Warren County School District

PLANNED INSTRUCTION

COURSE DESCRIPTION

Course Title: **Advanced Placement Calculus**

Course Number: **00292**

Course Description and Prerequisites: **Advanced Placement Calculus** is designed for the student who is interested in a course which furthers his/her fundamental knowledge of calculus. It is designed to introduce and develop fundamental functional behavior of the following topics: differentiation, integration, infinite series, three-dimensional space, vectors, conic sections, polar coordinates, and parametric equations. Completion of Functions Honors with an average of 85% or Functions with a 93% average is recommended.

Suggested Grade Level: 12

Length of Course: __ __One Semester __X___Two Semesters _____Other (Describe)_____

Units of Credit: **1** (Insert ***NONE*** if appropriate.)

PDE *Certification and Staffing Policies and Guidelines (CSPG)* Required Teacher Certification(s) ___Mathematics 50_____

Certification verified by WCSD Human Resources Department:
__X__Yes ____No

Board Approved Textbooks, Software, Materials:
Title: **Calculus w/Analytic Geometry 8th ed.**
Publisher: McDougal Little
ISBN #: 0 618 794344
Copyright Date: 2006
Date of WCSD Board Approval: November 13, 2006

BOARD APPROVAL:

Date Written: 2006-2007

Date Approved: May 14, 2007

Implementation Year: 2007-2008

Suggested Supplemental Materials: TI 89 or equivalent calculator

Course Standards

PA Academic Standards:

2.1.11 Numbers, Number Systems and Number Relations
2.2.11 Computation and Estimation
2.5.11 Mathematical Problem Solving and Communication
2.8.11 Algebra and Functions
2.9.11 Geometry
2.10.11 Trigonometry
2.11.11 Concepts of Calculus

1.2.11 Reading Critically in All Content Areas

WCSD Academic Standards: None

Industry or Other Standards: Must use College Board approved syllabus.

WCSD EXPECTATIONS

WCSD K-12 Expectations for instruction in writing, reading, mathematics and, technology have been developed and revised annually. The teacher will integrate all WCSD Expectations into this planned instruction

SPECIAL EDUCATION AND GIFTED REQUIREMENTS

The teacher shall make appropriate modifications to instruction and assessment based on a student's Individual Education Plan (I.E.P.) or Gifted Individual Education Plan (G.I.E.P.).

SPECIFIC EDUCATIONAL OBJECTIVES/CORRESPONDING STANDARDS AND ELIGIBLE CONTENT WHERE APPLICABLE

(List Objectives, PA Standards #'s, Other Standards (see samples at end))

Specific Educational Objectives to be Taught:

I. Functions, Graphs, and Limits

A. Analysis of graphs

- With the aid of technology, graphs of functions are often easy to produce.
- To predict and to explain the observed local and global behavior of a function.

B. Limits of functions (including one-sided limits)

- An intuitive understanding of the limiting process.
- Calculating limits using algebra.
- Estimating limits from graphs or tables of data.

C. Asymptotic and unbounded behavior

- Understanding asymptotes in terms of graphical behavior.
- Describing asymptotic behavior in terms of limits involving infinity.
- Comparing relative magnitudes of functions and their rates of change. (For example, contrasting exponential growth, polynomial growth, and logarithmic growth.)

D. Continuity as a property of functions

- An intuitive understanding of continuity. (Close values of the domain lead to close values of the range.)
- Understanding continuity in terms of limits.
- Geometric understanding of graphs of continuous functions. (Intermediate Value Theorem and Extreme Value Theorem)

II. Derivatives

A. Concept of the derivative

- Derivative presented geometrically, numerically, and analytically.
- Derivative interpreted as an instantaneous rate of change.
- Derivative defined as the limit of the difference quotient.
- Relationship between differentiability and continuity.

B. Derivative at a point

- Slope of a curve at a point. Examples are emphasized, including points at which there are vertical tangents and points at which there are no tangents.
- Tangent line to a curve at a point and local linear approximation.
- Instantaneous rate of change as the limit of average rate of change.
- Approximate rate of change from graphs and tables of values.

C. Derivative as a function

- Corresponding characteristics of graphs of f and f'.
- Relationship between the increasing and decreasing behavior of f and the sign of f'.
- The Mean Value Theorem and its geometric consequences.
- Equations involving derivatives. Verbal descriptions are translated into equations involving derivatives and vice versa.

