MT. DIABLO UNIFIED SCHOOL DISTRICT
COURSE OF STUDY
DRAFT

COURSE TITLE:	**Calculus AB (AP)**
COURSE NUMBER:	**1375**
CALPADS NUMBER:	**2480**
CST:	**Summative Math**
DEPARTMENT:	**Mathematics**
NCLB CREDENTIAL REQUIREMENT:	**Math Credential with Subject Matter Proficiency**
LENGTH OF COURSE:	**One year**
CREDITS PER SEMESTER:	**5**
GRADE LEVEL(S):	**12**
REQUIRED OR ELECTIVE:	**This course fulfills one year of the high school mathematics requirement and UC/CSU "c" requirement.**
PREREQUISITES:	**B or better in Pre-Calculus Honors**

BOARD OF EDUCATION ADOPTION:

COURSE DESCRIPTION:

This course consists of the study of functions, limits, continuity, differentiation, integration, and applications of the principles of differential and integral calculus. The course will prepare students for the Advanced Placement Exam in Calculus AB. It is recommended that a student has received a grade of C or higher in Pre-Calculus and obtained a teacher recommendation for Calculus.

COURSE OUTLINE:

1. MAJOR GOALS

1.1 To understand the meaning of the derivative in terms of rate of change and local linear approximations.

1.2 To be able to work with functions represented graphically, numerically, analytically, or verbally and should understand the connection among these representations.

1.3 To understand the meaning of definite integral both as a limit of Reimann sums and as a net accumulation of a rate of change, and understand the relationship between a derivative and an integral.

1.4 To be able to model problem situations with functions, differential equations or integrals and communicate both orally and in written form.

1.5 To be able to represent differential equations with slope fields, solve separable differential equations analytically and solve differential equations using numerical techniques such as Euler's method.

2. PERFORMANCE OBJECTIVES:

2.1 Understand basic pre-calculus concepts

2.1.1 Able to use increments to calculate slopes
2.1.2 Able to write an equation and sketch a graph given specific information
2.1.3 Identify relationships between parallel, perpendicular lines and their slopes
2.1.4 Identify domain and range a function using graphs or equations
2.1.5 Identify even and odd functions
2.1.6 Interpret and find formulas for piecewise functions
2.1.7 Understand the composition of two functions
2.1.8 Understand exponential equations
2.1.9 Solve problems with growth and decay
2.1.10 Graph curves described by parametric equations
2.1.11 Identify a 1-1 equation
2.1.12 Graph and describe algebraically a function and its inverse
2.1.13 Apply the properties of logarithms
2.1.14 Find the values of trigonometric functions
2.1.15 Able to graph trigonometric functions and their inverses

2.2 Understand Limits and Continuity
2.2.1 Calculate average and instantaneous speeds
2.2.2 Define, calculate and apply the property of limits
2.2.3 Understand the concept of continuity
2.2.4 Remove discontinuities by extending or modifying functions
2.2.5 Able to apply the Intermediate Value Theorem

2.3 Understand the Concepts of Derivatives
2.3.1 Calculate slopes and derivatives using the definition of derivatives
2.3.2 Graph a function from the graph of a derivative
2.3.3 Approximate derivatives numerically and graphically
2.3.4 Determine where a function is not differentiable
2.3.5 Calculate the instantaneous rate of change using derivatives
2.3.6 Use the derivative to analyze rates of change
2.3.7 Use the rules for differentiating the six basic trig functions
2.3.8 Differentiate composite functions using the Chain Rule
2.3.9 Find derivatives using implicit differentiation
2.3.10 Calculate derivatives of function using inverse trigonometric functions
2.3.11 Calculate derivatives of exponential and logarithmic functions

2.4 Understand the Applications of Derivatives
2.4.1 Able to understand the local or global extreme values of a function
2.4.2 Able to apply the Mean Value Theorem
2.4.3 Use derivative tests to determine extreme values
2.4.4 Determine the concavity of a curve using the second derivative
2.4.5 Graph a function given information about its second derivative
2.4.6 Solve optimization problems
2.4.7 Find linearization and use Newton's method to find zeros of a function
2.4.8 Solve related rate problems

2.5 Understand Integration
2.5.1 Approximate the area under a graph using rectangle approximation
2.5.2 Express the area under a curve using a limit of Reimann sums

2.5.3 Find the average value of a function over a closed interval
2.5.4 Apply the Fundamental Theorem of Calculus
2.5.5 Approximate the definite integral using the Trapezoidal Rule

2.6 Understand Differential Equations
2.6.1 Construct antiderivatives using the Fundamental Theorem of Calculus
2.6.2 Solve initial value problems
2.6.3 Construct slope fields
2.6.4 Use Euler's Method for graphing a solution to an initial value problem
2.6.5 Compute integrals using substitution
2.6.6 Compute integrals using integration by parts
2.6.7 Solve exponential growth and decay problems

2.7 Understand Applications of Definite Integrals
2.7.1 Find net change using integration
2.7.2 Calculate areas in a plane using integration
2.7.3 Calculate volumes of solids using integration
2.7.4 Calculate surface areas using integration
2.7.5 Calculate lengths of curves using integration
2.7.6 Model science applications using integration

