TAMALPAIS UNION HIGH SCHOOL DISTRICT

Algebra Course of Study (DRAFT)

Overview Information

Title of Course: Algebra	
Course Author(s): Axel Amzallag, Margie Brindley, Jeremy Bronson, Karen Gladysz, Raj Mistry, Matthew Post	Schools where the course will be taught: Archie Williams, Redwood, Tamalpais, Tamiscal and San Andreas
Length of Course: 1 year (2 semesters)	Subject Area and Discipline: Math Area "C"
Grade Levels: 9,10,11	Is this course an integrated course? NO
Is this course being submitted for possible UC honors designation? No	Are you seeking UC approval? If so, in what area (A-G)? Yes, area "C"
Prerequisites (required or recommended): Completion of Algebra with a passing grade	Co-requisites (required or recommended): None
If there are prerequisites for the course, please include a justification as to why they are in place:	
Check all that apply: ✅ UC A-G course ✅ Graduation Requirement (specify the requirement this course meets) ❑ Elective ❑ Honors/AP ❑ CTE	

Introduction to the Course

Course Overview:
This course is a one year Algebra course which covers the state of California Common Core Math Standards (CaCCSS-M) for the first year of Algebra. The course introduces students to the foundational concepts of algebra, emphasizing problem solving, reasoning, and the ability to represent real-world situations using mathematical models. Students will develop fluency with solving equations using math symbols while also building conceptual understanding through discussion, multiple representations, and inquiry-based learning.

Successful completion of this course prepares students for Geometry and satisfies the UC/CSU "c" mathematics requirement.

The following essential Mathematical Practices are incorporated throughout the course:

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

Unit Title: Solving Linear and Absolute Equations & Inequalities

Unit Summary:
Students will develop the ability to analyze, model, and solve linear equations and inequalities, including those involving absolute value expressions. Instruction focuses on understanding the properties of equality and inequality, applying inverse operations, and interpreting solutions both algebraically and graphically. Learners solve one-variable linear equations and inequalities, represent solutions on number lines, and interpret solution sets in context. Students will extend this knowledge to absolute value equations and inequalities, recognizing absolute value as a measure of distance from zero.

Throughout the unit, students will justify solution methods, check solutions for accuracy, and connect algebraic solutions to real-world situation problems. Emphasis is placed on mathematical reasoning, precise use of symbols, and understanding how solution sets change depending on the inequality relationship.

California Common Core Algebra Standards:
N-Q 1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

A-CED 1. Create equations and inequalities in one variable including ones with absolute value and use them to solve problems. for A.CED.3 linear only] Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

A-CED 4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R.

A-REI 1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

Sample Unit Assignments:
Real-World Application: A delivery service guarantees packages will arrive within 3 days of the expected delivery time. Example: expected time (in days)=10
Let x represent the difference in days between the expected delivery time and the actual delivery time.

1) Write an absolute value inequality representing this situation.
2) Solve the inequality
3) Explain what the solution means in terms of delivery times

Sample unit Assessment:
Students solve linear equations, linear inequalities, and absolute value equations and inequalities. Students demonstrate their ability to apply algebraic procedures , represent solution sets, and interpret mathematical results.

Unit Title: Graphing Lines & Absolute Value Equations

Unit Summary:
Students will interpret the slope and y-intercept of a given equation in context to a scenario, and determine whether or not a set of data is linear. Students will write the equation of a line through 2-points. Students will understand the meaning of the absolute value of a number; interpret the absolute value of the distance from zero on a number line; and determine the absolute value of real numbers.

California Common Core Algebra Standards:
N-Q 2. Define appropriate quantities for the purpose of descriptive modeling.

A-CED 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

F-IF 7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F-IF 7a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

F-BF 3. Identify the effect on the graph of replacing f(x) by f(x) + k, kf(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

Sample Unit Assignments:
Students perform repeated tasks in two variables to create data to input into a table and then graph on a coordinate plane. For example: How long does it take in seconds (x value) to bounce a ball 3 times (y value). Calculate the speed by finding the slope. Find and interpret the y-intercept.

Sample unit Assessment:
Students graph linear equations and absolute value functions accurately, including identifying key features such as slope, y-intercept, and vertex. They demonstrate understanding of slope as a rate of change and y-intercept as an initial value by interpreting and explaining these features in context. Students write linear equations from graphs, points, and real-world situations, and solve absolute-value equations while recognizing when multiple solutions are present. They explain their reasoning clearly and connect algebraic expressions to their corresponding graphic representation.

Unit Title: Fundamentals of Functions

Unit Summary:
Students will learn function notation and be able to solve for both the dependent and independent variable when given the other, both algebraically and graphically. The concepts of domain & range will be introduced for continuous graphs, with closed or open endpoints. Students will be able to construct their own linear function from a written description of a linear phenomenon (slope and y-intercept described in words), and define both the dependent and independent variables. Given an application context, students will be able to understand whether given information describes the dependent or independent variable and be able to solve for the other variable. Be able to construct axes and graph a function that models a given context.

