Course of study- Algebra 1-2

1. **Introduction**: Algebra 1-2 is a course offered in the Mathematics Department. The course will be primarily taken by students in Grades 9 and 10, but since all students must take this course to graduate from high school the course may contain 11th and 12th graders as well. The course is a two semester course.

2. **Course Description**

- Common Core Algebra is a one year algebra course which covers the state of California Common Core Math State Standards (CaCCSS-M) for the first year of algebra. Over the course of the year, students will participate in a broad range of instructional experiences using a variety of methods including the Common Core mathematical practices.   The course is rigorous and demanding.   The essential program goals are linear functions, quadratic functions, systems of linear equations, exponential functions, and single variable statistics. Successful completion of this course will prepare students for geometry and the second year of algebra. The intended audience is for all students who have the following prerequisite skills and who have yet to complete their graduation requirement of a full year of algebra.
  The Common Core Mathematical Practices are:
  > *Make sense of problems and persevere in solving them.*
  > *Reason abstractly and quantitatively.*
  > *Construct viable arguments and critique the reasoning of others.*
  > *Model with mathematics.*
  > *Use appropriate tools strategically.*
  > *Attend to precision.*
  > *Look for and make use of structure.*
  > *Look for and express regularity in repeated reasoning.*

3. **Prerequisite skills and knowledge suggested for success in the course:**

- Simplify Expressions-use the Distributive Property, order of operations, and algebraic properties to reorganize algebraic expressions into more useful form.
- 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.
- Add, subtract, multiply, and divide rational numbers and take positive rational numbers to whole-number powers.
- Convert fractions to decimals and percent and use these representations in estimations, computations, and applications.
- Combine like terms.
- Solve multi-step equations and simple word problems for one variable. Students should be able to check the solution for accuracy and reasonableness.
- Graph a line using a table of values.
- Graph a line in $y = mx + b$ form.
- Understand slope as a concept of constant change.
- Understand the x, y plane and how to plot a point.
- Analyze problems by identifying relationships, distinguishing relevant information, identifying missing information, sequencing and prioritizing information, and observing patterns.

Justification: Algebra is a challenging course that requires students to have a solid foundation in number sense and solving equations. Students must also understand the x-y coordinate system, how to plot points, and graph lines. These prerequisite skills will allow the focus of the course to be on learning the course goals.

4**. List of program goals/learning outcomes to be met.**

- **Goal-1**: Students will have the ability to graph, interpret and write equations of linear functions.
- **Goal-2**: Students will be able to solve and graph a quadratic equation.
- **Goal-3**: Students will be able to use various methods for solving systems of equations.
- **Goal-4**: Students will have the ability to graph, interpret, and write equations of exponential functions.
- **Goal-5**: Students will have the ability to graph, summarize and analyze data on a single count or measurement variable.

5. **Learning progressions and proficiency scales** aligned with the program goals listed above

Goal 1: Students will have the ability to graph, interpret and write equations of linear functions.

Advanced Content (4.0): What is the more complex use of content knowledge or skill required of students to master this goal?	Given a scenario, students will be able to graph and find a linear equation that models the data. Students will be able to use the model to answer all relevant questions pertaining to the problem.
Target Content (3.0): What is the specific target content knowledge or skill required of students to progress towards master of this goal?	Students can interpret the slope and y-intercept of a given equation in context to a scenario. Students can determine whether or not a set of data is linear. Students can write the equation of a line through 2-points.
Emerging Content (2.0): What basic terminology, specific facts, or simple ideas are required for students to progress toward mastery of this goal?	Students can write the equation of a line that is already graphed. Students can graph a line whose equation is given in any form. Students can calculate the slope from points or a graph, including slope that is zero or undefined.
Basic Content (1.0): Students understand only basic knowledge of the content.	Student can sometimes graph a line whose equation is given, but are unable to graph lines in all forms. Student can calculate the slope on occasion, but has difficulty when the points have negatives or calculates the slope as the change in x over the change in y.
Below Basic Content (0.0): Even with help, student has no understanding of the concept. Student demonstrates need for additional support in gaining the basic or prerequisite skill.	

Goal 2: Students will be able to solve and graph a quadratic equation.

Advanced Content (4.0): What is the more complex use of content knowledge or skill required of students to master this goal?	Students will be able to write quadratic equations that model a scenario. Students will interpret and be able to answer questions about these situations.
Target Content (3.0): What is the specific target content knowledge or skill required of students to progress towards master of this goal?	Students will solve quadratic equations by different methods including factoring and the quadratic formula. Students will be able to graph a quadratic function that is given in any form. 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.
Emerging Content (2.0): What basic terminology, specific facts, or simple ideas are required for students to progress toward mastery of this goal?	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.
Basic Content (1.0): Students understand only	Students can determine which functions are quadratic. Students can graph using a table of values.

basic knowledge of the content.	Students will understand that the graph of a quadratic function will be a parabola.
Below Basic Content (0.0): Even with help, student has no understanding of the concept. Student demonstrates need for additional support in gaining the basic or prerequisite skill.	

