AP CALCULUS BC 2011-2012

COURSE SYLLABUS

Instructor: Andrew J. Spieker **E-mail**: delve-calcbc-teachers@mit.edu

Location: TBA **Course Time**: Sundays from 10:00 to 3:00

Text: Calculus of a Single Variable by Larson et al.

Course Description: Advanced placement Calculus BC covers a two-semester sequence of college calculus. The four major topics of the course covered are differential calculus, integral calculus, polynomial approximations of functions, and the calculus of planar curves. The major aim of the course is, naturally, to prepare students for the advanced placement examination offered by the College Board in May of 2012. Doing well on the examination may exempt you from having to take calculus in college at some universities; some universities even offer credit.

The first semester approximately covers what would be considered "Calculus 1" at a typical university; the second semester approximately covers what would be considered "Calculus 2". In this classroom, you will get a good course in calculus (meaning, nothing is left out of our curriculum that you would get in most other calculus courses). Additionally, we will prove most of the major theorems we discuss (unless its proof involves theory that is well beyond the scope of the course). In the past, there has been some confusion about what the difference between AB and BC calculus is, and how it relates to "Calculus 1" and "Calculus 2". Unfortunately, these questions aren't easily reconciled, since AB covers more than just "Calculus 1". In plain terms, BC calculus includes all topics of AB plus a few additional topics. BC calculus content tends NOT to be more challenging than AB content, but more topics are covered in a the same amount of time. My recommendation is not to think too hard about these issues…to help put your mind at ease if you have any questions about this, "BC only" topics are marked as such on the course outline with a dagger symbol.

Assignments & Grades: The course contract contains more information about assignments, assessments, and grades and how they will work. In short, the semester's grade will be determined by the following weighting system:

Six homework assignments:	20% Total (Not evenly weighted)
Three tests + two quizzes:	45% Total (Not evenly weighted)
Mid-year or final exam:	25%
Attendance and Participation:	10%

Other Information, Policies, and More: Please refer to the course contract for all information on policies, more detailed information about grading, assignments, etc. The next page begins the topical outline of the entire course.

Office Hours and Extra Help: There are no physical office hours—I don't have an actual office. However, depending on student interest, there may be virtual office hours or something to that effect. I will make myself available as early as 9:30 and as late as 4:00 if you give me advance notice for coming in early and/or staying late for extra help.

Topical Course Outline*

Semester 1 – Differential Calculus and Introduction to Integral Calculus

Unit "0" (Two Weeks) – Review of Precalculus

Week 1 (September 18, 2011):	Review!
Week 2 (September 25, 2011):	More review (worksheets, in class examples, etc.) Introduction to limits

Unit 1 (Two Weeks) – Limits and Continuity

Week 3 (October 2, 2011):	Limits and techniques for evaluating limits
Week 4 (October 9, 2011):	Point-wise continuity The intermediate value theorem and the extreme value theorem

Unit 2 (Four Weeks) – The Definition of the Derivative and Rules for Differentiation

Week 5 (October 16, 2011):	Average rate of change Instantaneous rate of change and the definition of the first derivative The power rule and basic derivative rules Applications to physics and motion
Week 6 (October 23, 2011)[§]:	The product, quotient, and chain rules More applications to physics, motion, and other real-life situations
Week 7 (October 30, 2011):	Derivatives of trigonometric functions Implicitly defined functions and implicit differentiation Higher order derivatives
Week 8 (November 6, 2011):	Differentiability as local linearity Differentials and linearization Newton's method for approximating zeros of a function

Unit 3 (Two Weeks) – Curve Sketching and Graph Analysis

Week 9 (November 13, 2011):	Increasing and decreasing functions Critical points and the first derivative test Concavity and convexity Inflection points and the second derivative test Techniques for curve sketching and graph analysis
Week 10 (November 27, 2011):	Rolle's Theorem and the Mean Value Theorem L'Hôpital's rule[†]

Unit 4 (Two Weeks) – Applications of Differentiation

Week 11 (December 4, 2011):	Related Rates
Week 12 (December 11, 2011):	Optimization

Unit 5 (Four Weeks) – Riemann Sums and the Definite Integral

Week 13 (December 18, 2011):	Riemann sums LRAM, RRAM, MRAM, and trapezoid approximations of area The definite integral The first fundamental theorem of calculus
Week 14 (January 8, 2012):	The second fundamental theorem of calculus Indefinite integrals and antidifferentiation Applications to physics and modeling real-life situations
Lost Week (January 15, 2012):	IN-CLASS MID-YEAR EXAMINATION
Week 15 (January 22, 2012):	Substitution and coordinate changes in definite and indefinite integrals Average value of a function on an interval Area bounded between curves Arc Length† Improper Integrals†

Semester 2 – Applications to Integral Calculus, Polynomial Approximations, and Planar Curves

Unit 6 (Two Weeks) – Applications to Integration: Solids of Revolution; Work

Week 16 (January 29, 2012):	Volumes of solids by slicing Volumes of solids by disks and washers
Week 17† (February 5, 2012):	Work; springs, pumping, and lifting Hooke's Law

Unit 7 (One Week) – Calculus of Transcendental Functions

Week 18 (February 12, 2012):	Transcendental functions Calculus with the exponential and logarithm functions Calculus with inverse trigonometric functions Calculus of inverse functions in general

Unit 8 (One Week) – Techniques for Antidifferentiation

Week 19† (February 19, 2012):	Integration by parts Partial fraction reduction Trigonometric substitution General integration techniques

Unit 9 (Two Weeks) – Infinite Series of Real Numbers and Convergence Tests

Week 20† (February 26, 2012):	Infinite series of real numbers Geometric series p-series Direct and limit comparison tests
Week 21† (March 4, 2012):	The ratio test The root test Alternating series and the alternating series test

Unit 10 (Two Weeks) – Infinite Series of Functions

Week 22† (March 18, 2012):	Power series of functions Finding the radius and interval of convergence for power series
Week 23† (March 25, 2012):	The Taylor series of a function Finding a Taylor series Controlling error on Taylor series

Unit 11 (One Week) – Differential Equations

Week 24 (April 1, 2012):	Differential equations Slope fields Separable differential equations Euler's method for approximating solutions to a differential equation† Population models and logistic growth; phase diagrams†

Unit 12 (Two Weeks) – Vector Functions, Parametric Equations, and Polar Coordinates

Week 25† (April 15, 2012):	Parametric equations and vector valued functions Modeling motion and physics applications Calculus with parametric equations and vector valued functions
Week 26† (April 22, 2012):	Polar coordinates; polar functions and their graphs Calculus with polar coordinates

Crunch Month! – Review, Etc.

Week 27 (April 29, 2012):	Practice Exam (Final Exam)
Week 28 (May 6, 2012):	Practice Exam (Final Exam)

* Note that from year to year, it is impossible to determine exactly what topics students will find easier and what topics students will find more difficult. One advantage of this course is that we are not tied to a particular structure; therefore, it is possible that we will speed up or slow down as necessary, thus changing the timing indicated on this sheet. It will be my responsibility to inform you of such changes, and provide you with a new/updated topical outline; it will be your responsibility to keep up with such changes and ask questions if anything is unclear!

† Indicates BC only content. In the event that all topics for the week are BC content, this symbol is put by the week number; otherwise, just by the topic itself.

ˢ Indicates Spicy Delve week. This course will run from 10-12, with seminar class from 1-3.