TAMALPAIS UNION HIGH SCHOOL DISTRICT
Larkspur, California

Course of Study

INTERMEDIATE ALGEBRA 1-2

I. INTRODUCTION

Intermediate Algebra 1-2 is a mathematics course designed to act as a bridge for students who need to strengthen their algebra skills before taking Advanced Algebra 1-2. Intermediate Algebra also serves those students who need a third year of math to complete their graduation requirements. This course will present students with practical applications in preparation for topics in the Advanced Algebra curriculum.

This course provides opportunities for students to continue developing competence in the following district Student Learning Outcomes:

- Outcome #1: Communicate articulately, effectively, and persuasively when speaking and writing.
- Outcome #2: Read and analyze material in a variety of disciplines.
- Outcome #3: Use technology as a tool to access information, analyze and solve problems, and communicate ideas.
- Outcome #5: Apply mathematical knowledge and skills to analyze and solve problems.

II. STUDENT LEARNING OUTCOMES

A. General Goals and District Outcomes

The goals of all mathematics courses offered in the Tamalpais Union High School District reflect the four overarching curriculum standards of the *N.C.T.M. Standards for Curriculum and Evaluation*: communication, reasoning, problem solving, and making conjectures.

All district mathematics courses include the following goals for students:

- Become active learners by investigating, conjecturing, verifying, applying, evaluating, and communicating mathematical ideas both collaboratively and individually in solving problems.
- Develop awareness of one's own thinking.
- Explain and justify work and thinking both in or and written form.
- Use correct manipulative skills to solve simple algebraic problems.
- Develop consistent study habits and organizational skills and take personal responsibility for learning.

- Develop confidence, perseverance, and an appreciation of mathematics.
- Use appropriate technology including calculators and computers as an integral part of student work.

B. Course Outcomes

In support of the *N.C.T.M. Standards for Curriculum and Evaluation,* emphasis will be placed on solving and graphing equations and inequalities involving real world concepts, modeling, and problem solving. This will be facilitated by the acquisition and use of graphing calculator technology and supporting curricular materials. However, students will be expected to demonstrate mastery of basic course concepts without the use of graphing calculators.

The course is organized around five major strands: Functions, Quadratics, Matrices, Exponents/ Logarithms, and Rational Expressions.

Upon successful completion of Intermediate Algebra 1-2, student will, through modeling and solving problems, have learned the following topics:

1. Display and analysis of data. *(California Mathematics Standard (CMS) Grade 7, Statistics, Data Analysis & Probability: 1.1)*
    a. Collect, organize, represent and analyze data sets that have one or more variables.
    b. Make accurate displays of data, including scatterplots, histograms, stem-and-leaf plots, and box-an-whisker plots.
    c. Use displays to compare data sets and informally describe any apparent relationships between variables.
    d. Make predictions based on data.

2. Linear, quadratic, exponential, square root, and absolute value functions *(CMS Algebra 1: 6,7,16,17,18; Algebra 2: 9,10)*
    a. Determine whether or not relations defined by graphs, sets of ordered pairs, or symbolic expressions represent functions.
    b. Identify domain and range from graphs and tables.
    c. Use appropriate technology such as graphing calculators to reinforce the connection between algebraic functions and their graphs, to determine key features of such graphs, and to answer questions about situations modeled by those graphs.

3. Situations that exhibit constant rate of change *(CMS Algebra 1: 6, 7,8)*.
    a. Determine slope, rate of change, and intercepts for linear functions.
    b. Write an equation of a line given either two points, slope and point, or graph.
    d. Write an equation for a line parallel or perpendicular to another line through a given point.
    e. Solve and graph linear equations and inequalities.
    e. Write an equation for a visual line of best fit. Use graphing calculators to determine lines of best fit.

4. Systems of equations and systems of inequalities in two and three variables. *(CMS Algebra*

1: 9; Algebra 2: 2; Linear Algebra 6,9,11)

a. Write linear equations to represent given situations.

b. Solve systems of equations in a variety of ways: graphically, using substitution, matrices, and linear combination.

c. Use linear programming techniques. Develop constraints for given situations. Graph the feasible region with a developed set of constraints. Write an objective function and determine the optimal solution for that function.

