High School Course Description for **Algebra 2**

Course Title: Algebra 2

Course Number: MTH 203, 204, 263, 264, 283, 284, 2031, 2032, 2033, 2034

Grade Level: 9-12

Meets a UC a-g Requirement: Yes – C

Curricular Area: Mathematics

Length: One year

Prerequisites: Algebra I and Geometry with a grade of "C" or better. First semester with a grade of "C" or better is recommended before taking second semester.

Meets High School Graduation Requirement for: Mathematics

Meets NCAA Requirement: Pending

Course Description

The purpose of the course is to extend students' understanding of functions and the real numbers, and to increase the tools students have for modeling the real world. They extend their notion of number to include complex numbers and see how the introduction of this set of numbers allows the solutions of polynomial equations and the Fundamental Theorem of Algebra. Students deepen their understanding of the concepts of functions, and apply equations solving and function concepts to many different types of functions. The system of polynomial functions, analogous to the integers, is extended to the field of rational functions, analogous to the rational numbers. Students explore the relationship between exponential functions and their inverses, the logarithmic functions. Trigonometric functions are extended to all real numbers, and their graphs and properties are studied. Finally, students' statistics knowledge is extended to understanding the normal distribution, and they are challenged to make inferences based on sampling, experiments, and observational studies.

The standards in the traditional Algebra II course come from the following conceptual categories: Modeling, Functions, Number and Quantity, Algebra, and Statistics and Probability. The topics presented in this course are weaved together throughout the year through rich instructional experiences.

Alignment

This course is aligned to the California Common Core State Standards for Algebra 2.

Instructional Materials

Required Textbook(s)	Websites	Other Materials
1. Holt	3. www.mathshell.com	5. TBD
Supplemental Materials	Software	
2. TBD	4. TBD	

Exit Criteria

Activities	Percentage
Coursework/Participation	20%
Assessments	60%
Final Examination	20%
Total:	100%

Development Team

This course of study was developed in spring 2013 by a District Transition Team comprised of teachers from all 3 high schools.

SEMESTER ONE

Key Assignments:

- **TBD**

Assessments:

- **Common Site Driven Assessments**
- **District Benchmarks**
- **District Final**

Week	
1	Unit 1: Complex Numbers
2	
3	Unit 2: Polynomials
4	
5	
6	
7	Unit 3: Graphing Polynomials
8	
9	
10	
11	
12	Unit 4: Rational and Radical Expressions and Functions
13	
14	
15	
16	
17	Review
18	Finals

SEMESTER TWO

Key Assignments:

- **TBD**

Assessments:

- **Common Site Driven Assessments**
- **District Benchmarks**
- **District Final**

Week	
1	Unit 5: Exponential and Logarithms Functions
2	
3	
4	Unit 6: Modeling with Functions
5	
6	
7	
8	
9	Unit 7: Trigonometric Functions
10	
11	
12	
13	Unit 8: Statistics and Series
14	
15	
16	
17	Review
18	Finals

CJUSD Secondary Math Unit Outline

Unit Title: Unit 1: Complex Numbers

Grade Level/Course: Algebra 2 | Approximate Length of Unit: 2 Weeks

Priority Standards	Supporting Standards
N-CN.7 Solve quadratic equations with real coefficients that have complex solutions.	**N-CN.1** Perform arithmetic operations with complex numbers. Know there is a complex number *i* such that $i^2 = -1$, and every complex number has the form $a + bi$ with *a* and *b* real. **N-CN. 2** - Use the relation i^2 = -1 and the commutative, associative and distributive properties to add, subtract, and multiply complex numbers.

What do students have to know and be able to do in order to meet the targeted standards?	
Students will know and be able to do:	
Define of *i* and i^2 Write complex numbers in Standard Form $a + bi$ Identify the real and imaginary parts of a complex number Identify pure imaginaries Evaluate powers of *i* Add, Subtract, and Multiply complex numbers Simplify square roots of negative numbers	State complex solutions of a quadratic come in pairs Solve Quadratics with real coefficients that have complex solutions by quadratic formula and by taking the square root of both sides Simplify complex solutions in standard form $a + bi$ State that the graph of a quadratic with no real solutions does not cross the x-axis

Big Ideas/Essential Understanding:	**Essential/Guiding questions:**
Perform arithmetic operations with complex numbers. Use complex numbers in polynomial identities and equations. State that the graph of a quadratic with no real solutions does not cross the x-axis.	What is the form of a complex number? How are complex numbers added, subtracted and multiplied? What is i^2? How are quadratic equations with real coefficients solved (with complex solutions)? How are the equations of quadratics with complex roots written?

Summative/End of Unit Assessment Blueprint (Include question item Types)	
	Simplify square roots with negative radicands (3) Identify real and imaginary parts (1) Add, subtract, and multiply complex numbers using properties (3-6) Evaluate powers of *i* (2) Solve quadratic with non-real solutions by taking the square root, and by quadratic formula with solutions written in standard form (2-4) Questions about understanding real and complex solutions of a quadratic graphically (2)

Summative/End of Unit Performance Task	**Project** Students will work in pairs to solve a variety of quadratic equations in context such as modeling the speed of a rocket or the position of a projectile. Students will interpret the solutions and discuss the validity of the solutions, i.e. complex solutions are not viable solutions in a modeling context. Students will present their findings to the class and will be scored based on accuracy and ability to construct arguments and justify their findings.

Scoring Criteria for Assessment	Single point items and rubric based scoring.
Scoring Criteria for Performance Task	Rubric based scoring.

