Course Title:	Math I
Department:	Mathematics
Course #:	2212
Grade Level/s:	9
Length of Course:	Year
Prerequisite/s:	By placement: Grade C or better in Math 8, Teacher Recommendation, and/or District Assessment Results
UC/CSU (A-G) Req:	(C) Mathematics
Brief Course Description:	The purpose of Math I is to develop students' ability to think mathematically and develop their conceptual understanding of mathematics and procedural fluency in mathematics. Math I will extend the mathematics students learned in earlier grades and begin the development of concepts in Number and Quantity, Algebra, Functions, Modeling, Geometry, and Probability and Statistics. The critical topics of this course are: Relations and Functions, Linear Equations and Inequalities, Systems of Equations and Inequalities, Arithmetic and Geometric Sequences, Polynomial Expressions, Exponential Functions, Geometric Properties and Congruence, and Modeling Data. Extensive use of models (or real-world situations), manipulatives, graphs and diagrams will help students view how mathematics is a set of related topics as opposed to a set of discrete topics. In addition, students will solve problems graphically, numerically, algebraically, and to make verbal connections between these representations. Students routinely use the standards for mathematical practice to make sense of problems, justify solutions and conclusions, model with mathematics, and strategically use technology to analyze and solve real-world problems.

I. GOALS

The students will:
A.   Reason quantitatively and use units to solve problems

B.   Interpret the structure of expressions

C.   Create equations that describe numbers or relationships

D.   Understand solving equations as a process of reasoning and explain the reasoning

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E.   Solve equations and inequalities in one variable

F.   Solve systems of equations

G.   Represent and solve equations and inequalities graphically

H.   Understand the concept of a function and use function notation

I.   Interpret functions that arise in applications in terms of the context

J.   Analyze functions using different representations

K.   Build a function that models a relationship between two quantities

L.   Build new functions from existing functions

M.   Construct and compare linear and exponential models and solve problems

N.   Interpret expressions for functions in terms of the modeled situation

O.   Make geometric constructions

P.   Experiment with transformations in the plane

Q.   Understand congruence in terms of rigid motions

R.   Use coordinates to prove simple geometric theorems algebraically

S.   Summarize, represent, and interpret data on a single count measurement variable, as well as, on two categorical and quantitative variables

T.   Interpret linear models

These goals are aligned with the California State Standards, including the Standards Mathematical Practices.

II.   OUTLINE OF CONTENT FOR MAJOR AREAS OF STUDY

Semester 1

A.   Number and Quantity
   1.   Define quantities and interpret expressions (N.Q.2, A.SSE.1)
   2.   Interpret expressions and use units to understand problems (A.SSE.1, N.Q.1)
   3.   Use units as a way to understand problems (N.Q.1)
   4.   Explain each step in the process of solving an equation (A.REI.1)
   5.   Rearrange formulas to solve for a variable (A.REI.3, A.CED.4)
   6.   Solve literal equations (A.REI.1, A.REI.3, A.CED.4)
   7.   Write inequalities to fit a context (A.REI.1, A.REI.3)

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        8. Reason about inequalities and the properties of inequalities (A.REI.1, A.REI.3)
        9. Solve linear inequalities and represent the solution (A.REI.1, A.REI.3)

B. Systems of Equations and Inequalities
        1. Represent constraints with systems of inequalities (A.CED.3)
        2. Write and graph linear inequalities in two variables (A.CED.2, A.REI.12)
        3. Write and solve equations in two variables (A.CED.2, A.CED.4)
        4. Write and graph inequalities in two variables to represent constraints (A.CED.2, A.CED.3, A.REI.12)
        5. Graph the solution set of a linear system of inequalities (A.CED.3, A.REI.12)
        6. Solve systems of linear equations in two variables, including inconsistent and dependent systems (A.REI.6)
        7. Solve systems of linear inequalities representing constraints (A.CED.3)

