

## A.P. Calculus BC Syllabus

Teacher: Mrs. Cuba 2008-2009

Room: S109

Philosophy: Calculus is basically the study of change. You will learn how mathematics answers science's plea for solutions to questions of rates of change in population growth, interest income, distance traveled, and more. We will take a team approach to learning the concepts of calculus together using technology as an aid. Relax, enjoy, and work hard and we will have a fabulous journey to understanding the power of calculus together!

Required Materials: You need to bring to class daily your textbook, graphing calculator and your preferred style of notebook. We will also be using our A.P. preparation workbooks as announced.

Assessment: Ninety percent of your grade is based on your work on comprehensive tests, quizzes, and graded assignments. Partial credit is given based on shown work. Tests are worth two or three times more points than quizzes or graded assignments. The remaining ten percent of your grade is based on your work on daily written assignments. All of these assignments should be done in pencil and kept in your notebook. You must label the assignment with the page number and problem number and include the work for each problem, not just the answer. Each assignment is due at the beginning of the class period. It is graded as follows: 4 points - completely done and on time

3 points - partially done on time

2 points - late and completely done

1 points - late and partially done

0 points - not done

In May, the AP test will be taken by **all** students. In addition, the SAT Math Level 2 exam will also be taken if not already done satisfactorily.

Classroom Expectations: Our class time is limited! It is therefore expected that during class you will **be attentive, maintain a positive attitude, put forth your best effort, and respect others.**

## Tentative Calculus BC Schedule

### Week Chapter(s) Topic(s)

1 6 Euler's Method; Integration by Parts; Logistics Growth  
2 6 & 7 Logistics Growth; Lengths of Curves  
3 7 & 8 Applications from Science and Statistics; Sequences  
4 8 L'Hopital's Rule; Relative Rates of Growth;  
5 8 & 9 Improper Integrals; Test; Power Series  
6 9 Power Series; Taylor Series  
7 9 Taylor Series; Taylor's Theorem  
8 9 Radius of Convergence  
9 9 Testing Convergence at Endpoints  
10 9 Review and Test  
11 1-9 Review and Exam  
12 1-9 Review and Exam

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1 10 Parametric Functions  
2 10 Vectors in the Plane  
3 10 Polar Functions  
4 10 Review and Test  
5 2 Review of Limits and Continuity  
6 3 Review of Derivatives  
7 3 Review of Derivatives  
8 4 Review of Applications of Derivatives  
9 4 Review of Applications of Derivatives  
10 5 Review of Integration  
11 6 Review of Applications of Integration

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1 all Review and Exam  
2 all Review and Exam  
3 all Review and Exam  
4 all Review and Exam  
5 all Review and Exam  
6 all Review and Exam  
7 all Review and Exam  
8 all Review and Exam  
9 all Review and Exam

## **A.P. Calculus BC Course Outline**

- I. **Prerequisites for Calculus** (Approximately 7 days – it is recommended that students review this material over the summer to be fully prepared for this course.)
  1. Lines
  2. Functions and Graphs – polynomial, exponential, parametric, logarithmic, trigonometric, piece-wise, polar, and vector.
  3. Basic Techniques of the Graphing Calculator – all students have a graphing calculator; the model of choice is a TI-84 Plus; calculators are used throughout the course to aid in problems solving and students are taught how best to use the calculator to experiment, interpret results, and support solutions
  
- II. **Limits and Continuity** (Approximately 7 days)
  1. Rates of Change – emphasizing the difference between average and instantaneous using tables and graphs
  2. Definition of Limit and its Properties – including one-sided limits and The Sandwich Theorem
  3. Limits Involving Infinity – including end behavior models and asymptotes
  4. Continuity – including types of discontinuity which are explored graphically and the Intermediate Value Theorem
  5. Rates of Change Revisited – an introduction to derivatives through graphical and numerical approaches to instantaneous rates of change
  
- III. **Derivatives** (Approximately 28 days)
  1. Definition – including variations, one-sided derivatives, and graphing techniques
  2. Differentiability – when derivatives exist and do not exist; how the calculator finds derivatives; differentiability implies continuity
  3. Differentiation Rules – including second and higher order derivatives
  4. Velocity – analysis of up and down and left and right motion
  5. Derivatives of Trigonometric, Inverse Trigonometric, Exponential, Parametric, Polar, and Vector Functions
  6. Composition and the Chain Rule – including parametrized curves
  7. Implicit Differentiation
  
- IV. **Applications of Derivatives** (Approximately 15 days)
  1. Extreme Values – finding relative(local) and absolute(global) extrema

2. Mean Value Theorem – geometric interpretation
3. Increasing and Decreasing behavior and how it relates to the derivative
4. First and Second Derivative Tests for Extrema
5. Concavity and Points of Inflection
6. Relating  $f$ ,  $f'$ , and  $f''$  in tables and graphs
7. Optimization – applications to business, industry, and science
8. Linearization, Newton's Method, and Differentials
9. Related Rates

**V. The Definite Integral** (Approximately 16 days)

1. Riemann Sums – explored using graphing technology and programs – including LRAM, RRAM, and MRAM
2. Definite Integrals – basic properties, notations, calculator usage, and numerical approximations using tables and graphs
3. Average Value and Connections between Differential and Integral Calculus
4. Fundamental Theorem of Calculus – including its connection to area and the analysis of antiderivatives in graphical form
5. Trapezoidal Rule

**VI. Differential Equations and Mathematical Modeling** (Approximately 20 days)

1. Slope Fields – including the interpretation of differential equations and numerical solutions using Euler's Method
2. Antidifferentiation – including those following directly from basic functions, by substitution, by parts, and simple partial fractions
3. Exponential Growth and Decay – including solving separable differential equations, laws of exponential change, and applications to business and science
4. Logistic Growth

**VII. Applications of Definite Integrals** (Approximately 17 days)

1. Area Between Curves and Enclosed by Curves
2. Volume – including discs, washers, shells, and cross-sectional slices
3. Application of the Integral in Science and Industry – including motion, work, and net changes in data
4. Lengths of Curves

**VIII. Sequences, L'Hopital's Rule, and Improper Integrals** (Approximately 8 days)

1. Sequences – definition, types (arithmetic and geometric), graphing sequences, and finding limits
2. L'Hopital's Rule – indeterminate forms and use to compare growth rates
3. Improper Integrals – definition, evaluation, use of L'Hopital's Rule to determine convergence, comparison test, and applications

**VIII. Infinite Series** (Approximately 23 days)

1. Concept of Series – infinite series as a limit of a sequence of partial sums
2. Series of Constants – geometric series, harmonic series, p-series, and alternating series

3. Taylor Series – including the series for  $\sin x$  and  $\cos x$ , the Maclaurin Series, Taylor Series generated by  $f$  at  $x = a$ , and differentiation and antidifferentiation to determine new series
4. Taylor's Theorem – including the Lagrange form of the remainder
5. Radius of Convergence – including the Nth Term Test, Comparison Test, and Ratio Test
6. Convergence at Endpoints – discussion of the Integral Test, the P-Series Test, the Limit Comparison Test, and the Alternating Series Test