

AP Calculus BC (Calculus 2) Course Syllabus

Fall & Spring 2009-2010

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Textbook: Foerster, Paul A., *Calculus Concepts and Applications* 2nd ed. Emeryville, CA., Key Curriculum Press, 2005.

Other resources

Ancillary materials for the Foerster textbook: *Calculus Concepts and Applications* 2nd ed.

Various websites including but not limited to:

APCentral Website <http://apcentral.collegeboard.com/apc/Controller.jspf>

Visual Calculus <http://archives.math.utk.edu/visual.calculus/>

Calculus Resource Page: <http://www.chipola.edu/instruct/math/mathlab/calculus.htm>

Calculus BC Course Description

This course provides students with the opportunities and experiences to continue studying and master topics in four major concept areas: Limits, derivatives, definite integrals and indefinite integrals. Students are expected to utilize graphic, algebraic, numeric and verbal methods to design real world mathematical models and justify their results.

Prerequisites

Before studying calculus, all students should complete four years of secondary mathematics designed for college-bound students: courses in which they study algebra, geometry, trigonometry, analytic geometry, and elementary functions. These functions include those that are linear, polynomial, rational, exponential, logarithmic, trigonometric, inverse trigonometric, and piecewise defined. In particular, before studying calculus, students must be familiar with the properties of functions, the algebra of functions, and the graphs of functions. Students must also understand the language of functions (domain and range, odd and even, periodic, symmetry, zeros, intercepts, and so on) and know the values of the trigonometric functions of the numbers 0 , $\pi/6$, $\pi/4$, $\pi/3$, $\pi/2$, and their multiples.

Teaching Strategies

The students will spend a significant amount of time working in small groups to develop their understandings. Through various explorations and the creation of presentations by the students, they will be allowed to discover the concept before the material is thoroughly discussed. Throughout the week, the teacher will join the small group to check for understanding and to answer questions related to the material.

Technology

Students will continue learning the capabilities of their graphing calculator as it relates to calculus. Though the use of the TI-83 or TI-84 will be the calculator of choice of many students, the advanced capabilities of the TI-89 will also be seen throughout the year.

Student Agenda

- ☑ Do each of the first 6 chapter tests in the book are assigned as review from Calculus AB. These chapter cover limits, derivatives, and integral formulas and applications.
- ☑ Each student will do a project over each of the first 6 chapters.
- ☑ Each student will take a test over each of the first 6 chapters.
- ☑ Do cumulative review on pages 312-314.
- ☑ Starting in Chapter 7, the students will be given an outline of sections and problems to work through..
- ☑ After each chapter, each student will have a project and a chapter test as part of their evaluation.
- ☑ The month of April will be devoted to prepping for the AP Calc BC exam. You will be graded on the practice tests for this quarter.
- ☑ In early April, students will be given the option to form teams to participate in the APS Calculus Bowl.

Assignments

Assignments will be turned in at the end of the chapter. All work needs to be done neatly, with all critical steps shown. When units required the answer needs to be labeled. When a written response is required it should be done in complete sentences.

Tests

Unit or chapter tests are your chance to demonstrate how well you understood the material. They also represent a sizeable chunk of your grade. Keeping up with the assignments and spending a little time each day reviewing previous material will make studying and taking the assessments much easier. If you miss the testing day due to an absence, you must arrange a time to take a make-up test. Failure to do so in a prompt manner will result in partial or no credit for the test when it finally is taken.

Evaluation and Grading: Grades will be calculated by the approximate percentages.

All approximations	Homework:	25%	Grading Scale: A	93%-100%	
	Quizzes & Tests:	40%		B	82%-92%
	Projects	25%		C	71%-81%
	Final Exam:	10%		D	60%-70%
			F	Below 60%	

- ☑ Grades are computed using homework, written projects, quizzes, and tests. Exams will model AP-style assessments with multiple choice and free response questions. Students will be expected to explain and justify solutions using short, written responses during the course of the year.

Course Outcomes

- ◇ Write and state clearly the definitions and properties, differentiate, and integrate logarithmic and exponential functions
- ◇ Set up and solve applied problems involving logarithmic and exponential functions as selected by the instructor.
- ◇ Differentiate and integrate the inverse trigonometric functions.
- ◇ Define, differentiate, and integrate hyperbolic functions as selected by the instructor.
- ◇ Use the appropriate algorithm(s) – including integration by parts, trigonometric substitutions, partial fractions, numerical methods, etc. – to integrate algebraic, logarithmic, exponential, trigonometric, and composite functions.
- ◇ Use various limit theorems to evaluate improper integrals.
- ◇ Determine the convergence or divergence of various sequences and series.
- ◇ Use Taylor and Maclaurin series to express selected functions.
- ◇ Use Taylor's formula with remainder to approximate selected functions.
- ◇ Identify and graph equations involving a variety of conic sections.
- ◇ Convert between Cartesian and polar coordinates.
- ◇ Graph and determine the area of regions defined by polar equations.
- ◇ Read, analyze and apply written material to new situations.
- ◇ Demonstrate the ability to select and apply contemporary forms of technology to solve problems or compile information

Topic Outline BC Calculus includes all Calculus AB topics but in addition:

Parametric, polar, & vector functions
Analysis of planar curves, including velocity and acceleration.
Numerical solution using Euler's method
L'Hospital's Rule, including its use in determining limits and convergence of improper integrals and series.
Derivatives of parametric, polar, and vector functions.
Integral applications used to model physical, biological, or economic situations.
Antiderivatives by substitution of variables, parts, and partial fractions.
Improper integrals (as limits of definite integrals)
Solving logistic differential equations and using them in modeling.