What Prior Knowledge Should be Activated?	**How Will it be Activated?**
Combine like terms Perform the square root operation Add, Subtract, and Multiply square roots Properties of exponents (Product of like bases) Solving quadratics using Quadratic formula Solving quadratics by taking the square root of both sides Know Standard form of a quadratic Know Vertex form of a quadratic Properties of square roots are only defined on the real number system Terms Roots, x-intercepts, solutions, zeros (NOT Factoring Possibly)	Real numbers What is the operation of a square root? Simplify square roots Show arithmetic operations on square roots are similar to arithmetic operations on terms with a variable Review two forms of quadratic Review solving a quadratic by taking the square root of both sides and quadratic formula with real solutions and when there is not Review solutions of a quadratic graphically

Key Vocabulary		
Complex Number Imaginary Number Imaginary Unit	Imaginary Part Real Part Pure Imaginary	Conjugate Standard Form $a + bi$

Unit Sequencing:			
Show the need for complex numbers solve quadratic with non-real solutions Define i and i^2 Simplify square roots	Standard form of a complex number Real and imaginary part Arithmetic operations on complex numbers	Solve a quadratic with non-real solutions by taking the square root of both sides and quadratic formula Solutions graphically for a quadratic	Write solutions in standard form Complex solutions come in pairs

Resources/Tools	
Colored markers	Katm.org/up/common-core/
Whiteboards	Guest speakers
Whiteboard markers	Mobi
Erasers	Interwriteboard
Calculators	Document camera
Graph paper	LCD projector
Lined paper	Student response system
Colored pencils	Computer
Highlighters	Teacher textbook
Rulers	Ancillary materials
Textbooks	Oars
Smarter Balance Consortium	Zangle
Kuta software	
Pencils	
Excel spreadsheets	
Algebraic Software	
Dynamic Geometric Software	

Reflection on Best Practices (Feedback Loop)

CJUSD Secondary Math Unit Outline

Unit Title: Unit 2: Polynomials

Grade Level/Course: Algebra 2 | Approximate Length of Unit: 4 Weeks

Priority Standards	Supporting Standards
A.APR.3 - Identify zeros of polynomials when suitable factorizations are available and use the zeros to construct a rough graph of the function defined by the polynomial. **A.SSE.2** - Use the structure of an expression to identify ways to rewrite it. For example see x^4 - y^4 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) **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.	**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.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.APR.2** - Know and apply the Remainder Theorem: For a polynomial *p(x)* and a number *a*, the remainder on division by $x - a$ is *p(a)*, so *p(a)* = 0 if and only *if (x – a)* is a factor of p(x). **A.APR.4** - Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity *(x2 + y2)2 = (x2 – y2)2 + (2xy)2* can be used to generate Pythagorean triples.

What do students have to know and be able do in order to meet the targeted standards?	
Students will know:	*Students will be able to do:*
How to divide a polynomial by a binomial to find zeros How to perform operations on polynomials Parts of a polynomial expression	Identify parts of an expression, such as terms, factors, coefficients, etc… Add, Subtract, Multiply, Divide polynomials Remainder Theorem Use polynomial identities to describe numerical relationships Use the values of functions using function notation

Big Ideas/Essential Understanding:	**Essential/Guiding questions:**
Interpret the structure of expressions Write expressions in equivalent forms to solve problems. Perform arithmetic operations on polynomials Understand the relationship between zeros and factors of polynomials Use polynomial identities to solve problems Understand solving equations as a process of reasoning and explain the reasoning.	How do you interpret the parts of a polynomial expression such as terms, factors and coefficients? How can an expression be rewritten to enable factoring? How are polynomial operations performed (addition, subtraction, multiplication) What does it mean when you divide a polynomial by a binomial and there is a remainder or no remainder?

Summative/End of Unit Assessment Blueprint (Include question item Types)	Identify parts of an expression, such as terms, factors, coefficients, etc… Factor polynomials with a degree higher than 2 Add, Subtract, Multiply, Divide polynomials Remainder Theorem Find zeros by factoring Graph using zeros and end behavior Use a sign chart to determine what function values are above and below the x-axis Use polynomial identities to describe numerical relationships Use the values of functions using function notation
Summative/End of Unit Performance Task	**Project** Students are put into groups of 3 and assigned to one of the 10 problems. They simplify the problem and then classify it. The classification (such as the end behavior based on degree and leading coefficient, the number of zeros, the zeros, etc.) leads them to the next problem. If done correctly, the answer to their last problem should lead them back to where they started.

Scoring Criteria for Assessment	Single point items and rubric based scoring.
Scoring Criteria for Performance Task	Rubric based scoring.

What Prior Knowledge Should be Activated?	**How Will it be Activated?**
Term Coefficient Leading coefficient Distribution Like terms Combine like terms Degree Constant Polynomial Monomial Binomial Factor Properties of exponents Perfect square trinomial Trinomial Greatest common factor Leading coefficient Factoring Factor by grouping Difference of squares Solve quadratics	Starter questions Embedding in the lecture Review questions

Key Vocabulary		
Synthetic Division Long Division	Remainder	Closure

Unit Specific Instructional Strategies/Instructional Approach/Learning Experience
Math aerobics for parent functions

Unit Sequencing:			
Identify parts of polynomials Find the values of functions	Add, subtract, multiple, divide polynomials Factoring with degree higher than 2	Factor to find zeros Remainder theorem	Polynomial identities Compare polynomials

Resources/Tools	
Colored markers Whiteboards Whiteboard markers Erasers Calculators Graph paper Lined paper Colored pencils Highlighters Rulers Textbooks Smarter Balance Consortium Kuta software Pencils Excel spreadsheets Algebraic Software Dynamic Geometric Software	Katm.org/up/common-core/ Guest speakers Mobi Interwriteboard Document camera LCD projector Student response system Computer Teacher textbook Ancillary materials Oars Zangle

Reflection on Best Practices (Feedback Loop)

CJUSD Secondary Math Unit Outline

Unit Title: Unit 3: Graphing Polynomials

Grade Level/Course: Algebra 2 | Approximate Length of Unit: 5 Weeks

Priority Standards	Supporting Standards
A.APR.3 - Identify zeros of polynomials when suitable factorizations are available and use the zeros to construct a rough graph of the function defined by the polynomial. **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; symmetries; end behavior and periodicity. **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.3 -** Identify the effect on the graph of replacing f(x) by f(x) + k, K f(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.	**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. c. graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. **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. **G.GPE3.1** – Given a quadratic equation of the form $ax^2 + by^2 + cx + dx + e = 0$, use the method for completing the square to put the equation into standard from; identify whether the graph of the equation is a circle or a parabola, and graph the equation.