California Common Core Algebra Standards:
A-SSE 1. Interpret expressions that represent a quantity in terms of its context.

A-SSE 1a. Interpret parts of an expression, such as terms, factors, and coefficients.

F-IF 1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).

F-IF 2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F-IF 4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums.

F-IF 5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.

A-CED 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

Sample Unit Assignments:

- Domain/range assignment matching given domain/range to given images (~15 matches). Students cut and paste the correct domain & range to the appropriate graph.
- Modeling questions where students identify the meaning of variables in a given function and describe them in their words. Students write answers on small, personal whiteboards and progress through "levels" – increasingly tricky language/wording.
- In groups at vertical whiteboards, students draw a linear function and either solve for *x* or *f(x)* when given the other. Using the graph to get their answers.

Sample unit Assessment:

In a cumulative assessment, students individually demonstrate knowledge in the following ways:

1. Matching given domains/ranges to a given graph (~5 equations)
2. Write domain/range given a graph
3. Plug the independent/dependent variable into a given function in *f(x)* notation
4. Find the independent/dependent variable value from a given graph
5. Given a function in context, be able to identify the plain-language meaning of the variables in the function.

Unit Title: Writing and Modeling Linear Functions

Unit Summary:

Students will develop an understanding of linear relationships and the concept of constant rate of change. Students will analyze whether a linear model is appropriate in real-world situations and consider constraints that may affect the model. They will write and interpret linear equations from multiple representations, including graphs, points, intercepts, and contextual scenarios. Students will compare and convert between different forms of linear equations and determine which form is most useful for representing and analyzing a given situation. Through modeling and interpretation, students will connect algebraic representations to real-world relationships and decision-making.

California Common Core Algebra Standards:

N-Q 2. Define appropriate quantities for the purpose of descriptive modeling.

S-ID 7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

F-LE 1. Distinguish between situations that can be modeled with linear functions and with exponential functions.

F-LE 1a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

F-LE 1b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

F-LE 1c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

F-LE 5. Interpret the parameters in a linear or exponential function in terms of a context. [Linear and exponential of form f(x) = bx =+ k]

F-IF 8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-BF 1. Write a function that describes a relationship between two quantities.

Sample Unit Assignments:
Students create a linear model to represent and predict a scenario relevant to their lives, such as saving money, spending money, or increasing their maximum bench press over time. They use a model to make predictions about future outcomes, then collect real data over time and compare it to their model's predictions to evaluate the accuracy of the linear relationship. Based on their findings, students revise or create new models to better represent the observed data and reflect on how mathematical models can change as new information becomes available.

Sample Unit Assessment:
Students analyze data presented in various formats, including tables, graphs, scenarios, coordinate points, and equations of parallel and perpendicular lines, to determine if a linear model is appropriate. If a linear model is determined to be appropriate, students write the model using multiple forms, such as point-slope, standard, and slope-intercept forms, and effectively apply the most appropriate form for the given context.

Unit Title: Systems of Linear Equations and Inequalities

Unit Summary:
Students will learn to solve systems of linear equations using methods such as graphing, substitution and elimination to find points of intersection. They will explore systems of linear inequalities, graphing solution regions and interpreting feasible solutions in real world contexts. The unit emphasizes understanding how multiple constraints interact and how solutions can represent optimal or possible outcomes.

California Common Core Algebra Standards:
N-Q 2. Define appropriate quantities for the purpose of descriptive modeling.

A-CED 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A-REI 6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

A-REI 7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.

A-REI 12. – Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Sample Unit Assignments:
Students will use a System of Equations to find the cost of two rides at a carnival given a total amount spent by two carnival goers. Tasks involved include defining variables used and writing two equations to solve a system.

Sample Unit Assessment:
Students solve systems of equations in all three ways (graphing, substitution and elimination) and identify the point of intersection, including systems of inequalities that require graphing and shading the solution region. The assessment also includes several application problems (real world word problems) where students find solutions to problems in real world contexts.

Unit Title: Polynomials

Unit Summary:
Students will understand of polynomials and their vocabulary. Students will add, multiply, and subtract polynomials in a way analogous to integers. Students will learn how to use factoring to reveal the zeros of quadratic functions and will learn how to factor trinomial expressions with integer coefficients, including the case where the leading coefficient isn't 1. The unit emphasizes core algebraic manipulation skills for working with polynomials and is an introduction to manipulating non-linear expressions.

California Common Core Algebra Standards:
A-APR 1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

A-SSE 1.Interpret expressions that represent a quantity in terms of its context.

A-SSE 1b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1 + r)n as the product of P and a factor not depending on P.

A-SSE 2. Use the structure of an expression to identify ways to rewrite it.

A-SSE 3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

A-SSE 3a. Factor a quadratic expression to reveal the zeros of the function it defines.

A-CED 1. Create equations and inequalities in one variable including ones with absolute value and use them to solve problems. for A.CED.3 linear only] Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

Sample Unit Assignments:
Students perform various operations using polynomials to determine the materials needed and cost

to build a garden surrounded by a patio.

