

# AP Calculus AB Syllabus

School Year: 2011-2012

Instructor: Dewey Bodley

## **Introduction**

By enrolling in AP Calculus AB, students will have an opportunity to begin exploring higher level mathematics. Our study of calculus will be divided into two major topics: differential and integral calculus. Historically one of the greatest discoveries in mathematics, differential calculus solves the mystery of the slope of a curve. Differential calculus also calculates velocities and accelerations of moving bodies. Integral calculus studies areas of irregular regions in a plane, lengths of curves and other topics. Successful completion will develop a solid foundation in the Calculus AB topic outline as it is shown in the AP Calculus Course Description.

A great deal will be expected of students whether in class discussions or presentations, group work, or at home writing assignments and sample AP problems. Problems will be presented and solved in four basic ways: analytically, numerically, graphically, and verbally. Oral and written solutions will be presented to classmates and to instructor. Being able to explain their solutions will benefit both of us. Students will be required to have a graphing calculator and I will be teaching using TI-83. They will be used on a daily basis. Students will use them for exploring the ideas of limits using tables and graphs, graphing functions, solving equations and finding points of tangency of derivatives. In addition, graphing calculators will support algebraic solutions and assist in interpreting algebraic results. We will also evaluate derivatives and definite integrals. Programming will be introduced with Newton's Method.

About the first seven months of class will be devoted to the topics of a typical college Calculus I course. Students will be assessed daily with written assignments, at least once weekly with quizzes and twice during the chapter with full period tests. They will also take a midterm exam that will include sample AP questions. The next four weeks will be review for the AP test. After the AP exam in May, we will explore various topics in mathematics including further study of Calculus BC topics. Projects and presentations will be used for assessment during this time.

## **Course Outline**

### ***Unit One: Limits and Their Properties (3 weeks)***

- ***Find limits graphically and numerically.***
- ***Evaluate limits analytically.***
- ***Continuity and one-sided limits***
- ***Intermediate Value Theorem***
- ***Infinite limits and vertical asymptotes***

### ***Unit Two: Differentiation (9 weeks)***

- ***The derivative and the tangent line problem***
- ***Differentiability and continuity***

- *Basic differentiation rules and rates of change (average and instantaneous)*
- *Product and Quotient Rules and Higher Order derivatives*
- *The Chain Rule*
- *Implicit differentiation*
- *Related Rates*
- *Extrema on an interval*
- *Rolle's Theorem and the Mean Value Theorem*
- *Increasing and decreasing functions*
- *The First Derivative Test*
- *Concavity and points of inflection*
- *The Second Derivative Test*
- *Limits at Infinity (horizontal asymptotes)*
- *Summary of Curve Sketching (including monotonicity)*
- *Optimization problems*
- *Business problems*
- *Differentials*
- *Local linear approximations*

**Unit Three: Introduction to Integral Calculus (5 weeks)**

- *Antiderivatives and indefinite integration*
- *Differential equations*
- *Position, velocity, acceleration problems*
- *Riemann sums*
- *Definite integrals solved using geometric formulas*
- *Properties of definite integrals*
- *Trapezoidal Rule*
- *The Fundamental Theorem of Calculus*
- *Average value of a function*
- *Second Fundamental Theorem of Calculus*
- *Integration using u-substitution*
- *Displacement and definite integrals*

**Midterm Exam:** *The midterm exam includes problems from past AP exams that test the students' abilities to connect concepts graphically, analytically, numerically, and verbally. This exam determines 20% of the student's semester average while 40% of each of the first and second quarter grades make up the rest of the semester grade.*

**Unit Four: Transcendental Functions (7 weeks)**

- *The Natural Logarithmic Function and Differentiation*
- *The Natural Logarithmic Function and Integration*
- *Inverse Functions*

- *Exponential Functions: Differentiation and Integration*
- *Bases other than e and applications*
- *Differential equations: Growth and decay*
- *Differential equations: Separation of variables*
- *Differential equations: Slope fields*
- *Inverse trigonometric functions and Differentiation*
- *Inverse trigonometric functions and Integration*

**Unit Five: Applications of Integration (2 weeks)**

- *Area of a region between two curves*
- *Volume: Known cross-sections*
- *Volume: Disc method*
- *Volume: Washer method*

**Unit Six: AP Review (3 to 4 weeks)**

- *D & S Marketing Multiple Choice practice*
- *1997, 1998, and 2003 AP Exams*
- *Free response questions; 2000 to present*

**Unit Seven: Projects (3 to 4 weeks)**

- *History of a Famous Mathematician*
- *Create Solids of Revolution (for next years students)*
- *BC Calculus Exploration*
- *Final Exam covering the whole year*

**Resources and Textbooks**

*The College Board. AP Calculus AB Course Description*

*Finney, Ross L., Demana, Franklin, Waits, Bert, and Kennedy, Daniel. Calculus Graphical, Numerical Algebraic. Boston: Pearson Education, Inc., 2007.*

*Larson, Ron, Hostetler, Robert P. and Edwards, Bruce H. Calculus of a Single Variable. Boston: Houghton Mifflin, 1998, 6<sup>th</sup> edition.*

*Lederman, David. Multiple-Choice and Free Response Questions in Preparation for the AP Calculus (AB) Examination. D & S Marketing, , 8<sup>th</sup> edition.*