# MT. DIABLO UNIFIED SCHOOL DISTRICT
# COURSE OF STUDY

*(header: MT. DIABLO UNIFIED SCHOOL DISTRICT- COURSE OF STUDY)*
*(Footer: Location of the document to be housed + timestamp)*

| | |
|---|---|
| **COURSE TITLE:** | **Algebra I** |
| **COURSE NUMBER:** | **1310** |
| **CALPADS NUMBER:** | **2403** |
| **~~CST~~:** | **Algebra** |
| **DEPARTMENT:** | **High School/Middle School Mathematics** |
| **~~NCLB CREDENTIAL:~~** | |
| **REQUIREMENT:** | **Math Credential with Subject Matter Proficiency** |
| **LENGTH OF COURSE:** | **One Year** |
| **CREDITS PER SEMESTER:** | **5** |
| **GRADE LEVEL(S):** | **8-12** |
| **REQUIRED OR ELECTIVE:** | **This course fulfills one year of the high school mathematics requirement and UC/CSU "c" requirement.** |

**BOARD OF EDUCATION ADOPTION: ~~June 22, 2010~~**

**~~COURSE DESCRIPTION:~~**

~~This course covers the twenty-five California State Mathematics Standards for Algebra I. Emphasis is on writing, solving, and graphing linear and quadratic equations. The ability to communicate mathematical reasoning and understanding will be incorporated into all math topics. In addition, algebraic skills and concepts are developed and used in a wide variety of problem solving situations. This course is the first course in the three-year mathematics requirement for four-year college admission.~~

## COURSE OVERVIEW

Algebra I provides the transition from simple computation and problem solving into understanding the dynamic changes and relationships in the world, and universe, around us. The class aims to provide a symbolic understanding of the natural objects and events and how they relate to each other by understanding constants and formulaic relationships. Students will relate systems of equations to each other to find solutions in multiple ways and identify which process is best. An understanding of quadratic functions and equations will be developed through integration with technology and applications with real life examples across various methods to find solutions. This will be contrasted with exponential functions, radical functions, and geometric series.

**MT. DIABLO UNIFIED SCHOOL DISTRICT**
**COURSE OF STUDY**

Students are expected to work together on explorations, to make conjectures, to construct viable arguments, and to critique the reasoning of others. Explaining their thinking is a goal in their development early on in this course.

In addition to the **California Common Core State Standards for Mathematics**, students will experience and gain fluency with the **8 Standards for Mathematical Practice**:

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

Overall, the quality of a learning environment depends on the extent to which it provides opportunities for students along the following five dimensions:

1. The richness of disciplinary concepts and practices ("the content") available for learning;
2. Student sense-making and "productive struggle";
3. Meaningful and equitable access to concepts and practices for all students;
4. Means for constructing positive disciplinary identities through presenting, discussion and refining ideas; and
5. The responsiveness of the environment to student thinking.

~~**COURSE OUTLINE**~~
~~**1. MAJOR GOALS**~~

~~1.1 To develop the ability to reason logically and think symbolically 1.2 To develop skills for communicating mathematically~~
~~1.3 To build mathematical models, formulate and solve problems 1.4 To improve the skills necessary to be successful in various careers~~
~~**2. PERFORMANCE OBJECTIVES**~~
~~(numbers in parentheses refers to appropriate California State Algebra I standard)~~
~~2.1 Algebra I 2.1.1 Identify and use the arithmetic properties of subsets of integers and rational, irrational, and real numbers, including closure properties for the four basic arithmetic operations where applicable (1.0) 2.1.2 Use the properties of numbers to demonstrate whether assertions are true or false. (1.1) 2.1.3 Understand and use such operations as taking the opposite, finding the reciprocal, taking a root, and raising to a fractional power. Understand and use the rules of exponents. (2.0) 2.1.4 Solve equations and inequalities involving absolute values (3.0) 2.1.5 Simplify expressions (4.0) 2.1.6 Solve multi-step problems (5.0) 2.1.7 Graph a linear equation, and compute the x and y intercept; sketch the region defined by linear inequality (6.0) 2.1.8 Verify that a point lies on a line given an equation of the line. Derive linear equations using the point-slope formula (7.0) 2.1.9 Find the equation of a line perpendicular to a given line that passes through a given point (8.0) 2.1.10 Solve a system of two linear equations in two variables; solve a system of two linear inequalities and sketch the solution set (9.0) 2.1.11 Add, subtract, multiply and divide monomials and polynomials (10.0) 2.1.12 Apply basic factoring~~

