# AP Calculus BC Course Syllabus

**Course Description:**

This is a one year course designed to follow the Calculus BC course description as set forth by the College Board, with some additions. Students taking this course will be prepared to take the AP Calculus BC test in the spring of the school year that they are enrolled in the course.

The fundamentals and mechanics of Calculus are presented from graphical, numerical, and analytical perspectives. Technology is also employed to develop concepts, illustrate examples, and expedite calculations and investigations.

**Textbook:**

Larson, Ron, Robert P. Hostetler, Bruce H. Edwards. *Calculus*. 7th ed. Boston, Mass.: Houghton Mifflin, 2002.

**Supplemental Textbook:**

Larson, Ron, Robert P. Hostetler, Bruce H. Edwards. *Precalulus with Limits*. Lexington, Mass.: D.C. Heath, 1995.

**Assignments:**

Since the AP exam requires students to work with functions represented graphically, numerically, analytically, and verbally, the assignment problems will be such that a diligent student will be exposed to all of these forms throughout the course. If a student completes all parts of their daily assignment, they will get practice dealing with each of these, as well as some practice in using their calculator to help solve problems and in explaining answers in writing, on almost every assignment.

We will spend time reviewing questions on the previous assignment each class period. Students should be prepared to offer questions for discussion. Also, students should be prepared to offer suggestions for interpreting a problem, solving it, or justifying an answer as I do not plan on doing all of the work for you.

**Course Outline:**

**Calculus AB Review – 14 days**

**Parametric and Polar Equations (Ch. 9) – 12 days**

- Converting from parametric to rectangular and from rectangular to parametric
- Derivatives of parametric equations
- Finding the tangent line slope for a curve from a set of parametric equations
- Finding arc length and surface area of a curve segment using parametric equations
- Polar coordinate definitions
- Converting from polar to rectangular and from rectangular to polar
- Finding the tangent line slope for a curve given as a polar equation
- Area enclosed by a polar equation(s)
- Finding arc length and surface area of a curve segment given as a polar equation

**Analytical Geometry (Ch. 9) – 8 days**

- Conic sections

**Vectors in 2-D and 3-D (Ch. 10) – 20 days**

- Scalar vs. vector
- Unit vectors and component form of vectors
- The dot product and its geometric interpretation
- Projections of vectors
- Work defined as a dot product
- The cross product and its geometric interpretation
- Torque defined as a cross product
- Scalar triple product
- Lines and planes in 3-D space

- Distances between points, lines, and planes in 3-D space
- Cylindrical and quadric surfaces
- Surfaces of revolution
- Cylindrical coordinates – definition and conversion to rectangular
- Spherical coordinates – definition and conversion to rectangular and cylindrical

**Vector Valued Functions (Ch. 11) – 13 days**

- Definition
- Derivatives and integrals of vector valued functions
- Position, velocity, acceleration, and speed
- Projectile motion
- Arc length of a segment defined by a vector valued function
- Tangent and normal vectors

**Sequence and Series Review (Ch. 9 of supplemental textbook) – 10 days**

- Definition of a sequence
- Review of factorials and sigma notation
- Definition of a series
- Arithmetic and Geometric sequences and series
- Convergence of a geometric series
- Sum of an infinite geometric series
- Math induction
- Binomial theorem

**Sequences and Series (Ch. 8) – 20 days**

- Sequence convergence
- Infinite series
- Tests for convergence – $n^{th}$ term, Geometric, Integral, p-series, Direct Comparison, Limit Comparison, Alternating Series, Ratio, Root
- Alternating series remainder calculations

**Maclaurin, Taylor, and Power Series (Ch. 8) – 13 days**

- Definition of a Maclaurin series
- Definition of a Taylor series
- Maclaurin series as a specific example of a Taylor series
- Taylor's Theorem/Lagrange"s form of the remainder
- Definition of a power series
- Convergence of a power series – radius and interval of convergence
- Infinite geometric series summation as a template for creating a power series
- Differentiation and integration of power series
- Taylor series as a power series

**Differential Equations – 5 days**

- Review of slope fields and separable differential equations
- Euler's method
- Logistic differential equations

**Review for the AP Exam:**

This course makes extensive use of exam questions that have been released from previous AP exams by the College Board. These questions will be examined throughout the course as well as in a large review section prior to the AP test itself. Students will usually receive some sample questions at the end of each section highlighting how topics from that section have been used in the AP test.

Along with covering the topics from the previous section, these questions will be used to illustrate other facets of the AP test. Test items from all parts of the AP test will be used so that students are reminded that they will need to use calculator technology in order to solve certain problems while also remembering that they will need to work independently of their calculator for other questions. Special consideration will be given to

problems that present information in tabular form so that a numerical approach must be used. Also, we will focus on problems in which only a graph is given so that students can develop familiarity with the ways in which the features on a graph affect the features on its derivative or antiderivative graph. Lastly, we will use scoring guidelines and class discussion so that the students are comfortable explaining their work in ways that would be acceptable on an AP free response question. Careful attention to these review problems will allow the students to gain an understanding of the way AP questions are written and learn decoding skills that can be used on the AP test itself.

In order to simulate the AP test experience, students will take a complete multiple choice section and a complete free response section under actual testing conditions. These tests will be graded according to the guidelines used for the AP test, and students will be able to examine their work prior to the actual AP test. This will prepare students for working under the time constraints of the AP test.

**Following the AP test:**

**A Brief Foray into Multivariable Calculus (Ch. 12) – 15 days**

- Multivariable equations
- Partial derivatives
- Extrema
- Gradients
- Iterated integrals
- Double integrals and Volume

Although these topics are not required for the AP Calculus BC exam, they may be beneficial for students who plan on continuing their studies in calculus in college, and the time after the AP exam gives us the opportunity to cover them.

**Graphing calculator information:**

The primary model of graphing calculator used for this course will be the TI-83, but students may use any calculator which meets the requirements of the AP test. Students who are unsure about their calculator's suitability should check with the instructor.