AP® Calculus BC – Syllabus

Course Philosophy

AP® Calculus BC is a college-level class that includes all the material taught in AP® Calculus AB plus additional material equivalent to the second semester of college Calculus. A satisfactory score on the BC Advanced Placement® Calculus Exam in May will, in many cases, result in college credit for the first two semesters of Calculus. The BC Exam has an AB sub-score, meaning that it is possible to score well enough on the BC exam to get credit for one semester of college Calculus but not two semesters.

AP® Calculus is primarily concerned with developing the students' understanding of the concepts of calculus and providing experience with its methods and applications. The course emphasizes a multi-representational approach to calculus, with concepts, results, and problems being expressed geometrically, numerically, analytically, and verbally. The connections among these representations also are important. *(The College Board – AP® Calculus Teacher's Guide)*

Course Objective

The main objective of this course is to give students the understanding of calculus concepts, related mathematical skills and appropriate technology necessary for success on the Advanced Placement® Exam and in subsequent college mathematics courses. It is also my intent to enable students to appreciate the beauty and humanistic side of mathematics.

Course Textbook

Finney, Ross L., Franklin D. Demana, Bert K. Waits, and Daniel Kennedy. *Calculus—Graphical, Numerical, Algebraic. 3rd* ed. Pearson Prentice Hall, Boston, MA, 2007.

Teaching Philosophy

This course will focus not only on learning the necessary skills and operations but also on the mathematical theories and implications of the concepts. You will learn critical reading and thinking skills, how to express yourself both verbally and in writing, and how to manage your time and learn math effectively. This will NOT be a "watch what I do, do what I do" course. You will be actively involved in creating your own knowledge. Tests will not be carbon copies of the review or practice test. In order to better assess students' understanding, students will be required to apply the information they have learned in a new context on the tests. They will also be asked to explain and evaluate, in writing, various theories and mathematical concepts. Throughout the year, students will develop skills that will be valuable their entire lives: self-discipline, self-confidence, rigorous habits of mind, problem solving skills, and a love of learning. At the end of the course, the student will be able to earn college credit by passing the AP® examination, will be well-prepared for college-level mathematics, and will be able to think and learn for himself and have developed the ability to answer the questions that stem from his own curiosity.

Teaching Strategies

Daily Warm Up Multiple Choice Questions

At the beginning of each period, students are given up to 3 multiple choice questions to complete. Differing methods of solution are shared and discussed.

Homework review

Students with questions from the previous assignment have their questions answered by fellow "expert" students. These "expert" present the problems on the board in a step-by-step manner and verbally explain the sequence and the rational. This usually leads to great peer discussion about alternate representations and approaches to a particular problem. For their efforts, "experts" receive bonus points on quizzes.

Use of Graphing Calculator
Instruction will be given using primarily the TI-83+ and the TI-89. The graphing calculator will be used daily in class as a learning tool. The graphing calculator allows the student to support their work graphically, make conjectures regarding the behavior of functions and limits among other topics thus allowing students to view problems in a variety of ways.

The calculator helps students develop a visual understanding of the material. Students will master the most basic skills on the calculator: graphing a function with an appropriate window, finding roots and points of intersection, finding numerical derivatives and approximating definite integrals. Most students have their own calculator and are provided with appropriate programs such as those that calculate Riemann sums, generate slope fields, and Newton's method.

Most homework problems are clearly identified as being "calculator allowed" or "non-calculator" problems. Students are encouraged to develop a clear sense of when it is appropriate to use a calculator and when a calculator is not appropriate. Tests are divided in to calculator and non-calculator sections.

Multiple Approaches
Throughout the course, students are required to use multiple approaches to the understanding of functions. Students make daily use of the graphing calculator. Graphs are produced both with the calculator and by hand to assist in the understanding of problems. Students use the graphing calculator to experimentally determine solutions to problems and to interpret the results. Students also learn to use the calculator to support answers and conclusions that they have developed analytically.