C. Arithmetic and Geometric Sequences
        1. Represent arithmetic sequences with equations, tables, graphs, and story context (F.BF.1, F.LE.1a, F.LE.2, F.LE.5)
        2. Understand that arithmetic sequences have a constant difference between consecutive terms (F.BF.1, F.LE.1a/1c, F.LE.2, F.LE.5)
        3. Understand that arithmetic sequences either increase or decrease at a constant rate (F.BF.1, F.LE.1a/1b, F.LE.2, F.LE.5)
        4. Compare rates of growth in arithmetic and geometric sequences (F.BF.1, F.LE.1a/1c, F.LE.2, F.LE.5)
        5. Build recursive and explicit equations for arithmetic and geometric sequences and understand the difference between recursive and explicit equations (F.BF.1, F.BF.2, F.LE.1a/1b, F.LE.2, F.LE.5)
        6. Use rate of change to find missing terms in an arithmetic sequence (F.BF.1, F.LE.1a/1c, F.LE.2, F.LE.5)
        7. Use a constant ratio to find missing terms in a geometric sequence (F.BF.1, F.LE.1, F.LE.2)
        8. Develop fluency with geometric and arithmetic sequences (A.REI.3)

D. Linear and Exponential Functions
        1. Understand continuous linear and exponential functions (F.IF.3)
        2. Define linear and exponential functions based upon the pattern of change (F.LE.1, F.LE.2)
        3. Identify rates of change in linear and exponential functions (F.LE.1, F.LE.2)
        4. Distinguish between linear and exponential functions using various representations (F.LE.3, F.LE.5)
        5. Compare the growth of linear and exponential functions (F.LE.2, F.LE.3, F.LE.5, F.IF.7)
        6. Compare linear and exponential models of population (F.BF.1, F.BF.2, F.LE.1, F.LE.2, F.LE.3)
        7. Interpret equations that model linear and exponential functions (A.SSE.1, A.CED.2, F.LE.5)
        8. Evaluate the use of various forms of linear and exponential equations (A.SSE.1, A.SSE.3, A.CED.2, F.LE.5)
        9. Understand and interpret formulas for exponential growth and decay (A.SSE.1, A.CED.2, F.LE.5, F.IF.7)
        10. Solve exponential and linear equations (A.REI.3)

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A.   Features of Functions
1. Use a story context to graph and describe key features of functions t (F.IF. 4)
2. Use tables and graphs to interpret key features of functions (F.IF. 4, F.IF. 5)
3. Analyze features of functions using various representations (F.IF. 4, F.IF. 5)
4. Interpret functions using notation (F.IF.2, F.IF.4, F.IF. 5, F.IF.7, A.REI.11, A.CED.3)
5. Combine functions and analyzing contexts using functions (F.BF.1b, F.IF.2, F.IF.4, F.IF. 5, F.IF.7, A.REI.11, A.CED.3)
6. Use graphs to solve problems given in function notation (F.BF.1b, F.IF.2, F.IF.4, F.IF.5, F.IF.7, A.REI.11, A.CED.3)
7. Define a function (F.IF.1)
8. Identify whether or not a relation is a function given various representations (F.IF.1, F.IF.3)
9. Match features and representations of a specific function (F.IF.2, F.IF.4, F.IF. 5, F.IF.7, A.REI.11, A.CED.3)

B.   Congruence, Constructions and Proof
1. Develop the definitions of rigid motion transformations: translations, reflections and rotations (G.CO.1, G.CO.4, G.CO.5)
2. Examine the slope of perpendicular lines (G.CO.1, G.GPE.5)
3. Determine which rigid motion transformations carry one image onto another congruent image (G.CO.4, G.CO.5)
4. Write and apply formal definitions of the rigid motion transformations: translations, reflections and rotations (G.CO.1, G.CO.2, G.CO.4, G.GPE.5)
5. Determine rotational symmetry and lines of symmetry in special types of quadrilaterals (G.CO.3, G.CO.6)
6. Examine characteristics of regular polygons that emerge from rotational symmetry and lines of symmetry (G.CO.3, G.CO.6)
7. Make and justify properties of quadrilaterals using symmetry transformations (G.CO.3, G.CO.4, G.CO.6)
8. Describe a sequence of transformations that will carry congruent images onto each other (G.CO.5)
9. Establish the ASA, SAS and SSS criteria for congruent triangles (G.CO.6, G.CO.7, G.CO.8)
10. Explore compass and straightedge constructions to construct rhombuses, squares, parallelograms, equilateral triangles and inscribed hexagons (G.CO.12, G.CO.13)
11. Examine how compass and straightedge constructions produce desired objects (G.CO.12, G.CO.13)
12. Write procedures for compass and straightedge constructions (G.CO.12, G.CO.13)

