AP Calculus BC Course Description

AP Calculus BC is a year-long Desert Vista High School class which corresponds to the two separate semester courses at Rio Salado Community College MAT221 Calculus with Analytic Geometry I and MAT231 Calculus with Analytic Geometry II, which includes a complete coverage of all topics typically found in a Calculus I and Calculus II college curriculum.

1st semester The first semester includes all Calculus I topics and some Calculus II topics:

Unit 1: Limits and Continuity

- Finding limits graphically and numerically (using a table)
- Finding limits analytically
- Determining the continuity of a function at a given independent variable position
- One-sided Limits
- The Intermediate Value Theorem
- Infinite Limits, Limits at Infinity, and the connection between limits and asymptotes

Unit 2: Derivative Evaluation

- The limit definition of the derivative
- Derivative theorems for basic functions
- Derivative Product and Quotient Rules
- The Chain Rule
- Implicit Differentiation
- Logarithmic Differentiation
- Inverse Trigonometric function derivatives and general derivatives of inverse functions
- Higher-order derivatives

Unit 3: Derivative Applications

- Indeterminant Forms and L'Hopital's Rule
- The First and Second Derivative Tests and their uses
- Average vs. Instantaneous Rate of Change
- The Mean Value Theorem
- Extrema on an Interval
- Optimization problems
- Derivatives in Physics applications
- Linearization – using tangent lines to approximate functions
- Related Rates problems

Unit 4: Integral Definition and Evaluation

- Antiderivative evaluation using theorems
- Riemann Sums and the Definite Integral
- The Fundamental Theorem of Calculus – Evaluating Definite Integrals
- The Fundamental Theorem of Calculus – Start Plus Accumulation problems, Derivative of an integral problems.
- Displacement vs. Total Distance Traveled

- Average Value of a Function vs. Average Rate of Change
- Integration by Substitution
- Integration using Algebra Techniques
- Integration by Parts
- Trigonometric Integrals
- Trigonometric Substitution
- Integration by Partial Fractions
- Improper Integrals
- How to select a strategy for integration

Unit 5: Integral Applications

- Area Between Curves
- Volumes of Solids of Revolution – Disk/washer method
- Volumes of Solids of Revolution – Shell metho
- Volumes of Solids – using cross-sectional area shape
- Arc Length and Surface Area of Surfaces of Revolution
- (review) Average Value of a Function vs. Average Rate of Change

Unit 6: Intro to Differential Equations

- Introduction to Differential Equations (Slope Fields, Verifying Solutions)
- Approximating a Solution Curve for a differential equation using Euler's Method
- Solving differential equations using Separation of Variables
- Differential Equation Applications: growth and decay, radioactivity and carbon dating, Newton's law of cooling/warming
- Differential Equation Applications; The logistic growth model

2nd semester – The second semester continues topic coverage of the remaining Calculus II topics, and then provides a thorough entire-course review to prepare for the final exam and for the AP Calculus BC Exam:

Unit 7: Infinite Series / Taylor Polynomials

- Sequences
- Series and Convergence (Geometric Series and nth term Test)
- The Integral Test and the p-Series Test
- Comparison of Series (Direct and Limit Comparison tests)
- Alternating Series, Telescoping Series
- Absolute vs. Conditional Convergence
- The Ratio Test and the Root Test
- Error for Alternating Series
- Power Series
- Power Series representation of Functions
- Taylor and Maclaurin Polynomials
- Taylor and Maclaurin Series
- Binomial Series and using lists of Power Series of common functions
- Lagrange Error for Taylor Polynomials

Unit 8: Parametric Equations, Polar Coordinates, Vectors

- Review of conic section graphing
- Parametric Equations and Plane Curves
- Calculus with Parametric Equations (tangent lines, arclength, etc.)
- Polar Coordinates and Graphs
- Calculus with Polar Coordinates (tangent lines, arclength, area between polar curves, etc.)
- Vectors in 2D: properties and introductory applications
- Vector-Valued Functions
- Velocity and Acceleration as Vectors
- Displacement vs. Total Distance Traveled

Entire Course Review with a focus on Applications and preparing for the AP Calculus BC Exam.