CHINO VALLEY UNIFIED SCHOOL DISTRICT
INSTRUCTIONAL GUIDE
ADVANCED PLACEMENT CALCULUS AB

Course Number	5124
Department	Mathematics
Prerequisites	Successful completion of Integrated Math 3 Honors (Honors Pre-Calculus) or Trigonometry and teacher recommendation
Length of Course	Two (2) semesters/One (1) year
Grade Level	10-12
Credit	5 units per semester/10 total credits - math
UC/CSU	Meets “c” math requirement
Board Approved	November 6, 2008

Description of Course - Calculus AB will cover topics in differential and integral calculus. This course in mathematics consists of a full and intensive academic year of work in the calculus of functions of a single variable. The courses emphasize a multi-representational approach to calculus, with concepts, results, and problems being expressed graphically, numerically, analytically, and verbally. The connections among these representations also are important. Technology should be used regularly by students and teachers to reinforce the relationships among the multiple representations of functions, to confirm written work, to implement experimentation, and to assist in interpreting results. Through the use of the unifying themes of derivatives, integrals, limits, approximation, and applications and modeling, the course becomes a cohesive whole rather than a collection of unrelated topics. These themes are developed using all the functions listed in the prerequisites.

Rationale for Course - When taught in high school, calculus should be presented with the same level of depth and rigor as entry level college and university calculus courses. It is expected that students who take this course in calculus will seek college credit or placement, or both, from institutions of higher learning.

Student Selection - Admission to an AP course should depend on the student interest in the subject as well as on such formal credentials as an outstanding record of academic performance. Many highly motivated students with less-than-outstanding records have successfully completed AP courses and have obtained college credit, advanced placement, or both, through an AP Examination.

Standard 1 - Students understand functions, graphs, and limits.

1.1 Objective: Analyze graphs. With the aid of technology, graphs of functions are often easy to produce. The emphasis is on the interplay between the geometric and analytic information and on the use of calculus both to predict and to explain the observed local and global behavior of a function.

1.2 Objective: Students understand limits of functions (including one-sided limits).

1.2.1 Performance Indicator: Students will have an intuitive understanding of the limiting process.

1.2.2 Performance Indicator: Students can calculate limits using algebra.

1.2.3 Performance Indicator: Students can estimate limits from graphs or tables of data.

1.3 Objective: Understand asymptotic and unbounded behavior.

1.3.1 Performance Indicator: Students understand asymptotes in terms of graphical behavior.

1.3.2 Performance Indicator: Students can describe asymptotic behavior in terms of limits involving infinity.

1.3.3 Performance Indicator: Students can compare relative magnitudes of functions and their rates of change (for example, contrasting exponential growth, polynomial growth, and logarithmic growth).

1.4 Objective: Understand continuity as a property of functions.

1.4.1 Performance Indicator: Students have an intuitive understanding of continuity. (The function values can be made as close as desired by taking sufficiently close values of the domain.)

1.4.2 Performance Indicator: Students understand continuity in terms of limits.

1.4.3 Performance Indicator: Students have a geometric understanding of graphs of continuous functions (Intermediate Value Theorem and Extreme Value Theorem).

Standard 2 - Students understand derivatives.

2.1 Objective: Understand the concept of the derivative.

2.1.1 Performance Indicator: Students will be able to demonstrate an understanding of derivative presented graphically, numerically, and analytically.

2.1.2 Performance Indicator: Students will be able to demonstrate an understanding of derivatives interpreted as an instantaneous rate of change.

2.1.3 Performance Indicator: Students will be able to demonstrate an understanding of derivatives defined as the limit of the difference quotient.

2.1.4 Performance Indicator: Students will be able to demonstrate an understanding of the relationship between differentiability and continuity.

2.2 Objective: Understand the derivative at a point.

2.2.1 Performance Indicator: Students will be able to demonstrate an understanding of slope of a curve at a point.

2.2.2 Performance Indicator: Students will be able to demonstrate an understanding of the tangent line to a curve at a point and local linear approximation.

2.2.3 Performance Indicator: Students will be able to demonstrate an understanding of the instantaneous rate of change as the limit of average rate of change.

2.2.4 Performance Indicator: Students will be able to demonstrate an understanding of the approximate rate of change from graphs and tables of values.

2.3 Objective: Students will be able to understand the derivative as a function.

2.3.1 Performance Indicator: Students will be able to demonstrate an understanding of the corresponding characteristics of graphs of f and f'.

