

FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

MATH ANALYSIS

Date: January 2009

Category: Mathematics

Proposed Grade Level(s): 9 - 12

Course Length: 1 Year

Grading: A – F

Number of Credits: 5 per semester

Prerequisites: “C” or better in Trigonometry

COURSE DESCRIPTION:

This course continues the study of the algebraic, geometric, and trigonometric skills learned in previous courses. It is designed to prepare students for the study of calculus with an in depth study of the following topics: linear, quadratic, rational, polynomial, exponential, logarithmic, and trigonometric functions and their graphs, polar graphs, vectors, complex numbers, conic sections, matrices, determinants, sequences and series, mathematical induction, and limits. At the end of this course, students will have completed all the state standards for Mathematical Analysis and Linear Algebra.

GENERAL GOALS/PURPOSES:

This discipline combines many of the trigonometric, geometric, and algebraic techniques needed to prepare students for the study of calculus. Emphasis will be given to concept development through the study of functions and their applications. The goal is continue to develop abstract thinking and mathematical reasoning in solving problems. The use of a graphing calculator will be an integral part of the course to further develop conceptual understanding.

STUDENT READING COMPONENT:

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

STUDENT WRITING/ORAL COMPONENT:

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

DETAILED UNITS OF INSTRUCTION:

1. Review topics in Algebra and Trigonometry
 - a. Fundamental concepts of algebra
 - b. Trigonometric functions and their graphs
 - c. Solving trigonometric equations
 - d. Trigonometric identities
 - e. Law of sines/cosines
 - f. Trigonometric form of complex numbers

2. Functions and their graphs
 - a. Graphs of equations
 - b. Linear equations in two-variables
 - c. Functions
 - d. Analyzing Graphs of functions
 - e. A library of functions
 - f. Transformations of functions
 - g. Combinations of Functions
 - h. Inverse Functions
 - i. Mathematical Modeling
3. Polynomial and Rational functions
 - a. Quadratic functions
 - b. Polynomial functions of higher degree
 - c. Polynomial and synthetic division
 - d. Complex numbers
 - e. Zeros of Polynomial functions
 - f. Rational functions
 - g. Partial fractions
4. Exponential and Logarithmic functions
 - a. Exponential functions and their graphs
 - b. Logarithmic functions and their graphs
 - c. Properties of Logarithms
 - d. Exponential and logarithmic equations
 - e. Exponential and logarithmic models/applications
5. Systems of Equations and Inequalities
 - a. Solving systems of equations
 - b. Two-variable linear systems
 - c. Multivariable linear systems
 - d. Systems of Inequalities
 - e. Linear Programming
6. Matrices and Determinants
 - a. Matrices and systems of equations
 - b. Operations with matrices
 - c. The inverse of a square matrix
 - d. The determinant of a square matrix
 - e. Applications of matrices and determinants
7. Sequences and Series
 - a. Arithmetic sequences and partial sums
 - b. Geometric sequences and series
 - c. Mathematical induction
 - d. Binomial Theorem
8. Topics in Analytic Geometry
 - a. Lines
 - b. Parabolas
 - c. Ellipses
 - d. Hyperbolas
 - e. Rotation of conics
 - f. Parametric Equations
 - g. Polar Coordinates
 - h. Graphs of Polar Equations
 - i. Polar Equations of Conics

9. Introduction to Limits
 - a. Limits to specific numbers
 - b. Limits to infinity
 - c. The slope problem
 - d. Applications – polynomial equations
 - e. Area problem (Intro to Riemann Sums)

Final Assessment:

Each high school will use departmental finals for each semester.

SUBJECT AREA CONTENT STANDARDS TO BE ADDRESSED:

Mathematical Analysis

- 1.0 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.
- 2.0 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.
- 3.0 Students can give proofs of various formulas by using the technique of mathematical induction.
- 4.0 Students know the statement of, and can apply, the fundamental theorem of algebra.
- 5.0 Students are familiar with conic sections, both analytically and geometrically:
 - 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).
 - 5.2 Students can take a geometric description of conic sections and derive a quadratic equation representing it.
- 6.0 Students find the roots and poles of rational function and can graph the function and locate its asymptotes.
- 7.0 Students demonstrate an understanding of functions and equations defined parametrically and can graph them.
- 8.0 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.

Linear Algebra

- 1.0 Students solve linear equations in any number of variables by using Gauss-Jordan elimination.
- 2.0 Students interpret linear systems as coefficient matrices and the Gauss-Jordan method as row operations on the coefficient matrix.
- 3.0 Students reduce rectangular matrices to row echelon form.
- 4.0 Students perform addition on matrices and vectors.
- 5.0 Students perform matrix multiplication and multiply vectors by matrices and by scalars.
- 6.0 Students demonstrate an understanding that linear systems are inconsistent, have exactly one solution, or have infinitely many solutions.
- 7.0 Students demonstrate an understanding of the geometric interpretation of vectors and vector addition in the plane and in three-dimensional space.
- 8.0 Students interpret geometrically the solution sets of systems of equations. For example, the solution set of a single linear equation in two variables is interpreted as a line in the plane, and the solution set of a two-by-two system is interpreted as the intersection of a pair of lines in the plane.
- 9.0 Students demonstrate an understanding of the notion of the inverse to a square matrix and apply that concept to solve systems of linear equations.

- 10.0 Students compute the determinants of 2x2 and 3x3 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.
- 11.0 Students know that a square matrix is invertible if, and only if, its determinant is nonzero. They can compute the inverse to 2x2 and 3x3 matrices using row reduction methods or Cramer's rule.
- 12.0 Students compute the scalar (dot) product of two vectors in n-dimensional space and know that perpendicular vectors have zero dot product.

THIS COURSE WILL PREPARE STUDENTS FOR THE CAHSEE AND/OR CSTs IN:

Math

LAB FEE, IF REQUIRED: None

DISTRICT ESLR'S TO BE ADDRESSED:

Students will be:

- **Self-Directed Learners** who write independently, gaining confidence in their abilities to think on their own and synthesize information from a variety of sources, realizing that independent learning is a lifelong tool for success in the classroom and beyond.
- **Effective Communicators** who are able to relate polished formal and extemporaneous presentations with appropriate public speaking techniques and strategies.
- **Quality Producers/Performers** who take pride in all assignments and realize the value of creating an error-free product that is original in substance.
- **Constructive Thinkers** who reflect on their reading and writing to enhance the outcomes of their work. Students engage in higher level thinking activities, evaluation and peer editing of essays, and synthesis of a number of resources into a final written product.
- **Collaborative Workers** who are capable of working in both large and small groups in order to produce well-organized, thoughtful products. Group work will be a reflection of the effort contributed by each member of the group.
- **Responsible Citizens** who are prepared to contribute to our democracy in positive ways. From their reading and writing, students gain an understanding of the responsibility, honor, and integrity that is essential to become a functioning member of our society.