D. Second derivatives

- Corresponding characteristics of the graphs of f, f', and f''.
- Relationship between the concavity of f and the sign of f''.
- Points of inflection as places where concavity changes.

E. Applications of derivatives

- Analysis of curves, including the notions of monotonicity and concavity.
- Optimization, both absolute (global) and relative (local) extrema.

- Modeling rates of change, including related rates problems.
- Use of implicit differentiation to find the derivative of an inverse function.
- Interpretation of the derivative as a rate of change in varied applied contexts, including velocity, speed, and acceleration.

F. Computation of derivatives

- Knowledge of derivatives of basic functions, including power, exponential, logarithmic, trigonometric, and inverse trigonometric functions.
- Basic rules for the derivative of sums, product, and quotients of functions;
- Chain rule and implicit differentiation.

III. Integrals

A. Interpretations and properties of definite integrals

- Computation of Riemann sums using left, right, and midpoint evaluation pints.
- Definite integral as a limit of Riemann sums over equal subdivisions.
- Definite integral of the rate of change of a quantity over an interval interpreted as the change of the quantity over the interval:

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

- Basic properties of definite integrals. (Examples include additivity and linearity.)

B. Applications of integrals

- Appropriate integrals are used in a variety of applications to model physical, social, or economic situations.
- Students should be able to adapt their knowledge and techniques to solve other similar application problems.
- Using the integral of a rate of change to give accumulated change or using the method of setting up an approximating Riemann sum and representing its limit as a definite integral.
- Finding the area of a region, the volume of a solid with known cross sections, the average value of a function, distance traveled by a particle along a line.

C. Fundamental Theorem of Calculus

- Use of the Fundamental Theorem to evaluate definite integrals.
- Use of the Fundamental Theorem to represent a particular antiderivative, and the analytical and graphical analysis of functions so defined.

D. Techniques of antidifferentiation (optional topic)

- Antiderivatives following directly from derivatives of basic functions.
- Antiderivatives by substitution of variables (including change of limits for definite integrals).

E. Applications of antidifferentiation (optional topic)

- Finding specific antiderivatives using initial conditions, including applications to motion along a line.
- Solving separable differential equations and using them in modeling. In particular, studying the equation $y'=ky$ and exponential growth.

F. Numerical approximations to definite integrals (optional topic)

- Use of Riemann and trapezoidal sums to approximate definite integrals of functions represented algebraically, geometrically, and by tables of values.

ASSESSMENTS

PSSA Assessment Anchors Addressed: The teacher must be knowledgeable of the PDE Assessment Anchors and/or Eligible Content and incorporate them into this planned instruction. Current assessment anchors can be found at pde@state.pa.us.

Formative Assessments: The teacher will develop and use standards-based assessments throughout the course.

Portfolio Assessment: ____ Yes __X__ No

District-wide Final Examination Required: __X__ Yes ____ No

Course Challenge Assessment: Course challenge assessment will be based on activities and exams that measure student proficiency as the course standards at 84%.

REQUIRED COURSE SEQUENCE AND TIMELINE

(Content must be tied to objectives)

Days	Content Sequence
15 days	Limits of Functions
15 days	Asymptotic and Unbounded Behavior
15 days	Continuity as a Property of Functions
10 days	Concept of the Derivative
10 days	Derivative at a Point
10 days	Derivative as a Function
10 days	Second Derivatives
20 days	Applications of Derivatives
10 days	Computation of Derivatives
20 days	Interpretations and Properties of Definite Integrals
20 days	Applications of Integrals
10 days	Fundamental Theorem of Calculus
	Techniques of Anti-differentiation (optional topic)
	Applications of Anti-differentiation (optional topic)
_____	Numerical Approximations to Definite Integrals (optional topic)
180 days	

WRITING TEAM: Math Teachers

WCSD STUDENT DATA SYSTEM INFORMATION

1. Is there a required final examination? __X__ Yes ____ No
2. Does this course issue a mark/grade for the report card?
   __X__ Yes____ No
3. Does this course issue a Pass/Fail mark? ____ Yes __X__ No
4. Is the course mark/grade part of the GPA calculation?
   __X__ Yes ____ No
5. Is the course eligible for Honor Roll calculation? __X__ Yes ____ No

6. What is the academic weight of the course?

____ No weight/Non credit __ __ Standard weight

__X__ Enhanced weight (Describe) Policy 9745___