Sample unit Assessment:
Students classify and name polynomials, as well as add, subtract and multiply polynomials. The assessment includes problems in real world contexts where students combine their knowledge of area and perimeter with their knowledge of polynomials.

Unit Title: Graphing Quadratics

Unit Summary:
Students will be able to graph a quadratic function that is given in any form: standard, vertex, intercept. Students will identify the domain and range of a graphed quadratic equation. Given the equation of a quadratic function, students will be able to identify the key features including the vertex, the x- and y-intercepts, and the axis of symmetry, and then graph the function. Given the graph of a quadratic function, students will be able to identify the key features including the vertex, the x- and y-intercepts, and the axis of symmetry.

California Common Core Algebra Standards:
N-Q 2. Define appropriate quantities for the purpose of descriptive modeling.

F-IF 7a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

F-IF 8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF 8a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

F-BF 3. Identify the effect on the graph of replacing f(x) by f(x) + k, kf(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

Sample Unit Assignments:
Students graph a quadratic equation and then write the equation in the other forms (standard, vertex, intercept), and a parabola using transformations using Desmos activities to visualize graphs. Students use an equation and scenario of a ball being thrown into the air to answer questions such as when does the ball hit the highest point, when does it hit the ground, etc.

Sample unit Assessment:
Students graph a parabola using transformations and marking 5 accurate points; write the equation of a given parabola in the three different equation forms; identify the intercepts and vertex given the quadratic equation; interpret a projectile motion word problem and solve for maximum height, initial height, as well as find when the object is at a specific height (solved for via quadratic formula).

Unit Title: Solving Quadratics

Unit Summary:
Students will use a variety of algebraic techniques for solving quadratic equations with one variable. Students will learn to choose and apply the appropriate methods for solving, including factoring, taking square roots, completing the square, and using the quadratic formula. In order to use these techniques, students will learn perfect squares (up to 10) and use them to simplify square roots and cube roots for any two-digit number and for selected three-digit numbers. Finally, students will apply

these quadratic equations to model and solve real-world problems, such as those involving the projectile motion of objects under gravity. They will also be able to solve non-linear systems of equations involving linear and quadratic equations.

California Common Core Algebra Standards:
N-Q 2. Define appropriate quantities for the purpose of descriptive modeling.

F-LE 6. Apply quadratic functions to physical problems, such as the motion of an object under the force of gravity.

A-CED 1. Create equations and inequalities in one variable including ones with absolute value and use them to solve problems. for A.CED.3 linear only] Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

A-CED 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A-REI 1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A-REI 4. Solve quadratic equations in one variable.

A-REI 4b. Solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, the quadratic formula, and factoring, as appropriate to the initial form of the equation.

F-IF 9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

F-BF 1. Write a function that describes a relationship between two quantities.

Sample Unit Assignments:
Students use different methods to solve a Quadratic Equation. Methods involved can include Factoring, Graphing, Square Roots, or the Quadratic Formula.

Sample unit Assessment:
Students simplify cube and square roots. They also simplify square roots with addition, subtraction, multiplication, and division. Students solve one- and two-step equations involving square roots. For equations that don't factor, students use the quadratic formula to solve a quadratic equation. As an application, they find the sides of a rectangle for a given area and given the difference between the width and length (i.e x and x+3). They also solve a non-linear system of equations and a free-fall motion problem involving quadratics.

Unit Title: Exponential Functions

Unit Summary:
Students will explore exponential properties (multiplication, division, power property) and functions as models of growth and decay, and write equations of exponential growth and decay and analyze how parameters such as initial value and rate of growth or decay affect the graph. This unit connects exponential models to real world situations like population growth and compound interest.

California Common Core Algebra Standards:
A-CED 1. Create equations and inequalities in one variable including ones with absolute value and use

them to solve problems. for A.CED.3 linear only] Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

A-CED 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

F-LE.1. Distinguish between situations that can be modeled with linear functions and with exponential functions.

F-LE 1a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

F-LE 1b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

F-LE 1c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

F-LE 5. Interpret the parameters in a linear or exponential function in terms of a context. [Linear and exponential of form f(x) = bx =+ k]

A-REI 1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

F-IF 8b.Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)t , y = (0.97)t , y = (1.01)12t, and y = (1.2)t/10, and classify them as representing exponential growth or decay.

F-BF 1. Write a function that describes a relationship between two quantities.

F-BF 3. Identify the effect on the graph of replacing f(x) by f(x) + k, kf(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

Sample Unit Assignments:
Students explore and contrast various savings methods, specifically modeling and comparing investment growth (earning compound interest) against simple, linear savings (adding a constant amount). They use graphical displays to visualize and analyze the long-term disparities between these methods, thus demonstrating the impact of compound interest and exponential functions.

Sample Unit Assessment:
Students utilize provided real-world data (such as starting amounts, rates, or tables) to construct exponential models for at least two different scenarios (e.g., populations, investments). They then use these established models to predict future values and analyze the outcomes of the scenarios over a given period.

Recommended Texts and Resources: Larson, Ron and Laurie Boswell, *Big Ideas Math*, Big Ideas Learning, 2019

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