**Algebra 2 – UNIT 1**
**Model and Reason with Equations and Expressions**

**Critical Area**: Students use reasoning to analyze equations/ inequalities and develop strategies for solving them. Through reasoning students develop fluency writing, interpreting, analyzing and translating between various forms of linear equations and inequalities. By exploring a question about the world around them (mathematical modeling) and attempting to answer the question students expand the scope of algebraic operations to solve a wide variety of linear and quadratic real world problems. Students explain why the x-coordinates of the points where the graphs $y = f(x)$ and $y = g(x)$ intersects and explore cases involving polynomial, rational, absolute value, exponential, and logarithmic functions.

| CLUSTERS | COMMON CORE STATE STANDARDS |
|---|---|
| **(m)Create equations that describe numbers or relationships.** | **Algebra – Creating Equations**<br>**A-CED.1**. Create equations and inequalities in one variable **including ones with absolute value** and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. **CA** ★<br><br>**A-CED.2**. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★<br><br>**A-CED.3**. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.<br><br>**A-CED.4**. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. ★ |
| **(m)Understand solving equations as a process of reasoning and explain the reasoning.** | **Algebra – Reasoning with Equations and Inequalities**<br>**A-REI.2.** Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. |
| **(m)Solve equations and inequalities in one variable.** | **A-REI.3.1.** Solve one-variable equations and inequalities involving absolute value, graphing the solutions and interpreting them in context. CA |
| **(m)Represent and solve equations and inequalities graphically.** | **A-REI.11.** Explain why the $x$-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★ |
| MATHEMATICAL PRACTICES | |
| 1. **Make sense of problems and persevere in solving them.**<br>2. **Reason abstractly and quantitatively.**<br>3. **Construct viable arguments and critique** | As you begin the year, it is advised that you start with MP1 and MP 3 and MP4 to set up your expectations of your classroom. This will help you and your students become proficient in the use of these practices. All other practices may be evident based on tasks and classroom activities. |

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| **the reasoning of others.**<br>**4. Model with mathematics.**<br>5. Use appropriate tools strategically.<br>6. Attend to precision.<br>**7. Look for and make use of structure.**<br>8. Look for and express regularity in repeated reasoning. | |

PROGRESSION

Draft High School Progression on Algebra
http://opi.mt.gov/PDF/CCSSO/MCCS-MATH/STAGE1/Resources/2012_12-04Draft-High-School-Progression-Algebra.pdf

Draft High School Progression on Modeling
http://commoncoretools.me/wp-content/uploads/2013/07/ccss_progression_modeling_2013_07_04.pdf

**(m) Major Clusters – area of intensive focus where students need fluent understanding and application of the core concepts.**

**(S) Supporting/Additional Clusters – designed to support and strengthen areas of major emphasis/expose students to other subjects.**

**★Indicates a modeling standard linking mathematics to everyday life, work, and decision-making.**

**(+) Indicates additional mathematics to prepare students for advanced courses.**

| ENDURING UNDERSTANDINGS | ESSENTIAL QUESTIONS | KEY VOCABULARY |
|---|---|---|
| • Different types of relationships between quantities can be modeled with different types of functions.<br>• Graphs are visual representations of solution sets of equations and inequalities.<br>• The arithmetic of rational expressions is governed by the same rules as the arithmetic of rational numbers. | 1) What relationships between quantities can be modeled by functions?<br>2) What does it mean to solve equations graphically?<br>3) What are the similarities and differences between linear, quadratic, and exponential functions?<br>4) What do extraneous solutions represent?<br>5) How does the arithmetic of rational numbers relate to simplifying rational expressions? | • absolute value<br>• constraints<br>• equations<br>• equivalent<br>• exponential<br>• expressions<br>• extraneous<br>• functions<br>• inequalities<br>• Linear<br>• modeling<br>• quadratic<br>• quantities<br>• radical Equations<br>• rational equations |