C.   Connecting Algebra and Geometry
1. Use coordinates to find distances and determine the perimeter of geometric shapes (G.GPE.7)
2. Prove slope criteria for parallel and perpendicular lines (G.GPE.5)
3. Use coordinates to algebraically prove geometric theorems (G.GPE.4)

4. Write the equation $f(t) = m(t) + k$ by comparing parallel lines and finding k
(F.BF.3, F.BF.1, F.IF.9)
5. Determine the transformation from one function to another
(F.BF.3, F.BF.1, F.IF.9)
6. Translate linear and exponential functions using multiple representations
(F.BF.3, F.BF.1, F.IF.9)

D. Modeling Data
1. Use context to describe data distributions and compare statistical representations
(S.ID.1, S.ID.3)
2. Describe data distributions and compare two or more data sets (S.ID.1, S.ID.3)
3. Interpret two-way frequency tables (S.ID.5)
4. Use context to interpret and write conditional statements using relative frequency
tables (S.ID.5)
5. Develop an understanding of the value of the correlation coefficient (S.ID.8)
6. Estimate correlation and lines of best fit. Compare to the calculated results of
linear regressions and the correlation coefficient (S.ID.7, S.ID.8)
7. Use linear models of data and interpret the slope and intercept of regression lines
with various units (S.ID.6, S.ID.7, S.ID.8)
8. Use residual plots to analyze the strength of a linear model for data (S.ID.6)

III. ACCOUNTABILITY DETERMINANTS

A. Key Assignments
1. In the task "Taking Sides" from Number and Quantity Unit, students extend work
with solving linear equations to solving linear inequalities in one variable and to
solving literal equations that are linear in the variable being solved for.
2. In the task "Taken Out of Context" from Systems of Equations and Inequalities
Unit, students complete a strategy for solving a system of linear equations to a
situation that contains three equations and three unknowns.
3. In the task "I Know...What Do You Know?" from Arithmetic and Geometric
Sequences Unit, students practice their fluency in using various representations for
both arithmetic and geometric sequences.
4. In the task "Up a Little, Down A Little" from Linear and Exponential Functions Unit,
students consider how a percent change is written in a formula in both an
exponential growth and decay situation; in addition, a formula for depreciation.
5. In the task "To Function Or Not To Function" from Features of Functions Unit,
students determine whether or not each situation is a function, then justify their
answer.
6. In the task "More Things Under Construction" from Congruence, Constructions and
Proof Unit, students create additional construction strategies that are based on the
properties of quadrilaterals, congruent triangles, and rigid-motion transformations
such as constructing an equilateral triangle, a parallelogram and a hexagon
inscribed in a circle. Students are able to construct all other prior basic
constructions on segments, angles, parallel and perpendicular lines.
7. In the task "Shifting Functions" from Connecting Algebra and Geometry Unit,
students solidify their understanding of vertical transformations of exponential
functions then practice shifting linear and exponential functions by writing function
transformations using function notation.

8. In the task "Making More $" from the Modeling Data Unit, students use graphing calculators (or the GeoGebra software) to estimate and calculate correlation coefficients. They estimate lines of best fit and then compare them to the calculated linear regression. This task will demonstrate the dangers of using a linear model to extrapolate well beyond the actual data and use the correlation coefficient and scatter plot to determine the appropriateness of a linear model.

B. Assessment Methods
1. Daily Student Observations, Classroom Participation, Effort and Achievement
2. Classwork/Homework
3. Performance Tasks
4. Projects
5. Quizzes
6. End of Unit Tests
7. Semester Final Exams
8. District-wide Benchmark Exams

IV. INSTRUCTIONAL MATERIALS AND METHODOLOGIES

A. Required Textbook(s)
Bellman, Allan, et al. California Algebra 1. Boston: Pearson Prentice Hall, 2009

B. Supplementary Materials
1. Hendrickson, Honey, et al. Secondary One Mathematics: An Integrated Approach. Mathematics Vision Project, 2013. This is an e-book located at http://www.mathematicsvisionproject.org
2. Holt McDougal, Explorations in CORE Math for Common Core Algebra 1. Houghton Mifflin Harcourt Publishing Company, 2010
3. www.geogebra.org
4. www.illustrativemathematics.org

C. Instructional Methodologies
1. Guided Inquiry
2. Direct Instruction
3. Cooperative Learning
4. Discourse
5. Problem-Based Learning
6. Visual Representations and Concrete Models