Numerical solutions are developed both manually and with the calculator. Students are encouraged to check the reasonableness of their numerical solutions by using other approaches.

Students use analytical techniques to solve applied problems in differential and integral calculus. They are encouraged to develop general analytical approaches that can by applied to non-traditional problems.

Students are asked to explain calculus problems and techniques verbally and in writing, and each exam contains a writing prompt. Students also work in study groups, both in class and as outside study groups, to prepare for exams.

AP® Review
In addition to the ongoing, cumulative review throughout the year (warm ups and the AP® problems of the week), students are given an intensive review in the weeks prior to the AP® exam. During this time, practice exams are given and scored, strategies are reviewed, cumulative memorization quizzes are given, notation is emphasized, justification and verbal explanations are refined, and appropriate calculator usage is clarified.

Course Timeline

Unit	Topic		# Days
Chapter 1: Prerequisites/Summer Packet—6 days			
1.1,2	Lines, Functions and Graphs	0	
1.3	Exponential Functions		1
1.4	Parametric Equations		2
1.5	Functions and Logarithms		1
1.6	Trigonometric Functions		1
	Test		

Chapter 2: Limits and Continuity—7 days

2.1	Rates of Change and Limits	2
2.2	Limits Involving Infinity	1
2.3	Continuity	1
2.4	Rates of Change and Tangent Lines	1
	Review and Test	

Chapter 3: Derivatives—20 days

3.1	Derivative of a Function	1
3.2	Differentiability	1
3.3	Rules for Differentiation	3
3.4	Velocity and Other Rates of Change	3
3.5	Derivatives of Trigonometric Functions	3
3.6	Chain Rule	2
3.7	Implicit Differentiation	2
3.8	Derivatives of Inverse Trigonometric Functions	2
3.9	Derivatives of Exponential and Logarithmic Functions	1
	Review and Test	

Chapter 4: Application of Derivatives—16 days

4.1	Extreme Values of Functions	1
4.2	Mean Value Theorem	1
4.3	Connecting f' and f'' with the Graph of f	2
4.4	Modeling and Optimization	3
4.5	Linearization and Newton's Method	2
4.6	Related Rates	5
	Review and Test	

Chapter 5: The Definite Integral—11 days

5.1	Estimating with Finite Sums	1
5.2	Definite Integrals	2
5.3	Definite Integrals and Antiderivatives	3
5.4	Fundamental Theorem of Calculus	2
5.5	Trapezoidal Rule	1
	Review and Test	

Chapter 6: Differential Equations and Mathematical Modeling—13 days

6.1	Slope Fields and Euler's Method	2
6.2	Integration by Substitution	2
6.3	Integration by Parts	2
6.4	Exponential Growth and Decay	2
6.5	Logistic Growth & Partial Fractions	3
	Review and Test	

Chapter 7: Applications of Definite Integrals—13 days

7.1	Integral as Net Change	3
7.2	Areas in the Plane	2
7.3	Volumes	3
7.4	Lengths of Curves	2
7.5	Applications from Science and Statistics	1

	Review and Test	
	End of Semester Review and Semester Exam	1

Chapter 8: Sequences, L'Hôpital's Rule, and Improper Integrals—8 days

8.1	Sequences	1
8.2	L'Hôpital's Rule	2
8.3	Relative Rates of Growth	1
8.4	Improper Integrals	2
	Review and Test	

Chapter 9: Infinite Series—15 days

9.1	Power Series	3
9.2	Taylor Series	2
9.3	Taylor's Theorem	2
9.4	Radius of Convergence	2
9.5	Testing Convergence at Endpoints	4
	Review and Test	

Chapter 10: Parametric, Vector, and Polar Functions—11 days

10.1	Parametric Functions	2
10.2	Vectors in the Plane	2
10.3	Polar Functions	5
	Review and Test	

Review for AP® Exam 12

After the AP® Exam (introduction to additional topics):

Mathematical Induction
Centers of Mass
Trig Substitution
Functions of Two or More Independent Variables
Partial Derivatives
Double Integration 10