| RESOURCES | INSTRUCTIONAL STRATEGIES | ASSESSMENT |
|---|---|---|
| **LAUSD Adopted Textbooks and Programs**<br>• Big Ideas Learning - Houghton Mifflin Harcourt, 2015: Big Ideas Algebra 2<br>• College Preparatory Mathematics, 2013: Core Connections, Algebra 2<br>• The College Board, 2014:Springboard Algebra 2<br><br>**Illustrative Mathematics**<br>• Buying a Car: A-CED.1 http://www.illustrativemathematics.org/illustrations/582<br>• Basketball: A-CED.1 & A-REI.2 http://www.illustrativemathematics.org/illustrations/702<br>• How Much Folate: A-CED.2 http://www.illustrativemathematics.org/illustrations/1351<br>• Dimes and Quarters: A-CED.2 & A-CED.3 http://www.illustrativemathematics.org/illustrations/220<br>• Growing Coffee: A-CED.3<br>• http://www.illustrativemathematics.org/illustrations/611<br>• Bernado and Sylvia Play a Game: A-CED.3 http://www.illustrativemathematics.org/illustrations/1010<br>• Clea on an Escalator: A-CED.2 http://www.illustrativemathematics.org/illustrations/1003<br>• Equations and Formulas: A-CED.4 http://www.illustrativemathematics.org/illustrations/393<br>• Radical Equations: A-REI.2 http://www.illustrativemathematics.org/illustrations/391<br>• Introduction to Polynomials - College Fund: A-REI.11 http://www.illustrativemathematics.org/illustrations/1551 | Most standards in the Creating Equations domain carry a modeling star, denoting their connection with the Modeling category in high school. Therefore mathematical Modeling needs to be at the forefront of conversation with students. For example, equations in high school are also more likely to contain parameters that equations in earlier grades, and so interpreting a solution to an equation might involve more than consideration of a numerical value, but consideration of how the solution behaves as the parameters are varied.<br><br>Provide examples of real-world problems that can be modeled by writing an equation or inequality. Begin with simple equations and inequalities and build up to more complex equations in two or more variables that may involve quadratic, exponential or rational functions.<br><br>Give students examples of real-world problems that can be solved by writing an equation, and have students explore the graphs of the equations using technology application to determine which parts of the graph are relevant to the problem context.<br><br>Provide visual examples of radical and rational equations with technology so that students can see the solution as the intersection of two functions and further understand how extraneous solutions do not fit the model.<br><br>Have students use technology to graph and explore functions. Discuss the meaning of parameters in the graph including the table, the curves, and the solution to the equation. Have students investigate real-world examples of two-dimensional inequalities.<br><br>An instructional conversation with all students, in particular English learners will benefit from scaffolds that promote use of academic language. Mathematically Speaking is a scaffold that may be used. http://camsp.net/documents/NCTM-SpeakingArticle.pdf | Formative Assessment<br><br>LAUSD Assessments<br><br>The district will be using the SMARTER Balanced Interim Assessments. Teachers would use the Interim Assessment Blocks (IAB) to monitor the progress of students. Each IAB can be given twice to show growth over time.<br><br>State Assessments<br><br>California will be administering the SMARTER Balance Assessment as the end of course for grades 3-8 and 11. There is no assessment for Algebra 1.<br>The 11th grade assessment will include ítems from Algebra 1, Geometry, and Algebra 2 standards. For examples, visit the SMARTER Balance Assessment at: http://www.smarterbalanced.org/ |

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| **Illustrative Mathematics**<br>• Growth Rate: Given growth charts for the heights of girls and boys, students will use slope to approximate rates of change in the height of boys and girls at different ages. Students will use these approximations to plot graphs of the rate of change of height vs. age for boys and girls. http://illuminations.nctm.org/LessonDetail.aspx?id=L668 | | |

LANGUAGE GOALS for **low achieving, high achieving, students with disabilities and English Language Learners**

Writing:

1) Students will explain and justify the process of solving equations using key vocabulary and multiple representations.
   *Example:* I solved for the variable by _____. This means that I will multiply 1500 by 3 to get the number of votes Candidate

2) Compare and contrast the differences and similarities between linear, quadratic, and exponential relationships.
   *Example:*
3) Students will write a summary of the relationship between two variables.
   *Example: The rate of change of* _____ *and* _____ *is* _____.

Listening and Speaking:

1) Students will generate class discussions using specific vocabulary related to solving a wide variety of linear, quadratic, and exponential applications.
2) Students will explain and justify how to solve an equation to a partner as well as restating and summarizing their partner's explanation.
   *Example: First I* _____ *because* _____*, second I* _____ *because*_____*,…*

Reading:

1) Students will identify the relevant information and details in a passage that help them solve mathematical problems

PERFORMANCE TASKS

**Mathematics Assessment Project**

- Solving Linear Equations in two Variables: A-CED.2, 3; MP 2,3 http://map.mathshell.org/materials/lessons.php?taskid=209#task209
- Optimization Problems: Boomerangs: A–CED.2; MP 1,2,3,4 http://map.mathshell.org/materials/download.php?fileid=1241

**Illustrative Mathematics**

- Population and Food Supply : A-REI.2, 3, 11 http://www.illustrativemathematics.org/illustrations/645

**NCTM Illuminations**

- Trout Pond Population: A-CED.2. This investigation illustrates the use of iteration, recursion and algebra to model and analyze a changing fish population. Graphs, equations, tables, and technological tools are used to investigate the effect of varying parameters on the long-term population.

http://illuminations.nctm.org/LessonDetail.aspx?ID=L476

- Exploring Linear Data: A-CED.2. Students model linear data in a variety of settings that range from car repair costs to sports to medicine. Students work to construct scatterplots, interpret data points and trends, and investigate the notion of line of best fit. http://illuminations.nctm.org/LessonDetail.aspx?id=L298

**DIFFERENTIATION**

| UDL/FRONT LOADING | ACCELERATION | INTERVENTION |
|---|---|---|
| • Involve students to have a discussion that center around extending their knowledge of creating and analyzing linear equations and inequalities pairs of simultaneous linear equations. Have them use their prior knowledge of graphing linear equations to approaching system of linear and quadratic equations with two variables.<br>• Engage students in an activity that would involve comparing linear equations with quadratics equations, and then quadratics equations and exponential equations.<br>• Have students match linear, quadratic, and exponential functions with their graphs, tables, and equations. | Provide examples of real-world problems that can be modeled by writing linear, polynomial, rational, absolute value, exponential, and logarithmic functions. Have students use technology to graph the functions, make tables of values, or find successive approximations resulting from the function. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.<br><br>Give students examples of real-world problems that can be solved by writing an equation, and have students explore the graphs of the equations using technology application to determine which parts of the graph are relevant to the problem context.<br><br>Have students write a system of two equations in two variables where one equation is quadratic and the other is linear such that the system has no solution. Explain, using graphs, algebra and/or words, why the system has no solution. | Show students how to create numerical equations and then introduce linear equations in one variables. Students can make comparisons using the numerical and linear equations.<br><br>For graphing, have students make a T-chart of the equations, graph them and them analyze, find the intersection of the equations, and then explain what that means. Include a case where they would compare simple linear and quadratics equations, e.g. $y=2x$ and $y=x^2$ |

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