What do students have to know and be able do in order to meet the targeted standards?	
Students will know:	*Students will be able to do:*
Compare two properties of two functions algebraically, graphically, numerically, and verbally How to complete the square on a general conic to rewrite it in its standard form How to identify a conic in standard form How to graph a parabola and a circle Analyzing key features of polynomial graphs Relative min and max x and y intercepts Intervals of increasing and decreasing Intervals of positive and negative Symmetry across y axis and about origin End behavior	Represent and Solve polynomial functions graphically Solve graphically by hand and by technology Evaluate intersection of two functions graphically Find zeros by factoring Use a sign chart to determine what function values are above and below the x-axis Graph using zeros and end behavior Multiplicity Arrow notation Even and odd functions Factor polynomials with emphasis on degree higher than 2

Sketch by hand polynomial graphs x and y intercepts End behavior Intervals of positive and negative	

Big Ideas/Essential Understanding:	**Essential/Guiding questions:**
Represent and Solve Equations and Inequalities graphically	What is the graphical meaning of a remainder from polynomial division? How is the graph of a polynomial sketched given zeros or a factorable equation? How can key features of graphs be found by hand (by technology for more complicated cases)? What is the graphical significance of a zero? How is end behavior of a function known? How are systems of equations and inequalities solved graphically (linear, polynomial, rational, radical, absolute value and exponential)?

Summative/End of Unit Assessment Blueprint (Include question item Types)	Represent and Solve polynomial functions graphically Solve graphically by hand and by technology Evaluate intersection of two functions graphically
Summative/End of Unit Performance Task	**Project** Students will break into Jigsaw groups of 3-4 to create posters to present to the class explaining polynomial topics and strategies including: identifying key characteristics of a polynomial function numerically, graphically, and algebraically, using key characteristics to sketch rough graphs of polynomials, operations on polynomials, finding zeros of a polynomial, finding zeros of a polynomial. Students will rate each other on: ease of use, difficulty to remember, and efficiency.

Scoring Criteria for Assessment	Single point items and rubric based scoring.
Scoring Criteria for Performance Task	Rubric based scoring.

What Prior Knowledge Should be Activated?	How Will it be Activated?
Vertex x and y intercepts Intersection End behavior of a quadratic What zeros are graphically Domain and range Complete the square Factoring	Starter questions Embedding in the lecture Review questions

Key Vocabulary		
End Behavior Conic Multiplicity Even and odd functions Arrow notation without bounds Intervals increasing/decreasing Domain Range	Maximum Minimum	Intervals of Positive Function Values Intervals of Negative Function Values

Unit Specific Instructional Strategies/Instructional Approach/Learning Experience
Math aerobics for parent functions

Unit Sequencing:			
Analyze key features of the graph Sketch graphs by hand	Represent and solve polynomial functions graphically Zeros, y-intercepts, end behavior	Use sigh chart to determine function values above or below x-axis, max and min, symmetry across the y-axis and about the origin	Evaluate intersections of two polynomials Use technology to develop graphs and analyze conics

Resources/Tools	
Colored markers Whiteboards Whiteboard markers Erasers Calculators Graph paper Lined paper Colored pencils Highlighters Rulers Textbooks Smarter Balance Consortium Kuta software Pencils Excel spreadsheets Algebraic Software Dynamic Geometric Software	Katm.org/up/common-core/ Guest speakers Mobi Interwriteboard Document camera LCD projector Student response system Computer Teacher textbook Ancillary materials Oars Zangle

Reflection on Best Practices (Feedback Loop)

CJUSD Secondary Math Unit Outline

Unit Title: Unit 4: Exponential and Logarithms Functions

Grade Level/Course: Algebra 2 | Approximate Length of Unit: 3 Weeks

Priority Standards	Supporting Standards
F.LE.4 - For exponential models, express as a logarithm the solution to $ab^{(ct)} = d$ where a, c, and d are numbers and the base b is 2, 10 or e; evaluate the logarithm using technology. **(Extend to relationship between properties of logarithms and exponents)* **F.BF.3 -** Build new functions from existing functions. Identify the effect on the graph of replacing f(x) by f(x) = k, k f(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. **F.BF.1b** – Write a function that describes a relationship between two quantities. Combine standard function types using arithmetic operations.	**F.LE.4.1 -** Prove simple laws of logarithms. **F.LE.4.2 –** Use the definition of logarithms to translate between logarithms in any base. **F.LE.4.3 –** Understand and use the properties of logarithms to simplify logarithmic numeric expressions and to identify their approximate values. **A.SSE.1b -** Interpret complicated expressions by viewing one or more of their parts as a single entry. For example, interpret P(1 + r)^n as a product of P and a factor not depending on P. **(Extend to polynomial and rational expressions)* **F.IF.7e -** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline and amplitude. **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. **(Use all available types of functions to create such equations, including root functions, but constrain to simple cases)* **A.CED.2 -** Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **(Will often be linear, exponential, or quadratic)* **F.BF.4 -** Find inverse functions. a. Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse. *For example, $f(x) = 2x^3$ or $f(x) = (x + 1)/(x – 1)$ for $x \neq 1$. *(rational, simple radical, and simple exponential functions)*

