ADVANCED PLACEMENT CALCULUS AB – AP LEVEL

Code: M662 Full Year (12) (1 credit)

Prerequisite: Math 3H, or Math 3 with at least a 90% average, or Math 4. **(rank weight 1.06)**

Note: Each student is expected to take the Advanced Placement AB Calculus Examination in May. The fee is determined by the College Board and is the responsibility of the student. In the event that a student does not take the AP Exam, the student's report card and transcript will reflect only a course in high school Honors Calculus at a rank weight of 1.04.

This course may be offered as a Distance Learning course between John Jay and Roy C. Ketcham High Schools.

Areas of Study Include:

- Precalculus Review
  - Simplify expressions, solve equations, transform functions, and graph functions involving the functions used in calculus.
  - Model problems by transforming functions to fit the problem
  - Use of a graphing calculator to draw a complete graph in a suitable window
- Develop an Intuitive Understanding of Limits
  - Distinguish between determinate and indeterminate limits.
  - Evaluate limits graphically, numerically and analytically.
  - Recognize the three ways a limit does not exist
  - Change variables to evaluate limits
  - Define and test for continuity graphically, and analytically
  - Find and define horizontal and vertical asymptotes using limits
  - Recognize the ways pixels can be deceiving on a graphing calculator
- Derivatives analytically, graphically, and numerically
  - Find derivatives using the limit definition of a Fermat quotient
  - Evaluate derivatives numerically, and recognize when a numerical derivative may be defined even when the exact derivative does not exist
  - Recognize the four ways a derivative does not exist
  - Understand the relationship between continuity and differentiability
  - Given the graph of a function approximate the rate of change and produce a feasible graph of the derivative of the function
  - Determine derivatives using differentiation rules and techniques for polynomial rational, radical, trigonometric, inverse trigonometric, logarithmic, exponential, absolute values, and piecewise define functions and for linear combinations, products, quotients, powers, and compositions of these functions
  - Determine derivatives of functions and their inverses using implicit differentiation
- Applications with Derivatives
  - Define a function which models the changing process
  - Find equations of tangent lines and estimate function evaluations using linearization
  - Demonstrate and apply the intermediate value theorem, extreme value theorem, Rolle's Theorem, and the mean value theorem
  - Use the first and second derivative to accurately graph a function identifying extrema, intercepts, inflection points, and regions of increase, decrease, monotonicity, positive concavity, and negative concavity
  - Use derivatives to study rates of change at a variety of phenomena including motion.
  - Use derivatives to model and solve a variety of optimization problems
  - Use derivatives to model a variety of related rates problems
- Integration Analytically, Numerically, and Graphically
  - Define a function which models the integrand
  - Find integrals using the limit definition of a Riemann Sum
  - Evaluate integrals numerically using the left, right, midpoint, and trapezoidal rules, and realize the possible errors
  - Given the graph of the function, produce a feasible graph of the antiderivative as the net accumulation of a rate of change
  - Evaluate integrals using the Fundamental Theorem of Calculus
  - Evaluate definite and indefinite integrals of various functions using integration rules and techniques based on antiderivatives including linearity, change of variable, and by parts
  - Use the Variable Limits Theorem to evaluate the derivative of an integral with variable limits
  - Approximate definite integrals using the trapezoidal rule with and without a graphing calculator
- Mathematical Modeling
  - Antidifferentiation by substitution
  - Modeling problems with separable differential equations and analytically solving them
  - Investigate differential equations with slope fields
- Applications with Integrals
  - Determine area of a region
  - Determine volumes of solids of revolution by discs and washers
  - Determine volumes of solids of known cross section
  - Determine travel distance of a particle
  - Demonstrate the mean value theorem for integrals and find the average value of a function
- Optional Post AP Topics
  - Calculus of Parametric Functions
  - Integration by parts
  - L'Hopital's Rule
  - Improper Integrals
  - Challenge problems

Assessment: Final project or final exam

For the complete AP Curriculum see http://apcentral.collegeboard.com/apc/Controller.jpf

Textbook: *Calculus: Graphical, Numerical, Algebraic*, 3rd Edition, published by Pearson Education, © 2007