Algebra 1 - Unit 4
Expressions and Equations

Description of the critical area: In this unit, students build on their knowledge from Unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of numbers and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions and determine the values of the function it defines. Students understand that polynomials form a system analogous to the integers, they choose and produce equivalent forms of an expression.

CLUSTERS	COMMON CORE STATE STANDARDS
(m)Interpret the structure of expressions.	**Algebra - Seeing Structure in Expressions** A-SSE.1 Interpret expressions that represent a quantity in terms of its context.★ a. Interpret parts of an expression, such as terms, factors, and coefficients. b. 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. *For example, see x4 – y4 as* $(x^2)^2 - (y^2)^2$*, thus recognizing it as a difference of squares that can be factored as* $(x^2 - y^2)(x^2 + y^2)$*.*
(m)Write expressions in equivalent forms to solve problems.	**Algebra - Seeing Structure in Expressions** 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. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression 1.15t can be rewritten as* $(1.15^{1/2})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*
(m)Perform arithmetic operations on polynomials.	**Algebra – Arithmetic with Polynomial and Rational Expressions** 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.
(m)Create equations that describe numbers or relationships.	**Algebra - Creating Equations** A-CED.1 Create equations and inequalities in one variable and use them to solve problems. *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

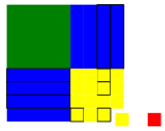
CLUSTERS	COMMON CORE STATE STANDARDS
	between quantities; graph equations on coordinate axes with labels and scales. A-CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*
(m)Solve equations and inequalities in one variable.	**Algebra - Reasoning with Equations and Inequalities** A-REI.4 Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. 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. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.
(s)Solve systems of equations.	**Algebra - Reasoning with Equations and Inequalities** A-REI.5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. 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. *For example, find the points of intersection between the line $y = –3x$ and the circle $x^2 + y^2 = 3$.*
MATHEMATICAL PRACTICES	
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.	Emphasize Mathematical Practice 1, 2, 4, and 7 in this unit.
LEARNING PROGRESSIONS	
Progression to Algebra Progression on HS Math (Functions) - http://commoncoretools.me/wp-content/uploads/2012/12/ccss_progression_functions_2012_12_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
• Represent a quantity in terms of an expression, such as terms, factors, and coefficients by viewing one or more of their parts as a single entity. • Write in equivalent forms to find solutions that reveal and explain properties of quadratic expressions from completing the square, factoring, and using properties of exponents. • Apply rules so that polynomials form a system analogous to integers. • Represent equations and inequalities in one variable in various ways and use them to solve problems. • Understand the relationship between quantities of two or more variables through graphing on a coordinate plane system. • Transform quadratic equations using the method of completing the square to derive a solution. • Recognize the various methods to solve quadratic equations stemming from an initial form as appropriate: taking the square root, completing the square, using the quadratic formula, and factoring. • Identify when the quadratic formula gives complex solutions. • Solve systems of linear equations in two variables algebraically and graphically	1. How will students identify the different parts of an expression and explain their meaning within the context of the problem? 2. What is the importance of identifying the structure of an expression and ways to rewrite it? 3. Why is it important to solve and produce equivalent forms of an expression? 4. When is factoring the best method to solve a quadratic equation? 5. When is completing the square useful to reveal the maximum or minimum value of the function it defines? 6. How do students know which method to use in solving quadratic equations? 7. Why is it important to know the operations of integers to understand the properties of polynomials? 8. How can students analyze algebraic equations/inequalities to solve problems? 9. What must students understand in order to create equations that describe numbers or relationships? 10. How do students know which is the most efficient ways to solve a quadratic equation? 11. Why is it important to understand solving a system of linear and quadratic equations in two variables algebraically and graphically? 12. How are the methods of solving a quadratic equation related? 13. How do students know when the roots of a quadratic equation are real or complex? 14. Why are the methods of solving quadratic equations not learned in isolation?	• Analogous • complex • coefficient • coordinate • equation • equivalent • exponentials • expression • factors • function • inequalities • interpret • intersection • linear • polynomial • product • quadratic • quantity • term • transform • variable

