MT. DIABLO UNIFIED SCHOOL DISTRICT
COURSE OF STUDY
DRAFT

COURSE TITLE:	**Pre-Calculus Honors**
COURSE NUMBER:	**1405**
CALPADS NUMBER:	**2414**
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):	**10-12**
REQUIRED OR ELECTIVE:	**This course fulfills one year of the high school mathematics requirement and UC/CSU "c" requirement.**
PREREQUISITES:	**B or better in Algebra II/Trigonometry, Advanced Math Topics and/or Teacher recommendation.**

BOARD OF EDUCATION ADOPTION:

COURSE DESCRIPTION:

Pre-Calculus Honors is considered to be the third or fourth year of a very strong high mathematics program, but is also taught at the college level where it is the second college level course in mathematics after trigonometry. Pre-Calculus Honors refines the Trigonometric, Geometric and Algebraic techniques needed in the study of Calculus. New skills will be introduced and many old skills will be pushed to new heights with a conceptual understanding beyond the reach of most high school students.

COURSE OUTLINE:

1. MAJOR GOALS

1.1 To acquire greater depth and understanding of functions

1.2 Apply various functions and mathematical processes to real world problems and careers.

1.3 To acquire foundational knowledge and skills for calculus and statistics.

1.4 Utilize technology to enhance understanding, encourage exploration, and enable students to solve more complex problems

2. PERFORMANCE OBJECTIVES:

2.1 Mathematical Analysis Standards

2.1.1 Students are familiar with, and can apply, polar coordinates and vectors in the plane. In particular, they can translate between polar and rectangular coordinates and can interpret polar coordinates and vectors graphically.

2.1.2 Students are adept at the arithmetic of complex numbers. They can use the trigonometric form of complex numbers and understand that a function of a complex variable can be viewed as a function of two real variables. They know the proof of DeMoivre's theorem.

2.1.3 Students can give proofs of various formulas by using the technique of mathematical induction.

2.1.4 Students know the statement of, and can apply, the fundamental theorem of algebra.

2.1.5 Students are familiar with conic sections, both analytically and geometrically:

> 2.1.5.1 Students can take a quadratic equation in two variables; put it in standard form by completing the square and using rotations and translations, if necessary; determine what type of conic section the equation represents; and determine its geometric components (foci, asymptotes, and so forth).
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> 2.1.5.2 Students can take a geometric description of a conic section - for example, the locus of points whose sum of its distances from (1, 0) and (-1, 0) is 6 - and derive a quadratic equation representing it.

2.1.6 Students find the roots and poles of a rational function and can graph the function and locate its asymptotes.

2.1.7 Students demonstrate an understanding of functions and equations defined parametrically and can graph them.

2.1.8 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

2.2 Trigonometry Standards

2.2.1 Students understand the notion of angle and how to measure it, in both degrees and radians. They can convert between degrees and radians.

2.2.2 Students know the definition of sine and cosine as *y*-and *x*-coordinates of points on the unit circle and are familiar with the graphs of the sine and cosine functions.

2.2.3 Students know the identity $\cos^2(x) + \sin^2(x) = 1$:

> 2.2.3.1 Students prove that this identity is equivalent to the Pythagorean theorem (i.e., students can prove this identity by using the Pythagorean theorem and, conversely, they can prove the Pythagorean theorem as a consequence of this identity).
>
> 2.2.3.2 Students prove other trigonometric identities and simplify others by using the identity $\cos^2(x) + \sin^2(x) = 1$. For example, students use this identity to prove that $\sec^2(x) = \tan^2(x) + 1$.

2.2.4 Students graph functions of the form $f(t) = A \sin (Bt + C)$ or $f(t) = A \cos (Bt + C)$ and interpret A, B, and C in terms of amplitude, frequency, period, and phase shift.

2.2.5 Students know the definitions of the tangent and cotangent functions and can graph them.

2.2.6 Students know the definitions of the secant and cosecant functions and can graph them.

2.2.7 Students know that the tangent of the angle that a line makes with the x-axis is equal to the slope of the line.

2.2.8 Students know the definitions of the inverse trigonometric functions and can graph the functions.

2.2.9 Students compute, by hand, the values of the trigonometric functions and the inverse trigonometric functions at various standard points.

2.2.10 Students demonstrate an understanding of the addition formulas for sines and cosines and their proofs and can use those formulas to prove and/or simplify other trigonometric identities.

2.2.11 Students demonstrate an understanding of half-angle and double-angle formulas for sines and cosines and can use those formulas to prove and/or simplify other trigonometric identities.

2.2.12 Students use trigonometry to determine unknown sides or angles in right triangles.

2.2.13 Students know the law of sines and the law of cosines and apply those laws to solve problems.

2.2.14 Students determine the area of a triangle, given one angle and the two adjacent sides.

2.2.15 Students are familiar with polar coordinates. In particular, they can determine polar coordinates of a point given in rectangular coordinates and vice versa.

2.2.16 Students represent equations given in rectangular coordinates in terms of polar coordinates.

2.2.17 Students are familiar with complex numbers. They can represent a complex number in polar form and know how to multiply complex numbers in their polar form.