	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. **(Include combinations of linear, polynomial, rational, radical, absolute value, 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.CED.3** - Create equations that describe numbers or relationships. Represent constraints by equation or inequalities. **A.SSE4** – Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*

What do students have to know and be able to do in order to meet the targeted standards?	
Graph and recognize inverses of relations and functions. Write equivalent forms for exponential and logarithmic functions. Write, evaluate, and graph exponential and logarithmic functions. Show intercepts and end behavior of exponential and logarithmic functions Use properties to simplify logarithmic expressions and use to approximate their values. Translate between logarithms in any base. Represent and solve logarithmic functions graphically. Create exponential equation in two variables, understanding the relationship, and graph. Derive *e* Estimate a log expression such as $\log 13$, $\ln 3$, $A = P(1 \pm r)^{nt}$, and $A = Per^{t}$	Use technology to evaluate logarithms Prove the simple laws of logarithms Interpret parts of a modeling exponential expression Transformations of exponential and logarithmic functions Domain of a logarithm algebraically Create equations in one variable and use them to solve problems. Find the inverse by switching the x and y variables to include radical and rational functions Find the inverse of an exponential function Combining functions Represent constraints by equations and inequalities Rearrange exponential formulas Derive the infinite geometric series formula Use the infinite geometric series formula

Big Ideas/Essential Understanding:	**Essential/Guiding questions:**
Construct and compare exponential and logarithmic models and solve problems.	How are exponential equations solved using logarithms with base 2, 10 or e? What are the properties of logarithms and how are they applied? Where is the inverse of a point in quadrant 2 located? If f(10) is 20, what do you know about $f^{-1}(20)$? How do you know what operation to undo first? How do you know whether the graphs of a function and its inverse cross each other? What does a logarithm equal to 0 mean? What does a logarithm equal to 1 mean? How would you change $\log_x x^3 = 3$ into exponential form? What question can you ask yourself to evaluate the logarithmic expression? What do inverses of growth functions look like? What do inverses of decay functions look like? Why would you want to change the base of a logarithm? How can you tell when you can write both sides using the same base? How is it possible to get a solution that doesn't make sense in the original problem? How does compounding continuously differ from compounding daily? Is there always an asymptote, regardless of the transformation? If there is more than one transformation, which do you do first? How can you determine where the asymptote is just by looking at the function? Which transformation will cause the asymptote to move? What characteristics of the data make you think that a logarithmic model is appropriate?

Summative/End of Unit Assessment Blueprint (Include question item Types)	Transformation of exponential graph Transformation of logarithmic graph Find inverse function algebraically Use properties of logarithms to evaluate logarithms Compound interest problems Solve exponential and logarithmic equations Solve equations graphically
Summative/End of Unit Performance Task	**Project** Students will help Captain Kirk determine if there really is a health threat to the crew and exactly how great it may be by modeling the population growth of the "Tribbles" through a simulation using Skittles candy. Students will work in pairs to gather data. Once data is gathered, students will graph a scatter plot attending to precision in scaling their graph and making sure that the scale is appropriate. Students will then use the data to create equations and use these equations to predict the population growth. Students will then use a regression tool (computer or graphing calculator) to obtain an exponential equation and use this equation to make predictions. Students will then write a written response comparing all 3 equations and determine which equation was the best model for the data set and justify their selection.

Scoring Criteria for Assessment	Single point items and rubric based scoring.
Scoring Criteria for Performance Task	Rubric based scoring.

What Prior Knowledge Should be Activated?	**How Will it be Activated?**
Exponents Exponential Growth and Decay Basic graph of an exponential function Intercept Geometric sequence and series Domain and Range Transformations of Functions	Starter questions Embedding in the lecture Review questions

Key Vocabulary		
Inverse Relation Inverse Function	Logarithm Common Logarithm	Natural Logarithm Asymptote

Unit Specific Instructional Strategies/Instructional Approach/Learning Experience
Unit Circle Hand trick

Unit Sequencing:			
Review graphs of exponential functions Compound Interest problems Inverse functions algebraically, graphically	Definition of logarithm Graph parent logarithm Transform logarithmic functions	Prove simple laws of logarithms Use definition of logarithms Use properties of logarithms to simplify	Use properties and definition of logarithms to solve equations Solve functions graphically

Resources/Tools	
Colored markers	Katm.org/up/common-core/
Whiteboards	Guest speakers
Whiteboard markers	Mobi
Erasers	Interwriteboard
Calculators	Document camera
Graph paper	LCD projector
Lined paper	Student response system
Colored pencils	Computer
Highlighters	Teacher textbook
Rulers	Ancillary materials
Textbooks	Oars
Smarter Balance Consortium	Zangle
Kuta software	
Pencils	
Excel spreadsheets	
Algebraic Software	
Dynamic Geometric Software	

Reflection on Best Practices (Feedback Loop)

CJUSD Secondary Math Unit Outline

Unit Title: Unit 5: Rational and Radical Expressions and Functions

Grade Level/Course: Algebra 2 | Approximate Length of Unit: 4 Weeks

Priority Standards	Supporting Standards
F.BF.3 - Build new functions from existing functions. Identify the effect on the graph of replacing f(x) by f(x) = k, k f(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. **A.APR.6** - Rewrite simple rational expressions in different forms; write *a(x)/b(x)* in the form *q(x)* + *r(x)/b(x)*, where *a(x)*, *b(x)*, *q(x)*, and *r(x)* are polynomials with the degree of *r(x)* less than the degree of *b(x)*, using inspection, long division, or, for the more complicated examples, a computer algebra system. **(The limitations on rational functions apply to the rational expressions)* **A.REI.2** - Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. **(Extend to simple rational and radical equations)* **F.BF.4** - Find inverse functions. a. Solve an equation of the form *f(x) = c* for a simple function *f* that has an inverse and write an expression for the inverse. *For example, $f(x) = 2x^3$ or f(x) = (x + 1)/(x – 1) for $x \neq 1$. *(rational, simple radical, and simple exponential functions)*	**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. * (Extend to polynomial and rational expressions)* **F.IF.7** - b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. **(Relate to the relationship between zeros of quadratic functions and their factored forms.)* **A.SSE.2** - Use the structure of an expression to identify ways to rewrite it. *For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2). *(Extend to polynomial and rational expressions)* **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. **(Include combinations of linear, polynomial, rational, radical, absolute value, and exponential functions)* **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. *(Use all available types of functions to create such equations, including root functions, but constrain to simple cases)*