Concept of series.
Motivating series examples including decimal expansion
Geometric series with applications
Harmonic series
Alternating series with error bound.
Terms of series as areas of rectangles and their relationship to improper integrals, including the integral test and its use in testing the convergence of p-series.
Ratio test for convergence & divergence
Comparing series to test for convergence or divergence.
Taylor Series
Maclaurin series
Power series

Derivatives reviewed from Calculus One

- Represent derivatives graphically, numerically, and analytically.
- Demonstrate fluency of the basic rules for the derivative of sums, products, quotients, and composite functions.
- Define the derivative as the instantaneous rate of change, and recognize the relationship between differentiability and continuity.
- Understand the relationship between the function and the first and second derivatives.
- Apply the concepts of first and second derivatives to graphs and data in problem-solving situations (e.g., optimization, profit, revenue, velocity, and acceleration).

Integrals reviewed from Calculus AB but also part of Calculus BC

- Express the relationship of a derivative to an integral and an integral to a derivative.
- Apply the Fundamental Theorem of Calculus to evaluate definite integrals.
- Calculate the definite integral as the limit of Riemann's sum and the area under a curve over an interval.
- Use integral models to solve physical, biological, or economic situations.
- Apply the definite integral to a variety of problem-solving situations (e.g., area of a region, volume of a solid, distance traveled on a function).

New topics for Calculus BC

- Use Taylor and Maclaurin series to express selected functions.
- Use Taylor's formula with remainder to approximate selected functions.
- Identify and graph equations involving a variety of conic sections.
- Convert between Cartesian and polar coordinates.
- Graph and determine the area of regions defined by polar equations.
- Read, analyze and apply written material to new situations.

Feel free to contact me with questions.

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Taking the Advanced Placement Calculus BC exam in May is expected of all students in this course. More AP information can be found at

<http://www.collegeboard.com/ap/students/calculus/>

Project Outlines

Chapter 1: Exploration on Instantaneous Rate of Change. Students gather data from the opening and closing of an automatic door and analyze various degrees of motion at given times.

Chapter 2: Introduction to Limits. The exploration will be completed prior to a formalized presentation of the concept. Students will study the concept of removable discontinuity through graphical and numerical analysis. The idea of limiting is developed through approaching points of discontinuity.

Chapter 3: Deriving Velocity and Acceleration from Displacement Data. Students using given displacement data will use regression to develop a model and modify it to represent velocity and acceleration functions. Students are asked to extrapolate and interpolate during the analysis that provides review on previous concepts.

Chapter 4: Introduction to Related Rates. Students are given the rates of change for two separate quantities, two individuals moving apart from each other, and are expected to find the rate of the changing distance between them. As a final analysis students are asked to reflect solution process.

Chapter 5: Volume by Plane Disk Slices and Washer Slices. These activities help students to visualize three-dimensional affects that occur when revolving a function about a given axis. Through graphs and algebraic manipulations, students develop and test conjectures related to the volume of a paraboloid and its circumscribed cylinder.

Chapter 5: Differentials, and Linearization of a Function. Students will find the linear equation that best fits the graph of a given function at a given point. Students will use the equation to find approximate values for $f'(x)$ and values of the differentials dx and dy .

Chapter 6: A Compound Interest Problem. Students use a base- e exponential function to explore and develop a model that shows the accumulated interest in a savings account over time.

Chapter 7: Introduction to Slope Fields. Students will explore the solution to a differential equation using graphs and then confirm the solution algebraically.

Chapter 8: Soda Can Problem. Students are asked to create a model that gives the mathematically ideal shape of a can. They are then asked to comment on their findings versus the actual can measurements. Further they will minimize the amount of metal products used in the can and reach conclusions based on manufacturer and consumer needs.

Chapter 9: Special Trigonometric Integrals. This investigation helps students develop a process for integrating $\int \sin^2 x dx$, $\int \cos^2 x dx$ and $\int \cos ax \sin b x dx$ through use of the double angle formulas. Students then put the process into practice.

Chapter 10: Speeding Ticket Problem

Students explore costs to a driver given averages over time. They fit the data to a curve and establish costs based on average speed over time. Students must then justify their results and provide a reasonable argument for the driver to present in court.

*Activities are taken from Calculus: Concepts and Applications Instructor's Resource Book, Paul Foerster