(s) of Inflection; Justify** **Apply Second Derivative Test**	**2**	**2, 4,5**
3.5	**Determine Limits at Infinity** **Determine Horizontal Asymptotes** ***Quiz 3.1-3.5***	**1**	**2,5**
	Relate the Graphs of f, f', and f''	**2**	**2,3, 4**
3.6	**Summary of Curve Sketching**	**2**	**2,3,4 ,5**
3.7	**Optimization Problems**	**2**	**2,3**
3.8	**Newton's Method**	**1**	**2**
3.9	**Linearization** **Find the Differential of a Function**	**2**	**2**
	Apply the Derivative including velocity, speed, and acceleration ***Chapters 1-3 Test***	**2**	**2,3,5**
	Slope Fields **(dittos)**	**2**	**2,3,5**

4.1	**Find General and Particular Solutions of Differential Equations Use Basic Integration Rules**	**2**	**2**
4.2	**Use Riemann Sums to Approximate Area Under a Curve**	**2**	**2,3,5**

Special Projects and Activities:
Foerster's <u>Calculus Explorations</u> #20 (product rule), 21 (quotient rule), 17 (chain rule), 29 (Mean Value Theorem)
Tootsie Roll Pop Lab Activity (<u>A Watched Cup Never Cools)</u> to give students hands on experience with related rates. **(C2, 3, 4)**

Second Quarter			
Textbook Correlation	**Topic**	**Number of Days**	**CR**
4.3	**Properties of Definite Integrals**	**2**	**2**
4.4	**Evaluate a Definite Integral Using the Fundamental Theorem of Calculus Understand and Use the Second Fundamental Theorem of Calculus Find the Average Value of a Function on a Closed Interval *Quiz 4.1-4.4***	**3**	**2,3,5**
4.5	**Integration by Substitution**	**2**	**2**
4.6	**Numerical Integration by Trapezoidal /Simpson's Rule *Chapters 1-4 Test***	**2**	**2,3,5**
5.1	**Derivative of Natural Logarithmic Function**	**2**	**2,5**
5.2	**Integrating the Natural Logarithmic Function**	**2**	**2,5**
5.3	**Find the Derivative of an Inverse Function**	**1**	**2**
5.4	**Finding Derivative and Integrals of the Exponential Function *Quiz 5.1-5.4***	**2**	**2,5**
5.5	**Finding Derivatives and Integrals of Functions with Bases Other than "e" *5.1-5.5 Test***	**2**	**2,5**

5.6	**Use Separation of Variables to Solve a Differential Equation Law of Growth and Decay**	**1**	**2,3**
	Comparing Rates of Growth of Functions Including, exponential, polynomial, and logarithmic	**1**	**2**
5.7	**Solve Separable Differential Equations *Quiz 5.6-5.7***	**2**	**2**
5.8	**Derivatives of Inverse Trigonometric Functions**	**1**	**2**
5.9	**Integrating Inverse Trigonometric Functions**	**1**	**2**
6.1	***Chapters 1-5 Test* Find Area of a Region between Two Curves**	**2**	**2,3, 5**
6.2	**Find Volume of a Solid of Revolution Using the Disk Method Find Volumes of Solids with a Known Cross Section**	**3**	**2,3, 5**
6.3	**Find Volume of a Solid Using the Shell Method *Quiz 6.1-6.3***	**2**	**2,3, 5**
6.4	**Find Arc Length of a Curve Find the Area of a Surface of Revolution**	**2**	**2**
6.5	**Find Work Done by Constant/ Variable Force *Chapters 1-6 Test***	**2**	**2**
7.2	**Find an Antiderivative Using Integration by Parts**	**2**	**2**
7.5	**Use Partial Fraction Decomposition to Integrate Rational Functions**	**2**	**2**
7.6	**Evaluate an Indefinite Integral Using a Table of Integrals**	**2**	**2**
7.7	**Apply l'Hopital's Rule to evaluate Limits of Indeterminate Forms**	**2**	**2**

Special Projects and Activities:

Foerster's Calculus Explorations # 28 (Riemann Sums); #56 (Integration by Parts)
Special Activity on Integration by Substitution: In groups, students write down a function and its derivative on two separate index cards. I collect the cards and re-distribute them among the different group so that students match the function to its derivative. (C3)

Speedometer-Odometer Project (adapted from Instructor's Guide for Stewart's Calculus: Concepts and Contexts, 1997/1998) (C3, C4, C5)
Midterm is composed of released AP Exam questions