What do students have to know and be able to do in order to meet the targeted standards?	
Students will know:	*Students will be able to do:*
How to simplify rational expressions by factoring No adding, subtracting, or multiplying of rational or radical expressions Interpret parts of an expression, such as terms, factors, and coefficients Rewrite rational expressions using division Use technology to see where graphs intersect (solution) where the same x produces the same y output How to find an inverse (addressed in logarithm and modeling unit) Transformations of radical and rational functions	Solve simple rational equations Solve simple radical equations Solve simple rational equations w/ extraneous solutions Solve simple radical equations w/ extraneous solutions (square both sides) Represent and Solve rational and radical functions graphically Create equations in one variable of simple rational functions to solve problems Graph basic parent functions of radical and rational and their transformations $y = \sqrt{x}, y = \sqrt[3]{x}, y = \frac{1}{x}$, and $y = \frac{1}{x^2}$ Know what transformations do to a parent function Add, subtract, and multiply rational and radical expressions

Big Ideas/Essential Understanding:	**Essential/Guiding questions:**
Rewrite Rational Expressions Understand solving equations as a process of reasoning and explain the reasoning. Represent and Solve Equations and Inequalities graphically	How is division performed on polynomials? How are operations performed on rational expressions (addition, subtraction, multiplication and division)? How are rational and radical equations solved? What is an extraneous solution? How are systems of equations and inequalities solved graphically (linear, polynomial, rational, radical, absolute value and exponential)? How can you tell if the function is translated left or right, up or down? How can you tell if the function is vertically or horizontally stretched or compressed? How do you find the zeros of the function's graph? How can you determine the y-intercept of the function's graph? How do you determine the LCD of the expression in the equation? Why should you multiply each term in the equation by the LCD? How can you tell whether a solution to a rational equation is extraneous? How do you rationalize the denominator? How do you isolate the radical? What is the index of the radical? How do you know which power you should raise both sides of the equation? How can you tell whether the solution to a radical equation is extraneous? How can you find the intersection of the graphs if your calculator window does not show the intersection?

	How could you test to see if the exact value is a solution of the equation? Given two functions, how can you verify whether or not the values shown on the table are the only solutions? How can a graph be used to determine if an equation has no solution?

Summative/End of Unit Assessment Blueprint (Include question item Types)	Transform rational functions Transform radical functions Solve rational equations Solve radical equations Rewrite rational expression using division Solve functions graphically Simplify rational expressions Create rational and radical equation
Summative/End of Unit Performance Task	**Project** Students will use an equation that models the amount of a drug in the bloodstream over time. Students will answer questions regarding the maximum amount of drug in the system and analyzing the shape of the graph with respect to its context. Students will also discuss the meaning of the asymptotes with in this context.

Scoring Criteria for Assessment	Single point items and rubric based scoring.
Scoring Criteria for Performance Task	Rubric based scoring.

What Prior Knowledge Should be Activated?	**How Will it be Activated?**
Least common multiple/denominator Intersection Simplifying radical Adding, subtracting, and multiplying rational and radical expressions Combine like terms Factoring Dividing rational expressions and excluded values Check your answers Properties of exponents Undefined Basic transformations	Starter questions Embedding in the lecture Review questions

Key Vocabulary		
Rational Expression Asymptote Reflection	Extraneous Solutions Complex Fraction Rational Function	Vertical and Horizontal Translation Vertical and Horizontal Stretch and Compression

Unit Sequencing:			
Simplify rational expressions Rewrite rational expressions using division Solve rational equations w/ and w/o extraneous solutions	Create rational equation Graph parent rational functions Transform rational functions	Solving radical equations w/ and w/o extraneous solutions Solve equations graphically	Graph parent radical function Transform radical function

Resources/Tools	
Colored markers Whiteboards Whiteboard markers Erasers Calculators Graph paper Lined paper Colored pencils Highlighters Rulers Textbooks Smarter Balance Consortium Kuta software Pencils Excel spreadsheets	Algebraic Software Dynamic Geometric Software Katm.org/up/common-core/ Guest speakers Mobi Interwriteboard Document camera LCD projector Student response system Computer Teacher textbook Ancillary materials Oars Zangle

Reflection on Best Practices (Feedback Loop)

CJUSD Secondary Math Unit Outline

Unit Title: Unit 6: Modeling with Functions

Grade Level/Course: Algebra 2 | Approximate Length of Unit: 5 Weeks

Priority Standards	Supporting Standards
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; symmetries; end behavior; and periodicity.* **F.BF.1b** – Write a function that describes a relationship between two quantities. Combine standard function types using arithmetic operations. **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. **A.CED.3** - Create equations that describe numbers or relationships. Represent constraints by equation or inequalities. **F.BF.3** - Build new functions from existing functions. Identify the effect on the graph of replacing f(x) by f(x) = k, k f(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. **F.BF.4A** - Find inverse functions. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example f(x) = 2x^3 or f(x) = (x+1)/(x-1) where x cannot equal 1. (rational, simple radical, and simple exponential functions)	**F.IF.5** - Interpret functions that arise in applications in terms of the context, relate the domain of a function to its graph and, where applicable to the quantitative relationship it describes **F.IF.6** - Calculate and interpret the average rate of change of a function over a specified interval. **A.CED.1** - Create equations and inequalities in one variable including ones with absolute value and use them to solve problems. **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.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. **F.IF.7B** - Graph square root, cube root and piecewise-defined functions including step functions and absolute value functions. **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. **F.IF.8** - Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

A.REI3.1 – Solve one-variable equations and inequalities involving absolute value, graphing the solutions and interpreting them in context. **F.LE.4 -** For exponential models, express as a logarithm the solution to $ab^{(ct)} = d$ where a, c, and d are numbers and the base b is 2, 10 or e; evaluate the logarithm using technology.	