5. Matrices. *(CMS Linear Algebra 4,5,9,11)*

a. Add, subtract, and multiply matrices. Multiply matrices by scalars.
b. Compute the determinant of a 2×2 matrix to determine whether the matrix is invertible.
c. Use systems of equations to compute the inverse of a 2×2 matrix .
d. Use matrices to solve systems of equations in three variables
e. Use matrices to solve application problems. For example, write and multiply price and quantity matrices to determine cost matrices.

6. Inverse relationships. *(CMA Algebra 1: 2; Algebra 2: 24,25)*

a. Determine when and how to perform inverse operations.
b. Determine if a given function is the inverse of another by studying tables and graphs.
c. Find the inverse of linear functions algebraically. Find the inverse of basic quadratic functions algebraically and graphically.
d. Solve problems involving composition of functions and arithmetic operations with functions.

7. Exponents and logarithms. *(CMS Algebra 1: 2; Algebra 2: 11,1, 12, 14)*

a. Simplify expressions involving exponents.
b. Use the principle of powers to solve equations involving radicals and exponents.
c. Write equations to fit exponential data and use them to solve problems.
d. Solve basic logarithm problems using the inverse relationship between logarithms and exponents.
e. Use the properties of logarithms to simplify logarithmic numeric expressions and identify their approximate values.
f. Use logarithms and exponents to solve problems about population growth, radioactive decay, and basic finance problems involving simple and compound interest.

8. Quadratic functions and inequalities. *(CMS Algebra 1: 14,19,20,21,22,23; Algebra 2: 8,9,10)*

a. Use a parabola's line of symmetry, roots and maximum/minimum value to graph and solve problems.
b. Solve quadratic equations having real number solutions graphically and symbolically by completing the square, applying the quadratic formula, and by factoring.
c. Determine how translations, reflections, and size transformations affect both the graph of a quadratic function and the equation of that function.
d. Graph quadratic functions and know their roots are *x*-intercepts.
e. Use the discriminant and factoring to determine whether the graph of a quadratic

function will intersect the *x*-axis in zero, one, or two points.

f. Apply quadratic equations to physical problems such as the motion of an object under the force of gravity.

9.Polynomials *(CMS Algebra 1: 4,10,11; Algebra 2: 3,4)*

a. Classify polynomials according to degree and number of terms
b. Add, subtract, and multiply polynomials.
c. Factor second and third degree polynomials using a variety of techniques including common factors, difference of squares, perfect square trinomials, and grouping.

10.Rational expressions and equations. *(CMS Algebra 1: 12,13,17; Algebra 2: 7)*

a. Simplify rational expressions.
b. Add, subtract, multiply and divide rational expressions
c. Solve rational equations.
d. Write the appropriate inverse and direct variation equations for given situations. Use inverse and direct variation equations to solve problems.
e. Describe the transformations applied to the parent function to produce graphs of rational functions.
f. Determine domain restrictions for rational functions.

b. Use the model to solve problems.

C. Intermediate Algebra 1–2 compared to the P1–P4 and Advanced Algebra Curricula

There is a lot of overlap between the student learning outcomes in Algebra P1-P4 and 1-2 and the Intermediate Algebra curriculum. It has been said that Intermediate 1–2 could be considered Algebra P5-P6. This overlap is intentional given the target student population, which has been previously identified as lower-level math performers. The distinction that separates Intermediate Algebra 1–2 from the lower level algebra sequence is time: while we review many of the standards from the lower sequence, we do it much faster.