Curriculum Topics			
Third Quarter			
Textbook Correlation	**Topic**	**Number of Days**	**CR**
7.8	**Evaluate Improper Integrals That Have Limits of Integration/Infinite Discontinuities** ***Chapters 1-7 Test***	**2**	**2,3,4**
8.1	**List Terms of a Sequence** **Determine Convergence/ Divergence of a Sequence** **Use Properties of Monotonic/ Bounded Sequences**	**2**	**2,5**
8.2	**Use Properties of Infinite Geometric Series** **Use the nth-Term for Divergence of an Infinite Series**	**2**	**2,5**
8.3	**Use the Integral Test to Determine Convergence/ Divergence of an Infinite Series** **Use Properties of P-series and Harmonic Series** ***Quiz 8.1-8.3***	**2**	**2**
8.4	**Use Direct Comparison Test/ Limit Comparison Test to Determine whether a Series Converges/ Diverges**	**2**	**2**

8.5	**Use Alternating Series to Determine whether an Infinite Series Converges**	**2**	**2**
8.6	**Use the Ratio/ Root Tests to Determine whether Series Converges/ Diverges** ***Quiz 8.4-8.6***	**2**	**2**
8.7	**Find Taylor and Maclaurin Polynomial Approximations of Elementary Functions** **Use the Remainder of a Taylor Polynomial**	**2**	**2,5**
8.8	**Find Radius and Interval of Convergence of a Power Series** **Differentiate and Integrate a Power Series**	**2**	**2**
8.9	**Construct a Power Series Representing a Function**	**2**	**2**
8.10	**Find Taylor/ Maclaurin Series for a Function** **Find a Binomial Series** ***Chapters 1-8 Test***	**2**	**2,5**
9.2	**Find a Set of Parametric Equations to Represent a Curve**	**2**	**2,5**
9.3	**Find Slope of a Tangent Line to a Curve Given by a Set of Parametric Equations** **Find the Arc Length of a Curve** **Find the Area of a Surface of Revolution**	**2**	**2.5**
9.4	**Rewrite Rectangular Equations in Polar Form and vv.** **Sketch Graph of Equation in Polar Form** **Find Slope of Tangent Line to Polar Graph** ***Quiz 9.2-9.4***	**2**	**2,5**
9.5	**Find Area of a Region, Points of Intersection of Two Polar Graphs** **Find Arc Length and Area of Surface of Revolution of Polar Graphs** ***Chapters 1-9 Test***	**2**	**2**

11.1	**Analyze and Sketch a Space Curve Given by a vector-valued Function Extend Concepts of Limits and Continuity to Vector-Valued Functions**	**2**	**2,3**
11.2	**Differentiate and Integrate Vector-Valued Functions**	**2**	**2,3**
11.3	**Describe velocity and Acceleration Associated with Vector-Valued Functions**	**2**	**2,3**
11.4	**Find Unit Tangent Vector at a Point on a Space Curve Find Tangential and Normal Components of Acceleration *Chapters 1-11 Test***	**2**	**2,3**
Appendix A3, A7	**Euler's Method**	**2**	**2,5**

Special Projects and Activities:
Foerster's Calculus Explorations #63 (Improper Integrals); #64 (Miscellaneous Integration Practice); #80 (Power Series); #83 (Intro to Ratio Technique); #84 and #85 (Convergence)

Curriculum Topics			
Fourth Quarter			
Textbook Correlation	**Topic**	**Number of Days**	**CR**
	College Board Sample Exam 2003	**4**	**2,3,4,5**
	College Board Sample Exam 1998	**4**	**2,3,4,5,**
	College Board Sample Exam 1997	**4**	**2,3,4,5,**
	Chapter Review Presentations	**4**	**2,3,4,5,**
	Free Response Questions 2006	**4**	**2,3,4,5,**
	Free Response Questions 2005	**4**	**2,3,4,5,**
	Free Response Questions 2004	**4**	**2,3,4,5,**
	AP Exam	**1**	
	Student Presentations of AP Free	**2**	**2,3,4,5**

	Responses after 48 hours wait		

Special Projects and Activities:
Calculus Review: Students are divided into groups. Each group is responsible for reviewing a chapter with the class. Each student is responsible for a section of the chapter. They may present the review as a game, as a lecture, as an activity. (C2, C3, C4, C5)
After the AP test, and once students have access to their own Free Response questions they get in groups. Each group works on an individual question and each group **presents** it to the class. This is as close as we get to "going over the test.
Math Poem (see attached)