~~techniques to second and simple third degree polynomials (11.0) 2.1.13 Simplify fractions with polynomials in the numerator and denominator (12.0) 2.1.14 Add, subtract, multiply, and divide rational expressions and functions (13.0) 2.1.15 Solve a quadratic equation by factoring or completing the square (14.0) 2.1.16 Apply algebraic techniques to rate problems, work problems, and percent mixture problems (15.0) 2.1.17 Understand the concepts of a relation and function (16.0) 2.1.18 Determine the domain of independent variables, and range of dependent variables defined by a graph, a set of ordered pairs, or symbolic expression (17.0) 2.1.19 Determine whether a relation is a function (18.0) 2.1.20 Learn the quadratic formula and become familiar with its proof by completing the square (19.0) 2.1.21 Use the quadratic formula to find the roots of a second degree polynomial (20.0)~~
~~2.1.22 Graph quadratic functions and know that their roots are the intercepts (21.0) 2.1.23 Use the quadratic formula or factoring to determine how the graph intersects the x-axis (22.0) 2.1.24 Apply quadratic equations to physical problems such as the motion of an object under the force of gravity. (23.0) 2.1.25 Explain the difference between inductive and deductive reasoning; identify and provide examples of each. (24.1) 2.1.26 Identify the hypothesis and conclusion in logical deduction. (24.2) 2.1.27 Use counterexamples to show that an assertion is false and recognize that a single counterexample is sufficient to refute an assertion. (24.3) 2.1.28 Students use properties of numbers to construct simple, valid arguments (direct and indirect) for, or formulate counterexamples to, claimed assertions. (25.1) 2.1.29 Judge the validity of an argument based on whether the properties of the real number system and order of operations have been applied correctly at each step. (25.2) 2.1.30 Given a specific algebraic statement involving linear, quadratic, or absolute value expressions or equations or inequalities, students determine whether the statement is true sometimes, always, or never. (25.3)~~
**~~3. CONTENT OUTLINE~~**
~~(numbers in parentheses refers to appropriate performance objectives) 3.1 Algebra I 3.1.1 Properties of numbers ( 2.1.1-2.1.2) 3.1.2 Exponents, reciprocals and working with roots (2.1.3) 3.1.3 Equation and inequality solving (2.1.2, 2.1.4-2.1.6) 3.1.4 Relations, Functions and Graphs (2.1.17-2.1.19) 3.1.5 Graph of linear equations and linear inequalities (2.1.7) 3.1.6 Linear equations (2.1.8-2.1.9) 3.1.7 Systems of equations and inequalities including graphs (2.1.10) 3.1.8 Polynomials, factoring techniques (2.1.11-2.1.13) 3.1.9 Rational expressions and equations (2.1.14) 3.1.10 Rate, work, and mixture problems (2.1.16) 3.1.11 Quadratic equations, quadratic formula, including graphing (2.1.20- 2.1.24) 3.1.12 Logical reasoning and proof (2.1.25-2.1.28)COU~~

## COURSE CONTENT:

### Unit 1: Solving Linear Equations

This unit presents the foundational skills related to solving linear equations, solving absolute value equations, and rewriting equations and formulas. Students will activate prior knowledge and help to connect concepts to each other. Students will synthesize the exploration activities and make connections and conclusions. Students will demonstrate their understanding of each lesson's concepts and will complete computational and applied problems. Students will do this by using verbal models; drawing diagrams; sketching a graph or number line; writing equations; making a table; looking for patterns; making a list; working backward; and breaking the problem into parts.

At the end of the unit, through a performance task: Magic of Mathematics, students will create equations in one variable to focus on a quantity of interest, justify each step in solving a simple equation and solve linear equations in one variable with a partner or in groups.

### Unit 2: Solving Linear Inequalities

Techniques used in solving linear equations are applied to linear inequalities. Students will learn to write and graph linear inequalities, using graphs to both display and check their answers. This will include multi-step, compound and absolute value inequalities. Students will do this by following the steps for solving an equation and reversing the inequality symbol when multiplying or dividing by a negative number for simple inequalities. Writing the inequality as two separate inequalities, then solving each inequality separately and including and or or in the solution for compound inequalities.

