OM4BC: AP Calculus BC

Course Description
AP Calculus BC is a one-year course that covers college-level single-variable differential calculus, integral calculus, and infinite sequences and series, with particular emphasis on those topics that form the Advanced Placement Calculus BC curriculum. Course concepts will be approached from graphical, numerical analytical, and verbal points of view. Emphasis will be placed on the themes that unify calculus, including derivatives, integrals, limits, infinite sequences and series, polynomial approximations of functions, and applications and modeling. Technology (including graphing calculators and computer algebra systems) will be used regularly to analyze functions and deepen relationships among the multiple representations of functions.

Learning Objectives
Upon successful completion of the AP Calculus BC course, students will:

• Be able to work with functions represented in a variety of ways, including graphical, analytical, numerical, and verbal.
• Understand the meaning of the derivative in terms of a rate of change and local linear approximation.
• Use derivatives to solve problems.
• Understand the meaning of the definite integral, both in terms of a Riemann sum and as an interpretation of net change.
• Understand the connection between derivatives and integrals using the Fundamental Theorem of Calculus.
• Understand how to work with infinite sequences and series, including Taylor and Maclaurin series.
• Be able to construct polynomial approximations of functions.
• Be able to communicate mathematics verbally and develop mathematical models for applications of mathematics to physical situations.
• Be able to use technology to assist in mathematical problem-solving.

Required Textbook
*Calculus, Late Transcendentals Combined*
Howard Anton, Irl C. Bivens, and Stephen Davis
Printed textbook or eBook, WileyPLUS access code required

Course Topics

• **Functions**
  Real numbers, inequalities, absolute value, distance formula, properties of functions, graphing transformations, parametric, polar, and vector functions

• **Limits and Continuity**
  Intuitive notion of a limit, computing limits, continuity, end behavior
• **Derivatives**
  Instantaneous rates of change, definition of the derivative, differentiation rules, chain rule, differentiation of trigonometric functions, implicit differentiation, derivatives of parametric, polar, and vector functions

• **Applications of the Derivative**
  Maximization and minimization Problems, Rolle's Theorem, Mean Value Theorem, increasing and decreasing functions, concavity, finding local extrema, differential approximation, related rates, L'Hopital's Rule, Numerical solutions of differential equations using Euler's method

• **Integrals**
  The indefinite Integral, the area problem, the Riemann integral, the Fundamental Theorem of Calculus, average value

• **Applications of the Integral**
  Area between curves, volumes of revolution

• **Exponential, Logarithmic, and Inverse Trigonometric Functions**
  Defining logarithmic and exponential functions using calculus, derivatives and integrals of exponential and logarithmic functions, derivatives and integrals of inverse trigonometric functions

• **Techniques of Antidifferentiation**
  Antiderivatives, integration by substitution, integration by parts, partial fractions, improper integrals

• **Applications of Antidifferentiation**
  Applications to motion along a line, separable differential equations, logistic differential equations

• **Polynomial Approximations and Series**
  Convergence of infinite series, Taylor series, Taylor polynomial approximations, Maclaurin series and polynomials, power series, Lagrange error bound for Taylor polynomials

**Overview of Assignments**
Each semester, the letter grade in the course will be determined based on performance on the following types of assignments.

• In class participation: Students are expected to participate in in-class discussion sections, and are expected to have a functioning graphics tablet for presenting problems and asking questions during discussion sections. Students will contribute to and be part of an active learning environment.

• Homework assignments: Students will complete regular homework assignments (written and/or electronic) to demonstrate their mastery and knowledge of the material covered in each week’s lectures and discussion sections.

• Written exams: Students will complete written exams designed to test depth of understanding of calculus concepts and the ability to integrate knowledge of course concepts to solve problems. There will be approximately 8-10 such exams per semester.

• Midterm and final exams: There will be comprehensive, proctored midterm and final exams each semester. These exams will include material covered in lecture, discussion, homework assignments, and exams.