2.2.18 Students know DeMoivre's theorem and can give nth roots of a complex number given in polar form.

2.2.19 Students are adept at using trigonometry in a variety of applications and word problems.

2.3 Linear Algebra Standards

2.3.1 Students demonstrate an understanding that linear systems are inconsistent (have no solutions), have exactly one solution, or have infinitely many solutions. (6.0)

2.3.2 Students demonstrate an understanding of the geometric interpretation of vectors and vector addition (by means of parallelograms) in the plane and in three-dimensional space. (7.0)

2.3.3 Students compute the determinants of 2 x 2 and 3 x 3 matrices and are familiar with their geometric interpretations as the area and volume of the parallelepipeds spanned by the images under the matrices of the standard basis vectors in two-dimensional and three-dimensional spaces. (10.0)

2.3.4 Students compute the scalar (dot) product of two vectors in *n*- dimensional space and know that perpendicular vectors have zero dot product. (12.0)

3. CONTENT OUTLINE:

3.1 Functions

3.1.1 Evaluate domain and range of a function.

3.1.2 Perform the arithmetic of functions.

3.1.3 Evaluate the composition and inverse of functions.

3.1.4 Solve polynomial equations.

3.1.5 Apply the factor and the rational root theorem.

3.1.6 Determine existence of asymptotes (vertical of horizontal), symmetry and intercepts.

3.1.7 Use synthetic substitution to evaluate a function and the bounds for the value of a function.

3.1.8 Sketch the graph of polynomial functions. Find the relative maximum and minimum.

3.2 Exponential & Logarithmic Functions

3.2.1 Understand and graph exponential and logarithmic functions. Know the domain and range of each function.

3.2.2 Translate between exponential and logarithmic functions. Know the inverse relationship.

3.2.3 Apply the basic properties of logarithmic functions.

3.2.4 Apply the product, quotient and power properties.

3.2.5 Solve exponential and logarithmic equations. Using base 10 and base e logarithms.

3.2.6 Solve problems such as compound interest, growth and decay.

3.3 Trigonometric Functions

3.3.1 Express angular measure in radians or degrees (including decimal and DMS form).

3.3.2 Draw graphs of the six trigonometric functions and the three inverse functions without a calculator.

3.3.3 Draw graphs of the form $y = A \sin B(x - C) + D$ without a calculator.

3.3.4 Find all solutions to trigonometric equations.

3.3.5 Prove trigonometric identities.

3.3.6 Solve triangles, including both right triangles and scalene triangles, using Law of Sines and Law of Cosines.

3.3.7 Solve trigonometric applications problems, including navigation, surveying, and angular velocity.

3.4 Complex Numbers

3.4.1 Express complex numbers in either rectangular or polar form and convert from each form to the other.

3.4.2 Perform complex number arithmetic (add, subtract, multiply, divide, and find reciprocal).

3.4.3 Find powers and all roots of a complex number using DeMoivre's Theorem.

3.4.4 Plot a complex number on the plane and state the absolute value.

3.5 Series and Sequences

3.5.1 Apply mathematical induction to prove or disprove statements.

3.5.2 Recognize arithmetic and geometric series and to calculate their sums.

3.5.3 Expand a binomial.

3.5.4 Determine the limit or a sequence or the nonexistence of a limit.

3.6 Vectors

3.6.1 Find geometric and algebraic representation of vectors in two and three dimensions.

3.6.2 Add and subtract vectors. Find scalar product, dot products and cross products.

3.6.3 Find vector compositions, parallel and perpendicular vectors.

3.6.4 Solve vector and parametric equations.

3.6.5 Use applications to solve; motion in a plane, force, area and volume problems.

3.7 Analytical Geometry

3.7.1 Master proofs on the coordinate plane.

3.7.2 Know the equations of all conic sections.

3.7.3 Apply completing the square to determine standard form.

3.7.4 Solve systems of second degree equations.

4. TIME ESTIMATES:

4.1 Instructional sequences vary in length from a few days to several weeks

5. INSTRUCTIONAL MATERIALS:

5.1 District adopted textbooks
5.2 Supplementary and teacher-created materials that include a career focus
5.3 Technology use when appropriate

6. EVALUATION OF STUDENT PROGRESS:

Students communicates mathematically and demonstrates content knowledge in a variety of ways that lead to mathematical competence in their chosen careers.

6.1 Teacher observation
6.2 Written assignments
6.3 Quizzes and tests
6.4 Career based projects and portfolios
6.5 Rubrics

Committee Members:

Norma Meyerkorth	CHS
Brianne Whiteside	CHS
Suzette Blanke	CPHS
Robert Lovelace	CPHS
Angel Niedzielski	CPHS
Frank Bruketta	CVHS
Danielle Dell	CVHS
Susan Seeley	CVHS
Bodhi Young	CVHS

Kathleen Magana	MDHS
Steve Sankey	MDHS
Judith Cubillo	NHS
Ellen Dill	NHS
Rianne Pfaltzgraff	NHS
Sharon Simone	RMS
Leslie Addiego	YVHS
Mary Ditkof	YVHS
Kelly Donlon	YVHS
John Ghiozzi	YVHS
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