RESOURCES	INSTRUCTIONAL STRATEGIES	ASSESSMENT
LAUSD Adopted Textbooks and Programs • Big Ideas Learning - Houghton Mifflin Harcourt, 2015: Big Ideas Algebra I • College Preparatory Mathematics, 2013: Core Connections, Algebra I • The College Board, 2014:Springboard Algebra I **Enage New York** Algebra I Module 4: Polynomial and Quadratic Expressions, Equations, and Functions **Illustrative Mathematics** http://www.illustrativemathematics.org/standards/hs http://www.wiki-teacher.com/ Math Resources – algebra **Mathematics Assessment Projects (MARS Tasks)** http://map.mathshell.org/materials/tasks.php Algebra lessons	• Have students create multiple ways to rewrite an expression that represents its equivalent form. Have them understand the notion of equivalent expression and the solution to an equation. Help them to understand that an equation in two variables can sometimes be viewed as defining a function, if one of the variables is designated as the input variable and the other as the output variable, and if there is just one output for each input. This is the case if the expression is of the form y = (expression in x) or if it can be put into the form by solving for y. • The use of algebraic tiles to establish a visual understanding of algebraic expression and the meaning of terms, factors, and coefficients can be effective. • The development and proper use of mathematical language (ie: Frayer Model, Word Wall, using real world context) could be used to introduce new terms. • Engage students in various techniques for solving quadratic equations and the relationship between those techniques (A-REI.4.a-b). Teach students to make use of the symmetric and transitive properties, and certain properties of equality with regards to operations (e.g. "equals added to equals is equal") when solving equations. This approach would enable students to establish the idea of proof, while not explicitly named, is given a prominent role in the solving of equations, and the reasoning and justification process is not simply relegated to a future mathematics course. • Tile representations of quadratics illustrate that the process of completing the square has a geometric interpretation that explains the origin of the name. Encourage students to explore these representations in order to make sense out of the process of completing the square (MP.1, MP.5). Completing the square is an example of a theme that reoccurs throughout algebra: finding ways of transforming equations into certain standard forms that have the same solutions.	**Formative Assessment** **LAUSD Assessments** 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. **State Assessments** 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. The 11th grade assessment will include ítems from Algebra 1, Geometry, and Algebra 2 standards. For examples, visit the SMARTER Balance Assessment at: SBAC - http://www.smarterbalanced.org/

RESOURCES	INSTRUCTIONAL STRATEGIES	ASSESSMENT
	Completing the Square: The method of completing the square is a useful skill in Algebra. It is generally used to change a quadratic in standard form, $ax^2 + bx + c$, into one in vertex-form, $a(x - h)^2 + k$. The vertex form can help determine several properties of quadratic functions. Completing the square also has applications in Geometry (G-GPE.1) and later higher mathematics courses. **Example:** To complete the square for the quadratic $y = x^2 + 8x + 15$, we take half the coefficient of the x-term and square it to yield 16. We realize that we need only to add 1 and subtract 1 to the quadratic expression: $y = x^2 + 8x + 15 + 1 - 1 = x^2 + 8x + 16 - 1$. Factoring gives us $y = (x + 4)^2 - 1$. In the picture, note that the tiles used to represent $x^2 + 8x + 15$ have been rearranged to try to form a square, and that a positive unit tile and a "negative" unit tile are added into the picture to "complete the square." 	

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

Students will be able to compare and contrast the various methods of solving a quadratic equation.
Example: To solve this quadratic equation, I use_____ instead of _____ because_____.

Students will be able to explain (orally and in writing) their understanding of the properties of the quantity represented in terms of their context.
Example: x2 + 6x + 9 = _____.

Students will be able to read a word problem and identify the language need to create an algebraic representation in order to solve the problem.
Example:

Students will explain the use of the _____method to find the solution of the quadratic equation. (writing/speaking)
Example: To solve this quadratic equation, I use_____ because_____.

Students will be able to understand the vocabulary for the parts that make the whole expression/equation and be able to identify their parts and interpret their meaning in terms of a context.
Example: Using the Frayer Model to introduce students to understand the difference between the parts of an expression and that of an equation.

PERFORMANCE TASKS

Mathematics Assessment Project – MARS Task

- Interpreting Algebraic Expressions - A.SSE.1-2:
- Solving Linear Equations in Two Variables – A.REI.5-7:
- Sorting Equations and Identities – A.SSE.1-3, A.REI.4:

DIFFERENTIATION📖		
UDL/FRONT LOADING	ACCELERATION	INTERVENTION
• Have students apply their understanding of expressions as sums of terms and products of factors to find and use the properties of operations to find the values of numerical expressions. • Engage students in a discussion regarding applying their prior knowledge about the order of operations and properties of operations to transform simple expressions. Transformations require an understanding of the rules for multiplying negative numbers, and properties of integer exponents. • Involve students to have a discussion that would have them extend their knowledge of analyzing and solving linear equations and pairs of simultaneous linear equations. Have them use their prior knowledge of graphing proportional relationships, lines, and linear equations to approaching system of linear and quadratic equations with two variables.	• Provide the students with a problem (either quadratic equation or system of linear equations), ask them to solve it by different methods (for system: algebraic methods – elimination, substitution, addition, etc. and graphing; for quadratics – factoring, completing by square, quadratic formula, graphing), then have them write an explanation of which method was most relevant to the problem type. • Take students through the process of designing word problems involving quadratic equations and functions. Have students write a scenario and explain the process needed to solve a system of linear and quadratic equations with two variables. • Create a real world problem where factoring is the best method to solve a quadratic expression. Have students apply their math knowledge of quadratic equations to solve a word problem they have created.	• Use of real context examples to demonstrate the meaning of quadratics equation, such rocket trajectory, basketball path when thrown to the hoop, etc. • Have students use technology, such as graphing calculator, graphing apps, and other software to graph both a linear function and quadratic function on the same plane. Engage them in a discussion to identify the point of intersection of the linear graph and the quadratics graph and discuss what that means. • Provide a situation that uses realia to further demonstrate the meaning of quadratic equation.