Goal 3: Students will be able to use various methods for solving systems of equations.

Advanced Content (4.0): What is the more complex use of content knowledge or skill required of students to master this goal?	Students will be able to write equations that are linear or quadratic to model a scenario. Students can find the points of intersection using algebra techniques and the graphing calculator. Students interpret the meaning of the point(s) of intersection in context and understand when one or more than one solution is not possible.
Target Content (3.0): What is the specific target content knowledge or skill required of students to progress towards master of this goal?	Students can algebraically solve a system of two lines or a line and a quadratic. Students can graphically solve a system of two lines or a line and a quadratic. Students can set up, solve, and interpret systems of linear equations that solve a "real life" situation.
Emerging Content (2.0): What basic terminology, specific facts, or simple ideas are required for students to progress toward mastery of this goal?	Students understand that a solution to a system could be a finite set of points, infinitely many points, or no points. Students can solve systems of linear equations using an algebraic method or by graphing.
Basic Content (1.0): Students understand only basic knowledge of the content.	Given the graph of the system, the student can identify the solution. Student "solves" the system by giving a one variable solution only. Student can use the substitution method when both equations are in "y = …" form, but not when the student has to solve for a variable in order to substitute.
Below Basic Content (0.0): Even with help, student has no understanding of the concept. Student demonstrates need for additional support in gaining the basic or prerequisite skill.	

Goal 4: Students will have the ability to graph, interpret, and write equations of exponential functions.

Advanced Content (4.0): What is the more complex use of content knowledge or skill required of students to master this goal?	Given multiple sets of exponential data, students can write equations, graph the data, and use the model or graph to questions.
Target Content (3.0): What is the specific target content knowledge or skill required of students to progress towards master of this goal?	Given a set of data, students will be able to clearly explain whether the data models linear or exponential growth. Students can write the equation of an exponential function from a graph or table.

	Students can graph an exponential function given an equation or table.
	Students can identify the domain and range from an exponential graph.
Emerging Content (2.0): What basic terminology, specific facts, or simple ideas are required for students to progress toward mastery of this goal?	Students understand the difference between exponential growth and decay.
	Students understand each variable in the equation $f(x)=ar^x$
Basic Content (1.0): Students understand only basic knowledge of the content.	Students can recognize an exponential function from its graph Students can recognize an exponential function from its equation.
Below Basic Content (0.0): Even with help, student has no understanding of the concept. Student demonstrates need for additional support in gaining the basic or prerequisite skill.	

Goal 5: Students will have the ability to graph, summarize and analyze data on a single count or measurement variable.

Advanced Content (4.0): What is the more complex use of content knowledge or skill required of students to master this goal?	Students compare and contrast the key features of a distribution for two or more groups of data.
	Students understand how making changes to a data set affects the key features of its distribution.
Target Content (3.0): What is the specific target content knowledge or skill required of students to progress towards master of this goal?	Students can identify and interpret key features of graphical displays for numeric data including shape, center, spread, gaps, clusters and extreme points.
	Students can determine mean, standard deviation and five-number summaries for data sets. They can also recognize which measures are appropriate given the shape of a distribution.
Emerging Content (2.0): What basic terminology, specific facts, or simple ideas are required for students to progress toward mastery of this goal?	Students represent data with plots on the real number line (dot plots, stem-and-leaf plots, histograms, box plots).
	Students can identify variables as categorical or numerical and select and appropriate display for the data.
Basic Content (1.0): Students understand only basic knowledge of the content.	Students can read plots on a number line. The student can answer basic questions if shown a dot-plot or stem-and-leaf plot.
Below Basic Content (0.0): Even with help, student has no understanding of the concept. Student demonstrates need for additional support in gaining the basic or prerequisite skill.	