What do students have to know and be able to do in order to meet the targeted standards?	
Students will know:	*Students will be able to do:*
Translate between the various representations of functions. Create equations and inequalities in one variable of linear, quadratic, rational, and exponential to solve Step-function Write and graph piece-wise function Use piece-wise functions to describe real world situations. Graph Absolute Value equations and inequalities Create Linear, quadratic, and exponential equation in two variables, understanding the relationship, and graph Linear Programming (exponential and quadratic) Solve literal Equations State why in real life application problems the domain should be positive Slope of a secant line on any function (rate of change)	Transform functions Interpret the relationship between two quantities from graphs and tables Sketch graphs showing key features to include: intercepts, intervals of increasing, intervals of decreasing, positive or negative, relative maximums and minimums; symmetries; end behavior; and periodicity. Students will be able to rewrite functions in various forms to explain properties of the function Combination of functions Basic Transformations Write an expression for an inverse function Solve one variable equations and inequalities, graph the solutions and interpreting them

Big Ideas/Essential Understanding:	**Essential/Guiding questions:**
Create Equations that Describes numbers or relationships Interpret functions that arise in applications in terms of a context. Analyze functions using different representations Build a function that models a relationship between two quantities Build new functions from existing functions Construct and compare linear, quadratic and exponential models and solve problems	How are literal equations solved? How are models created given data sets and/or situations (include linear, quadratic, root functions, and exponential) How are the key functions of a model interpreted in context including intercepts, increasing/decreasing intervals, relative max/min, symmetries, end behavior, periodicity? How do you calculate and interpret the average rate of change of a function? How is the rate of change estimated from a graph? Identify Domain How are key features of square root, cube root, step, absolute value, exponential, logarithmic and piecewise - defined functions found by hand and technology (more complicated cases)? How are these types of functions compared and contrasted algebraically, graphically and numerically (tables) or by verbal descriptions?

	How do you write a function that describes a relationship between two quantities? (Modeling - more complex situations than previous courses). Combine Standard Function Types such as exponential plus constant What are the effects of transformations (vertical, horizontal, stretches/compressions)? How is the inverse of a function found?

Summative/End of Unit Assessment Blueprint (Include question item Types)	Translate between the various representations of functions. Create equations and inequalities in one variable of linear, quadratic, rational, and exponential to solve Step-function Write and graph piece-wise function Use piece-wise functions to describe real world situations. Graph Absolute Value equations and inequalities Create Linear, quadratic, and exponential equation in two variables, understanding the relationship, and graph Linear Programming (exponential and quadratic) Solve literal Equations State why in real life application problems the domain should be positive Slope of a secant line on any function (rate of change) Transform functions Interpret the relationship between two quantities from graphs and tables Sketch graphs showing key features to include: intercepts, intervals of increasing, intervals of decreasing, positive or negative, relative maximums and minimums; symmetries; end behavior; and periodicity. Students will be able to rewrite functions in various forms to explain properties of the function Combination of functions Basic Transformations Write an expression for an inverse function Solve one variable equations and inequalities, graph the solutions and interpreting them
Summative/End of Unit Performance Task	**Project** Using their knowledge of the characteristics of different functions students will choose a function to model different situations such as the weight gain of an infant over time and then test the validity of their selections by using the functions to make predictions. Students will analyze their results and change their selection accordingly. Students will write a response and present it to their peers defending their choice of a function with mathematical analysis.

Scoring Criteria for Assessment	Single point items and rubric based scoring.
Scoring Criteria for Performance Task	Rubric based scoring.

What Prior Knowledge Should be Activated?	How Will it be Activated?
Exponential and logarithm unit Absolute value Rational and radical unit Polynomial unit Complex number unit Statistic unit Trigonometry unit	Starter questions Embedding in the lecture Review questions

Key Vocabulary		
Literal Equations Regressions Model Increasing Decreasing Relative Maximum/Minimum Symmetry	Periodicity Average Rate of Change Parent Functions Piecewise Function Multiply-Defined Step Function	Vertical Translation Horizontal Translation Vertical Stretch and Compression Horizontal Stretch and Compression Reflection

Unit Sequencing:			
Literal equations Multiple representations of functions Piecewise functions	Step functions Review parent functions	Transformations on parent functions Graph and transform absolute value function	Combine functions Inverse functions Model real world data Change of rate

Resources/Tools	
Colored markers Whiteboards Whiteboard markers Erasers Calculators Graph paper Lined paper Colored pencils Highlighters Rulers Textbooks Smarter Balance Consortium Kuta software Pencils Excel spreadsheets Algebraic Software Dynamic Geometric Software	Katm.org/up/common-core/ Guest speakers Mobi Interwriteboard Document camera LCD projector Student response system Computer Teacher textbook Ancillary materials Oars Zangle

Reflection on Best Practices (Feedback Loop)

CJUSD Secondary Math Unit Outline

Unit Title: Unit 7: Trigonometric Functions

Grade Level/Course: Algebra 2 | Approximate Length of Unit: 3 Weeks

Priority Standards	Supporting Standards
F.TF. 2 - Explain how the unit circle in the coordinate plane enables the extension of the trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.	**F.TF.1** - Understand the radian measure of an angle as the length of the arc on the unit circle subtended by the angle. **F.TF.2.1** – Graph all 6 basic trigonometric functions **F.TF.5** - Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency and midline **F.TF.8** - Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle. **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. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