2.3.2 Performance Indicator: Students will be able to demonstrate an understanding of the relationship between the increasing and decreasing behavior of f and the sign of f'.

2.3.3 Performance Indicator: Students will be able to demonstrate an understanding of The Mean Value Theorem and its geometric interpretation.

2.3.4 Performance Indicator: Students will be able to demonstrate an understanding of equations involving derivatives.

2.4 Objective: Understand second derivatives.

2.4.1 Performance Indicator: Students will be able to demonstrate an understanding of the corresponding characteristics of the graphs of f, f', and f''.

2.4.2 Performance Indicator: Students will be able to demonstrate an understanding of the relationship between the concavity of f and the sign of f''.

2.4.3 Performance Indicator: Students will be able to demonstrate an understanding of the points of inflection as places where concavity changes.

2.5 Objective: Understand the applications of derivatives.

2.5.1 Performance Indicator: Students will be able to demonstrate an understanding of the analysis of curves, including the notions of monotonicity and concavity.

2.5.2 Performance Indicator: Students will be able to demonstrate an understanding of the optimization, both absolute (global) and relative (local) extrema.

2.5.3 Performance Indicator: Students will be able to demonstrate modeling rates of change, including related rates problems.

2.5.4 Performance Indicator: Students will be able to use implicit differentiation to find the derivative of an inverse function.

2.5.5 Performance Indicator: Students will be able to demonstrate an understanding of the interpretation of the derivative as a rate of change in varied applied contexts, including velocity, speed, and acceleration.

2.5.6 Performance Indicator: Students will be able to demonstrate an understanding of the geometric interpretation of differential equations via slope fields and the relationship between slope fields and solution curves for differential equations.

2.6 Objective: Understand the computation of derivatives.

2.6.1 Performance Indicator: Students will be able to demonstrate the knowledge of derivatives of basic functions, including power, exponential, logarithmic, trigonometric, and inverse trigonometric functions.

2.6.2 Performance Indicator: Students will be able to demonstrate an understanding of the derivative rules for sums, products, and quotients of functions.

2.6.3 Performance Indicator: Students will be able to demonstrate an understanding of the chain rule and implicit differentiation.

Standard 3 - Students understand integrals.

3.1 Objective: Understand the interpretations and properties of definite integrals.

3.1.1 Performance Indicator: Students will be able to demonstrate an understanding of the definite integral as a limit of Riemann sums.

3.1.2 Performance Indicator: Students will be able to demonstrate an understanding of the definite integral of the rate of change of a quantity over an interval.

3.1.3 Performance Indicator: Students will be able to demonstrate an understanding of the basic properties of definite integrals (examples include additivity and linearity).

3.2 Objective: Understand the applications of integrals.

3.2.1 Performance Indicator: Students can find the area of a region.

3.2.2 Performance Indicator: Students can find volumes of solids generated by revolving the graph of a function about the x or y axis or a given line.

3.2.3 Performance Indicator: Students understand and can compute the average value of a function.

3.2.4 Performance Indicator: Students understand how to compute the distance traveled by a particle along a line.

3.2.5 Performance Indicator: Students understand how to use integration as an accumulation function in a variety of applications.

3.3 Objective: Understand the Fundamental Theorem of Calculus.

3.3.1 Performance Indicator: Students will be able to demonstrate an understanding of the use of the Fundamental Theorem to evaluate definite integrals.

3.3.2 Performance Indicator: Students will be able to demonstrate an understanding of the Fundamental Theorem to represent a particular anti-derivative, and the analytical and graphical analysis of functions so defined techniques of anti-differentiation.

3.3.3 Performance Indicator: Students will be able to demonstrate an understanding of anti-derivatives following directly from derivatives of basic functions.

3.3.4 Performance Indicator: Students will be able to demonstrate an understanding of anti-derivatives by substitution of variables (including change of limits for definite integrals).

3.4 Objective: Understand the applications of anti-differentiation.

3.4.1 Performance Indicator: Students will be able to find specific anti-derivatives using initial conditions, including applications to motion along a line.

3.4.2 Performance Indicator: Students will be able to solve separable differential equations and use them in modeling, and numerical approximations to definite integrals

3.5 Objective: Students understand how to use Reimann sums

3.5.1 Performance Indicator: Students know how to use Riemann sums (using left, right, and midpoint evaluation points) and trapezoidal sums to approximate definite integrals of functions represented algebraically, graphically, and by tables of values.