3. CONTENT OUTLINE:

3.1 Pre-Calculus Concepts
3.1.1 Slope as rate of change
3.1.2 Parallel and perpendicular lines

3.2 Equations of lines
3.2.1 Functions and Graphs
3.2.2 Functions
3.2.3 Domain and range
3.2.4 Families of function
3.2.5 Piecewise functions
3.2.6 Composition of functions
3.2.7 Absolute value functions
3.2.8 Even and odd functions

3.3 Exponential Functions
3.3.1 Exponential growth and decay
3.3.2 Inverse functions

3.4 Parametric Equations
3.4.1 Relations
3.4.2 Circles and ellipses
3.4.3 Lines and other curves

3.5 Functions and Logarithms
3.5.1 One-to-one functions
3.5.2 Logarithmic functions
3.5.3 Properties of logarithms

3.6 Trigonometric Functions
- 3.6.1 Graphs of basic trigonometric functions
- 3.6.2 Applications

3.7 Limits and Continuity
- 3.7.1 Rates of Change and Limits
- 3.7.2 Average and instantaneous speed
- 3.7.3 Definition of limit
- 3.7.4 One-sided and two-sided limits
- 3.7.5 Sandwich theorem
- 3.7.6 Limits Involving Infinity
- 3.7.7 Asymptotic behavior
- 3.7.8 End behavior
- 3.7.9 Properties of limits
- 3.7.10 Visualizing limits
- 3.7.11 Continuity
- 3.7.12 Continuity at a point
- 3.7.13 Continuous functions
- 3.7.14 Discontinuous functions

3.8 Derivatives
- 3.8.1 Rates of change and Tangent Lines
- 3.8.2 Average rate of change
- 3.8.3 Tangent to a curve
- 3.8.4 Slope of a curve
- 3.8.5 Derivative of a Function
- 3.8.6 Definition of derivative
- 3.8.7 Graphing the derivative from data
- 3.8.8 One-sided derivatives
- 3.8.9 Differentiability
- 3.8.10 Local linearity
- 3.8.11 Numeric derivatives using the calculator
- 3.8.12 Differentiability and continuity
- 3.8.13 Rules for Differentiation
- 3.8.14 Positive integer powers, multiples, sums and differences
- 3.8.15 Products and quotients
- 3.8.16 Negative integer powers of x
- 3.8.17 Second and higher order derivatives
- 3.8.18 Velocity and Other Rates of Change
  - 3.8.18.1 Instantaneous rates of change
  - 3.8.18.2 Motion along a line
- 3.8.19 Derivatives of Trigonometric Functions
- 3.8.20 Chain Rule
- 3.8.21 Derivative of a composite function
- 3.8.22 Power chain rule
- 3.8.23 Implicit Differentiation
  - 3.8.23.1 Differential method
  - 3.8.23.2 y' Method

3.8.24 Derivatives of Inverse Trigonometric Functions
3.8.25 Derivatives of Exponential and Logarithmic Functions

3.9 Applications of Derivatives
3.9.1 Extreme Values of Functions
3.9.2 Mean Value Theorem
3.9.3 Connecting f' and f'' with the graph of f.
3.9.4 First derivative test for local extrema
3.9.5 Concavity
3.9.6 Points of inflection
3.9.7 Second derivative test for local extrema
3.9.8 Modeling and Optimization
3.9.9 Linearization and Newton's Method

3.10 The Definite Integral
3.10.1 Estimating with Finite Sums
3.10.2 Distance traveled
3.10.3 Rectangular approximation method (RAM)

3.11 Definite Integrals and Antiderivatives
3.11.1 The Average Value Theorem
3.11.2 Mean Value Theorem for definite integrals

3.12 Fundamental Theorem of Calculus
3.12.1 Fundamental Theorem parts 1 and 2
3.12.2 Graphing

3.13 Trapezoidal Rule

3.14 Integration by Substitution

3.15 Integration by Parts

3.16 Exponential Growth and Decay

3.17 Euler's Methods

3.18 Areas in the Plane

3.19 Volumes
3.19.1 Volumes of solids with known cross-sections
3.19.2 Volumes of solids of revolution

3.20 Lengths of Curves

4. TIME ESTIMATES:
Instructional sequences vary in length from a few days to several weeks. All material will be covered by scheduled AP Exam date. A course project will be given after the AP Exam.

5. INSTRUCTIONAL MATERIALS:

5.1 District adopted textbooks
5.2 Technology materials
5.3 Supplemental materials from book and teacher materials

6. EVALUATION OF STUDENT PROGRESS:

6.1 Pre and post tests to determine mastery
6.2 Teacher observation
6.3 Written Assignments
6.4 Student Projects

Committee Members:

Frank Bruketta	CVHS
Danielle Dell	CVHS
Susan Seeley	CVHS
Bodhi Young	CVHS
Suzette Blanke	CPHS
Robert Lovelace	CPHS
Angel Niedzielski	CPHS
Norma Meyerkorth	CHS
Brianne Whiteside	CHS
Kathleen Magana	MDHS
Steve Sankey	MDHS
Judith Cubillo	NHS
Ellen Dill	NHS
Rianne Pfaltzgraff	NHS
Leslie Addiego	YVHS
Mary Ditkoff	YVHS
Kelly Donlon	YVHS
John Ghiozzi	YVHS
Sharon Simone	RMS
Sandy Bruketta	Curriculum Specialist (Curriculum & Instruction)