At the end of the unit, through a performance task: Grading Calculations, students will need to create inequalities in one variable and solve linear inequalities in one variable.

**Unit 3: Graphing Linear Functions**
Students will review what functions are, function notation, linear functions, and how to graph using standard form, slope-intercept form, do transformations and graph absolute value functions. Students will do this by defining what a function is; determine whether a function is linear or nonlinear; using function notation to represent a function; describing the graph of the equation $Ax + By = C$; describing the graph of the equation $y= mx + b$; comparing the graphs of the linear function $f(x) = x$ to the graphs of $g(x)=f(x) + c$ and $h(x) = f(cx)$; and stating how the values of a, h, and k affect the graph of the absolute value function $g(x) = a|x -h| + k$.

At the end of the unit, through a performance task: The Cost of a T-Shirt; students will compare four functions that are each represented in a different format (table, written description, equation, and graph) and create equations in two variables to represent relationships between quantities or graph equations on coordinate axes and relate the domain of a function to its graph.

**Unit 4: Writing Linear Functions**
This unit covers how to write equations of lines. It exposes the students to scatter plots and lines of best fit. Students will learn how to write and tell the difference between slope-intercept and point-slope forms of equations of a line. Students will be able to write both parallel and perpendicular line equations. Students will learn to use scatter plots and determine lines of best fit. Lastly, students will be able to make predictions based on arithmetic sequences and interpret piecewise functions.

At the end of the unit, through a Desmos activity: Investigating T-Shirt Offers, students write linear equations to compare the cost of two T-shirt companies. Students then draw connections between the algebraic and graphical solution, and interpret the results in context. The activity can be found on Desmos.com.

**Unit 5: Solving Systems of Linear Functions**
This unit covers solving systems of linear equations by graphing, substitution, or elimination. Students will develop attention to detail as they compare equations in a system to each other as they need to develop a plan to determine which method is the best to solve the system. The unit ends with students applying the same skill set for solving systems of inequalities.

At the end of the unit, through a Desmos activity: Systems of two Linear Equations; students write and solve a system of two linear equations to explore the numerical and graphical meaning of the solution. Students apply what they have learned to similar situations. The activity can be found on Desmos.com.

**Unit 6: Exponential Functions & Sequences**
This unit encompasses exponents and radicals, exponential growth and decay, solving exponential functions, geometric sequences, and recursively defined sequences.

Students transition into a new topic of visualizing and understanding exponential relationships and the properties that drive them, including making quantities very large or small quickly. They will solve simple problems with technology that becomes integrated with scientific concepts that require scientific notation and business concepts, such as simple interest. Students will explore the inverse operations of rational roots and how geometric shapes' sides relate to their area and volume. Students will take their skill set of graphing unknown functions to determine the shape of exponential functions in order to describe the parent function and its translations.

At the end of the unit, using the performance task: The New Car students use and interpret exponential growth and decay functions and construct a geometric sequence.

**Unit 7: Polynomial Equations and Factoring**
This unit covers operations with polynomials and solving polynomial equations in factored form. It also handles the factoring of quadratics and special products of polynomials. The introduction of these concepts prepares the students for better understanding of functions, roots, and radicals in future lessons. Students will add, subtract, multiply and divide polynomials. Students will also be able to factor quadratics and solve them in a single variable.

At the end of the unit, using the performance task: The View Matters, students add, subtract, and multiply polynomials, identify ways to rewrite and expression and factor a polynomial to find the roots of a polynomial equation.

**Unit 8: Graphing Quadratic Functions**
Students will explore concepts of quadratic equations in a similar progression of linear equations. They will use known graphing strategies to visualize the graph of a parabola and develop vocabulary to discuss its features and features that make it drastically different from a linear function. Students will then develop multiple skill sets in order to solve for the x-intercepts including different types of factoring and the quadratic formula. As students grow into real-life examples, they will be able to explain why a solution may not be valid. Students will compare different types of equations for parabolas, including standard form and vertex form and the information that each one gives for the creation of the function.

At the end of the unit, students work on a project. Students create a hypothetical suspension bridge on paper. The bridge will need to be drawn to scale and must have a coordinate plane overlaid upon it. Then students will write a function to model the path of the main cable with x and y distance. They will use their model to determine/verify the minimum distance that the cable is above the ground and write quadratic equations, find the vertex of the function, and find the minimum value of a quadratic function.

