FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

Course Outline
AP Calculus

Date: May 2003 **Subject Area: Mathematics**

Proposed Grade Level(s): 11-12 **Course Length: 1 Year**

Grading: A-F **Number of Credits: 5/Semester**

Prerequisites: 'B' or better in Precalculus or Honors Algebra 2/Trig

BRIEF COURSE DESCRIPTION:

An Advanced Placement (AP) course in calculus consists of a full high school academic year of work that is comparable to a calculus course in colleges and universities. AP Calculus will follow the syllabus recommended by the Advanced Placement program. Each student will complete a simulated AP exam in early May which will be counted as the final exam for the course. During the last weeks of the spring semester, advanced topics will be covered. The course is primarily concerned with developing students' understanding of the concepts of calculus and providing experience with its methods and applications. The course emphasizes a multi-representational approach to calculus, with concepts, results, and problems being expressed geometrically, numerically, analytically, and verbally. The connections among these representations are demonstrated through the use of the unifying themes of derivatives, integrals, limits, approximation, applications and modeling.

GENERAL GOALS/PURPOSES:

A major objective of the class is to prepare students for the Advanced Placement Calculus A/B exam to be given in May. Most universities award credit to students based upon their scores on this exam. Students will be encouraged to participate in the national exam.

STUDENT READING COMPONENT:

Students will receive instruction on the effective use of their textbook. This course includes applications where effective reading and analysis are taught as part of the course.

STUDENT WRITING/ORAL COMPONENT:

Students will have opportunities to express their understanding of concepts in writing as well as presenting work orally in class discussions. All written work will follow standard rules of English. Any research projects will follow MLA format, which has been distributed at all secondary sites.

Final Assessment:

A simulated AP Calculus exam is given in early May and used as the course final.

DETAILED UNITS OF INSTRUCTION:

Note: This outline of topics is from the Advanced Placement Program Guide for Calculus AB. Topics may be taught in different orders and enriched by additional topics.

1) Functions, Graphs, and Limits
   a) Analysis of graphs
      i) Emphasis is on the interplay between the geometric and analytic information and on the use of calculus to predict and explain the observed local and global behavior of a function
   b) Limits of functions (including one-sided limits)
      i) Intuitive understanding of the limiting process
      ii) Calculating limits using algebra
      iii) Estimating limits from graphs or tables of data
   c) Asymptotic and unbounded behavior
      i) Understanding asymptotes in terms of graphical behavior
      ii) Describing asymptotic behavior in terms of limits involving infinity
      iii) Comparing relative magnitudes of functions and their rates of change
   d) Continuity as a property of functions
      i) Intuitive understanding of continuity
      ii) Continuity in terms of limits
      iii) Geometric understanding of graphs of continuous functions
      iv) Intermediate Value Theorem and Extreme Value Theorem
2) Derivatives
   a) Concepts of the derivative
      i) Derivative presented geometrically, numerically, and analytically
      ii) Derivative interpreted as an instantaneous rate of change
      iii) Derivative defined as the limit of the difference quotient
      iv) Relationship between differentiability and continuity
   b) Derivative at a point
      i) Slope of a curve at a point
      ii) Tangent line to a curve at a point and local linear approximation
      iii) Instantaneous rate of change as the limit of average rate of change
      iv) Approximate rate of change from graphs and tables of values
   c) Derivative as a function
      i) Corresponding characteristics of graphs of f and f '
      ii) Relationship between the increasing and decreasing behavior of f and the sign of f '.
      iii) The Mean value Theorem and its geometric consequences
      iv) Equations involving derivatives
   d) Second derivatives
      i) Corresponding characteristics of the graphs of f, f ', and f "
      ii) Relationship between the concavity of f and the sign of f '
      iii) Points of inflection as places where concavity changes
   e) Application of derivatives
      i) Analysis of curves, including the notions of monotonicity and concavity
      ii) Optimization, both absolute (global) and relative (local) extrema
      iii) Modeling rates of change, including related rates problems
      iv) Use of implicit differentiation to find the derivative of an inverse function
      v) Interpretation of the derivative as a rate of change in varied applied contexts, including velocity, speed, and acceleration
   f) Computation of derivatives
      i) Knowledge of derivatives of basic functions, including power, exponential, logarithmic, trigonometric, and inverse trigonometric functions
      ii) Basic rules for the derivative of sums, products, and quotients of functions
      iii) Chain rule and implicit differentiation
3) Integrals
   a) Interpretations and properties of definite integrals
      i) Computation of Riemann sums using left, right, and midpoint evaluation points

ii) Definite integral as a limit of the Riemann sums over equal subdivisions
iii) Definite integral of the rate of change of a quantity over an interval interpreted as the change of the quantity over the interval:

$$\int_a^b f'(x)dx = f(b) - f(a)$$

iv) Basic properties of definite integrals

b) Application of Integrals
c) Fundamental Theorem of Calculus
   i) Used to evaluate definite integrals
   ii) Used to represent a particular antiderivative, and the analytical and graphical analysis of functions so defined
d) Techniques of antidifferentiation
   i) Antiderivatives following directly from derivatives of basic functions
   ii) Antiderivatives by substitution of variables
e) Applications of antidifferentiation
   i) Finding specific antiderivatives using initial conditions, including applications to motion along a line
   ii) Solving separable differential equations and using them in modeling. In particular, studying the equations of y' = ky and exponential growth
f) Numerical approximations to definite integrals

THIS COURSE WILL PREPARE STUDENTS FOR THE HSEE AND/OR FCUSD EXIT EXAMS IN:

Math

LAB FEE, IF REQUIRED: None

SUBJECT AREA CONTENT STANDARDS TO BE ADDRESSED:

See "Detailed Units of Instruction"

DISTRICT ESLRs TO BE ADDRESSED:

When students exit a secondary mathematics course, they will be:

- **Self-directed Learners** who will be able to use notes and a textbook to assist them in continuing their learning outside of the classroom setting.
- **Efficient Communicators** who can explain mathematical concepts to others and use mathematics to organize and explain data.
- **Quality Producers** who understand the importance of neat, organized work that demonstrates their thinking and understanding of the solution they've formed to solve a problem.
- **Constructive Thinkers** who are able to attack problems with organization, logic, and mathematical skills they've developed in a systematic fashion.
- **Collaborative Workers** who can work in a variety of settings in culturally diverse groups. They will be able to form and use study groups to strengthen their own understanding in addition to providing the same service for classmates.
- **Responsible Citizens** who accept the consequences of their actions and who demonstrate their understanding of their role in the learning process.