What do students have to know and be able to do in order to meet the targeted standards?	
Students will know:	*Students will be able to do:*
How to convert from radian to degree measure and vice versa with the special unit circle angles (within one rotation) How to find arc length How to find measurement of six trig functions How to graph the six parent trig functions from the unit circle Use key characteristics to perform transformations on the six trig functions Every ordered pair on a unit circle is $(\cos\theta, \sin\theta)$ How to derive the Pythagorean Trig Identity How to find the period of the six trig functions and use the periodic phenomena	Define understand the concept of the measure of 1 radian. Convert angle measures between degrees and radians. Find the values of trigonometric functions on the unit circle. Recognize and graph all 6 basic trigonometric functions. Recognize and graph periodic phenomena with specified amplitude, frequency, and midline. Use fundamental trigonometric identities to simplify and rewrite expressions.

Big Ideas/Essential Understanding:	**Essential/Guiding questions:**
Extend the domain of trigonometric functions using the unit circle. Model periodic phenomena with trigonometric functions. Prove and apply trigonometric identities.	How are angles measured and converted in degrees and radians? How are amplitude, frequency and midline used to model periodic phenomena? How is the Pythagorean identity $\sin^2\Theta = \cos^2\Theta = 1$ proven and used to find sin Θ, cos Θ, and tan Θ and the quadrant of the angle?

Summative/End of Unit Assessment Blueprint (Include question item Types)	Define understand the concept of the measure of 1 radian. Convert angle measures between degrees and radians. Find the values of trigonometric functions on the unit circle. Recognize and graph all 6 basic trigonometric functions. Recognize and graph periodic phenomena with specified amplitude, frequency, and midline. Use fundamental trigonometric identities to simplify and rewrite expressions.
Summative/End of Unit Performance Task	**Project** Students will engage in a CSI simulation to analyze blood splatter to find the angles of impact and determine the point of convergence in a crime scene. They will present their findings to the class and determine if a suspect is guilty or not.

Scoring Criteria for Assessment	Single point items and rubric based scoring.
Scoring Criteria for Performance Task	Rubric based scoring.

What Prior Knowledge Should be Activated?	**How Will it be Activated?**
Sine Cosine Tangent Degrees Pythagorean theorem Quadrants Clockwise Counterclockwise Relative max and min Special right triangles Undefined Intercepts	Starter questions Embedding in the lecture Review questions

Key Vocabulary		
Angle Of Rotation	Unit Circle	Period
Radian	Cycles	Identities
Initial Side	Rotation	6 Trig Identities
Terminal Side	Amplitude	6 Trig Reciprocal Identities
Co-Terminal Angle	Frequency	Pythagorean Trig Identity
Reference Angle	Midline	Two Ratio Trig Identities
Standard Position	Arc Length	Intervals
Quadrantal Angle	Asymptote	Phase Shift

Unit Sequencing:			
Standard position	Unit circle	Graph tangent	Fundamental trigonometric identities
Reference angle	Graph sine	Graph cotangent	
Definition of radian	Graph cosine	Graph cosecant	
Convert degrees to radians and vice versa	Phase shift of sine and cosine	Graph secant	

Resources/Tools	
Colored markers	Algebraic Software
Whiteboards	Dynamic Geometric Software Katm.org/up/common-core/
Whiteboard markers	Guest speakers
Erasers	Mobi
Calculators	Interwriteboard
Graph paper	Document camera
Lined paper	LCD projector
Colored pencils	Student response system
Highlighters	Computer
Rulers	Teacher textbook
Textbooks	Ancillary materials
Smarter Balance Consortium	Oars
Kuta software	Zangle
Pencils	
Excel spreadsheets	

Reflection on Best Practices (Feedback Loop)

CJUSD Secondary Math Unit Outline

Unit Title: Unit 8: Statistics and Series

Grade Level/Course: Algebra 2 | Approximate Length of Unit: 3 Weeks

Priority Standards	Supporting Standards
S.ID.4 - Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets and tables to estimate areas under the normal curve. **S.IC.1** - Understand statistics as a process for making inferences about population parameters based on a random sample from that population. **S.IC.2** - Decide if a specified model is consistent with results from a given data-generating process, e.g. Using simulations.	**S.IC.3** – Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. **S.IC.4** - Use data from a sample survey to estimate a population, mean or proportions, develop a margin of error through the use of simulation models for random sampling. **S.IC.5** - Use data from randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. **S.IC.6** - Evaluate reports based on data.

What do students have to know and be able to do in order to meet the targeted standards?	
Students will know:	*Students will be able to do:*
	Recognize normally distributed data Use the characteristics of the normal distribution to solve problems Use tables to estimate areas under normal curves Recognize data sets that are not normal Explain how random samples can be used to make inferences about a population Focus on the commonalities and differences between surveys, experiments, and observational studies Estimate population means and proportions and develop margin of error from simulations involving random sampling Analyze surveys, experiments, and observational studies to judge the validity of the conclusion Use simulations and hypothesis testing to compare treatments from a randomized experiment

Big Ideas/Essential Understanding:	**Essential/Guiding questions:**
Summarize, represent, and interpret data on single count or measurement variable. Understand and evaluate random processes underlying statistical experiments. Make inferences and justify conclusions from sample surveys, experiments and observational studies.	What is a normal distribution? How are the mean and standard deviation of a data set used to estimate population percentages? When is it appropriate to use a normal approximation for a data set? Will a simulation for finding probability experimentally always yield theoretical probability? Is variability always a factor when sampling? What is the difference between a survey, and experiment and an observational study? How does randomization relate to each? How is data from a sample survey used to estimate a population mean or proportion? How is a margin of error found? How are data from two treatments compared? How are reports criticized base on data collection methods and data manipulation/calculations?