**Unit 9: Solving Quadratic Equations**
This unit introduces/reviews the properties of radicals. It also teaches students to solve quadratic equations by several different methods: graphing, using square roots, completing the square and using the quadratic formula. Lastly, it covers how to solve nonlinear systems of equations. Students will use graphs to solve a quadratic equation in one variable. They will determine the number of solutions of a quadratic equation of the form $ax^2+c=0$.

At the end of the unit, students will complete a MARS (https://www.map.mathshell.org/download.php?fileid=1736 ) activity to make sense of a real life situation and decide on the proper math to apply to the problem; solve quadratic equations by taking square roots, completing the square, using the quadratic formula, and factoring and interpreting the results in the context of a relief situation.

**Unit 10: Radical Functions & Equations**

Students will learn to graph square root functions and cube root functions. They will also learn to solve radical equations and determine the inverses of functions. Students continue to build their skill set by using inductive reasoning. They explore the various graphs of square and cubed root graphs in order to explain why each function varies in its domain and range. Building from skills in earlier units. Students become fluent in moving between one dimensional sides, two dimensional area, and three dimensional volume. They will use these concepts in order to visualize how to solve radical functions with different strategies and why some solutions cannot be valid. Lastly, students construct inverse functions as a way to see how operations relate to each other more.

At the end of the unit, students will be put into collaborative groups and will be given several square root and cube root functions on color coded index cards to graph functions and calculate the average rate of change.

**Unit 11: Data Analysis and Displays**
Students will study the foundation of statistics: measures of center and variation, box-and-whisker plots, shapes of distributions, two-way tables and how to choose a data display. Students will explore different types of data, both given and collected on their own and understand how different types of presentation and statistical calculation affects the data's appearance and conclusions that can be made. Students will explore measures of center, box and whisker plots, shapes of distribution, and two way tables in order to understand ways to show quantitative information. They will understand what information is shown, and excluded, and be able to justify what display is the best choice. Students will also explore ways to ask unbiased questions and create surveys in order to obtain accurate information and results.

At the end of the unit, students can collect data on a topic of their choice from their classmates. The data will need to be in a format where students can count the frequency of different responses. Students can then calculate and display the measures of central tendency and variation, as well as compile the data into a box-and-whisker plot and a histogram. Students will be asked to describe the data distributions and shape of the histogram.

**~~4.~~ TIME ESTIMATES**
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 materials~~
**COURSE MATERIALS**

| Authors | Copyright | Publisher | Title | Website |
|---|---|---|---|---|
| Larson, R. & Boswell | 2019 | National Geographic Learning | Big Ideas Math: Algebra 1 | www.bigideaslearning.com |

Teacher support resources can also be found in the Educational Services Website and supplemental online curriculum (for ex. Apex).

**~~6.~~ EVALUATION OF STUDENT PROGRESS:**

**MT. DIABLO UNIFIED SCHOOL DISTRICT**
**COURSE OF STUDY**

~~Students communicate mathematically and demonstrate content knowledge that leads to mathematical competence in subsequent mathematics courses and chosen careers. 6.1 Teacher observation 6.2 Written assignments and projects 6.3 Quizzes and tests 6.4 Rubrics~~

Assessment Methods:

- Summative assessment
- Formative Assessment

Formative:

- Mathematical Discourse
- Reflection questions
- Teacher observations/evidence
- Student discussions
- Quiz
- Exit ticket

Summative:

- Performance task
- Unit Assessment

**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)~~ |

| | |
|---|---|
| College Park | Joan Dahl, Teacher |
| Concord | Maxwell Cazanov, Teacher |
| Concord | Norma Meyerkorth, Teacher |
| Mt. Diablo | Kyle Kondo, Teacher |
| Mt. Diablo | Lisa Scranton, Teacher |
| Northgate | Gregory Lyons, Teacher |
| Ygnacio Valley | David Swenson, Teacher |

**MT. DIABLO UNIFIED SCHOOL DISTRICT**
**COURSE OF STUDY**

| | |
|---|---|
| Ygnacio Valley | Erica Huie, Teacher |
| Dent Center | Susan Hartwig, Curriculum Specialist |
| Willow Creek Center | Jodi Masongsong, TOSA |
| | Jeanne Johnson, TOSA |
| | Angela Victor, TOSA |