6. **Suggested scope and sequence of Curriculum**

Linear Functions:

- Determine which linear growth situations are discrete and which are continuous. Recognize appropriate domain for given linear functions.
- Recognize if a function exhibits linear behavior by graph, equation, table, or verbal description
- Compare properties of two functions each represented in a different way (algebraically, graphically, numerically

in tables, or verbal description)
- Calculate and/or interpret intercepts, graph linear functions using intercepts
- Calculate and interpret the slope (rate of change) of a function. Estimate slope from a graph.
- Graph a line using slope and y-intercept when equation is given in any form
- Create equations in two variables to represent relationships between quantities
- Determine if a given point is on a line
- Write the equation of line given two points
- Relate table, graph and equation of a linear function
- Use point-slope to write equations of linear functions
- Understand the relationship between parallel and perpendicular lines. Emphasize visual aspect and relationship between slopes.
- Understand the relationship between the slope, the graph, and the equation of horizontal and vertical lines

Systems of Linear Functions and Systems of Linear Inequalities:

- Solve systems of linear equations exactly and approximately. Use graphing, substitution and elimination.
- Solve word problems by writing a system of equations
- Graph the solutions to a linear inequality or to a system of linear inequalities

Exponents and Polynomials:

- Simplify exponential expressions, including scientific notation
- Perform operations with polynomials (addition, subtraction, multiplication, monomial division)
- Rewrite special products of binomials
- Factor using GCF
- Factor trinomials in the form $ax^2 + bx + c$ for $a = 1$ and $a > 1$
- Factor by grouping

Quadratics:

- Graph quadratic functions by understanding the parent graph and transformations
- Interpret key features of a quadratic function given graphically or in a table
- Graph quadratic functions given in standard form by finding key features; intercepts, axis of symmetry, vertex, and stretch factor.
- Solve quadratic equations by graphing, taking square roots, the quadratic formula and factoring, as appropriate
- Write quadratics in standard form
- Complete the square to get standard form into vertex form
- Solve and graph systems of linear and non-linear equations

Exponential Functions:

- Graph exponential functions
- Construct exponential functions given a graph, a description of a relationship, or two input-output pairs
- Distinguish between situations that can be modeled with linear functions and with exponential functions
- Describe a relationship given a graph or sketch a graph given a description (linear, quadratic, exponential, absolute value)

Data Analysis and Probability:

- Represent data with plots on the real number line (dot plot, histograms, and box plots)
- Use statistics appropriate to the shape of the data distribution to compare center (median, mean) of two or more different data sets
- Interpret differences in shape, center, and spread in the context of the data sets, accounting for outliers.

Overview of Graphing Goals for all Functions:

- Identify key features which include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums, symmetries
- Identify key features above within mathematical modeling problem (projectile motion, etc)
- Understand that the graph of an equation in two variables is the set of all solutions plotted in the coordinate plane, often forming a curve (which could be a line)
- Understand that a function from one set (domain) to another set (range) assigns to each element of the domain

exactly one element of the range
- Distinguish between discrete and continuous functions
- Use function notation with equations and graphs, $f(3) = \underline{\hspace{1cm}}$ and $f(x) = 4$
- Apply context of modeling problem with function notation.
- Recognize that sequences are functions whose domain is the subset of the integers. Focus on arithmetic sequences.

7. **Suggested textbook(s), materials, equipment and resources**

No new common core books have been approved at this time.

8. **Requirements satisfied** (A-G, grad requirement)

9. **Appendix** to contain a sample unit of study and assessment(s)

Stage 1 – Desired Results

Established Goal(s):
Students will know and be able to apply the laws of exponents to simplify expressions containing exponents.
Students will be able to model a pattern exhibiting exponential growth or decay using exponential functions.
Students will be able to graph an exponential function.

Understanding(s):	Essential Question(s):
Students will understand that…	How can the properties of exponents be used to simplify and/or solve real-life problems, such as calculating the interest earned on an investment or the depreciated value of a car?
Patterns exist when multiplying or dividing the same base raised to different exponents, and that these patterns are known as the laws of exponents.	
The value of a base raised to the zero exponent equals one.	How is exponential growth or decay modeled mathematically?
Exponential functions can be used to make predictions or understand past behavior.	
Student will know…	***Students will be able to…***
Laws of exponents	**Evaluate** exponential expressions
Exponential Functions	**Apply** the laws of exponents
Growth Factor	**Simplify** expressions containing multiple exponents
Decay Factor	**Create** a mathematical model to describe exponential growth or decay
Effect of a zero exponent	**Graph** exponential functions
	Translate the output from an exponential function into words.

Stage 2 – Assessment Evidence

Performance Task(s):	Other Evidence:
Openers and alternate openers	Class Notes
Penny decay graph – exponential decay (lab)	White Boards
Poster on growth or decay of a population (project)	Warm-ups
	Homework assignments.
	Unit test and quizzes

Stage 3 – Learning Plan

Learning Activities:

Discover laws of exponents worksheet
Which prize on day 20? Prize A: start with $100 and add $100 each day or Prize B: start with $0.01 and double it each day?
Book assignments to practice skill