In addition, there is a lot of overlap between the Intermediate Algebra 1–2 student learning outcomes and the Advanced Algebra 1–2 curriculum. Again, this is intentional given that Intermediate Algebra 1–2 serves as a bridge course between the lower algebra sequence, and Advanced Algebra. The distinctions that separate Intermediate Algebra 1–2 from Advanced Algebra 1–2 are in complexity, and to some extent, topical. Some specific, representative examples are:

- When completing the square, Intermediate doesn't extend to problems where $a \neq 1$
- While in Intermediate, students solve rational equations, but they do not graph them.
- Students in Intermediate solve only linear systems of equations.
- Students in Intermediate graph simple quadratic inequalities that are given in vertex form in two variables, but do not deal with more complex quadratic inequalities in one variable
- Students in Intermediate study probability, but do not use combinations and permutations for these calculations
- Students in Intermediate do not find inverses of quadratic functions that would require completing the square
- Students in Intermediate add, subtract, and multiply polynomials, but do not divide them

These topics from Advanced Algebra are omitted entirely from the Intermediate sequence:
- Sequences and series, including summation notation
- Binomial theorem

There are also two areas where the Intermediate Algebra 1–2 outcomes are almost perfectly aligned with the outcomes in Advanced Algebra. These areas include:
- Matrices (although word problems may be somewhat simpler in Intermediate, all the calculations are comparable)
- Graphing transformations of quadratic, square root, reciprocal, cubic, and absolute value functions

D. Intermediate Algebra and the CAHSEE

This course addresses content standards assessed in the CAHSEE by addressing many Algebra P1-P4 content standards.

III. ASSESSMENT

A. Student Assessment

Assessment and instruction should be aligned and designed to promote mathematical thinking. Teachers should move towards assessment that uses engaging problem situations that involve students in investigating, conjecturing, verifying, applying, evaluating, and communicating with their assessments.
Assessment should include a variety of means such as performance tasks, quizzes, tests, and projects (both individual and group). Informal assessment can involve writing samples and daily work.

Criteria for grading will be provided at the beginning of the semester, preferably in writing.

B. Course Assessment

The effectiveness of this course will be evaluated using the following criteria: 1) the number of students who use these credits to satisfy their third year math requirement, and 2) the number of students who subsequently pass Advanced Algebra or Statistics with a C– or better.

IV. METHODS AND MATERIALS

A. Student Learning Activities

Instruction will be designed so that students are actively involved in the learning experience. Students will work both collaboratively and individually in solving problems. They will be expected to explain and justify their work orally and in writing. Preparation will be given for the SAT I and STAR tests.

B. Materials

Teacher generated materials will be used in conjunction with a Board-adopted textbook (see approved textbook list).

C. Technology

Use of calculators and computers as an integral part of instruction and student work will be incorporated into the course when appropriate. The following technology skills will be taught to all Intermediate Algebra students:

Store data (possibly gathered with the use of motion detectors) into lists

Create scatterplots, lines of best fit, box-and-whisker plots, and other displays from data stored in lists.

Enter linear, quadratic, exponential, radical and absolute value functions, then analyze the characteristics of those functions by viewing data tables and graphs.

Set an adequate window to view the critical features of a graph using an appropriate domain, range, and scale.

Entering matrices and using matrix functions to solve matrix equations.

D. School to Career

Coursework will be connected to the real world when possible and appropriate. Real world problems that come from various career areas will be employed. Guest speakers who use math in their work may be invited to the classroom. Students may be encouraged to interview adults who use math in their work, then share the results with the class.

V. GENERAL INFORMATION

Intermediate Algebra 1-2 is a year long, upper division mathematics course designed for students who need more practice and application to solidify skills learned in Algebra 1-2 or Algebra P1-P4.

A. Prerequisites

Students must complete Geometry 1a-2a or Geometry 1-2 with a passing grade. Course enrollment requires a recommendation from the student's Geometry teacher.

B. Requirements Met

This course can be used in partial fulfillment of the district's three year mathematics requirement.

This course is not approved for the UC or CSU "d" mathematics requirement. Students planning to apply to other colleges and universities need to check with those institutions to determine if the course can be used to meet a "second year algebra" requirement.

Approved: 5/93
Revised: 7/00
Revised: 4/22/05
Revised: 2/1/06