Summative/End of Unit Assessment Blueprint (Include question item Types)	Recognize normally distributed data Use the characteristics of the normal distribution to solve problems Use tables to estimate areas under normal curves Recognize data sets that are not normal Explain how random samples can be used to make inferences about a population Focus on the commonalities and differences between surveys, experiments, and observational studies Estimate population means and proportions and develop margin of error from simulations involving random sampling Analyze surveys, experiments, and observational studies to judge the validity of the conclusion Use simulations and hypothesis testing to compare treatments from a randomized experiment
Summative/End of Unit Performance Task	**Project** Students will work in pairs to analyze a "population" of rectangles to investigate the importance of randomization. Students will pick rectangles of their own choice (they will then discuss bias and the effect that has on a sample) and compare it to a true randomized selection. Students will investigate how random sampling produces sampling distributions that center on the true value of the mean that is estimated (in this case the area of the rectangles).

Scoring Criteria for Assessment	Single point items and rubric based scoring.

Scoring Criteria for Performance Task	Rubric based scoring.

What Prior Knowledge Should be Activated?	**How will it be activated?**
Mean Mode Median Range Variance Standard deviation Expected value Outlier Skew Normal distribution	Work out one problem that will review all of these concepts Starter questions Embedding in the lecture Review questions

Key Vocabulary		
Standard Normal Value Population Census Sample Random Space Biased Space Statistic Parameter	Experiment Observational Study Controlled Experiment Control Group Treatment Group Randomized Comparative Experiment Simple Random Sample Systematic Sample	Stratified Sample Cluster Sample Convenience Sample Self-Selected Sample Probability Sample Margin of Error Hypothesis Testing Null Hypothesis

Unit Sequencing:			
Recognize normally distributed data Use tables to estimate areas under normal curves Recognize data sets that are not normal Use the characteristics of the normal distribution to solve problems	Explain how random samples can be used to make inferences about a population Focus on the commonalities and differences between surveys, experiments, and observational studies	Estimate population means and proportions and develop margin of error from simulations involving random sampling	Analyze surveys, experiments, and observational studies to judge the validity of the conclusion Use simulations and hypothesis testing to compare treatments from a randomized experiment

Resources/Tools	
Colored markers	Katm.org/up/common-core/
Whiteboards	Guest speakers
Whiteboard markers	Mobi
Erasers	Interwriteboard
Calculators	Document camera
Graph paper	LCD projector
Lined paper	Student response system
Colored pencils	Computer
Highlighters	Teacher textbook
Rulers	Ancillary materials
Textbooks	Oars
Smarter Balance Consortium	Zangle
Kuta software	
Pencils	
Excel spreadsheets	
Algebraic Software	
Dynamic Geometric Software	

Reflection on Best Practices (Feedback Loop)

Learning Experiences and Instruction:

Teachers utilize the Direct Interactive Instruction model to introduce new skills and concepts that are essential to the grade level content standards, then reinforce and develop those skills each quarter with the goal of bringing students to mastery by the end of the fourth quarter. All instruction will be based on the "I do, We do, You do" scaffolding model with an emphasis on individual differentiation as needed. Teachers will use a variety of the following:

- Inquiry-based learning
- Engaged reading opportunities
- Think-pair-share
- Reciprocal teaching
- Cloze reading & writing
- Guided reading & writing
- Cognitive modeling
- Questioning strategies
- Graphic organizers/concept attainment
- Student-led groups
- Peer pairing
- Metacognitive learning: self-regulation, goal-setting, self-monitoring, and self-questioning
- Personal white boards
- Think-pair-share
- Scaffold material
- Teacher modeling
- Ask students why they did a particular step
- Have students define vocabulary terms in their own words
- Planned-discovery activities
- Structured cooperative learning groups
- Provide authentic context
- Integration of appropriate technology
- Use of manipulatives
- Simulations and field experience
- Reciprocal teaching
- Graphic organizers
- Making predictions
- Problem solving
- Diagrams
- Mnemonic devices
- Paraphrasing word problems
- Do Now
- Present organized lessons
- Present clear procedures when appropriate
- Contextualize problems
- Review
- Use correct math terminology often
- Repeated questioning with student chorusing back
- Draw a picture whenever possible
- Check answer to see if it makes sense
- Similarities and differences
- Write summary of learning
- Continually assessing verbally and in writing
- Encourage students to work in pairs and groups
- Encourage annotating notes with their own words so it makes sense to them
- Encourage finishing work at home and practicing
- Encourage note taking
- Provide timely and specific feedback
- Encourage students to write down questions to ask the following day
- Teach note taking skills
- Teach test taking skills
- Teach students how to organize their materials
- Require assignments to be completed to a specific criteria
- Teach studying skills

Support for English Language Learners:

Extra time or modified versions of assignments will be given. The District will provide a language assistant. Additional strategies will be developed through the Response to Intervention plans –such as:

- SDAIE strategies
- Texts/materials in first language.
- Flexible grouping
- Structured engagement
- Peer pairing/tutoring
- Academic vocabulary development
- Use realia
- Structured language experience: write in English the steps done to complete a problem
- Use of math glossary
- Draw pictures / diagrams and combine with spoken words
- Highlight / color-code key words
- Teacher repeat or rephrase directions
- Vocabulary concept map "Frayer"
- Use gestures
- Cooperative learning
- Graphic organizers
- Explicit vocabulary development
- Comprehensive input
- Repetition and practice
- Prior knowledge
- Relate to life experience
- Encourage oral and written language
- Teach strategies to learn new vocabulary such as flash cards and word walls
- Have students explain their process out loud
- Interact reading and writing through interactive journals
- Use explicit instruction
- Deliver multi-sensory lessons (visual, auditory, tactile, and kinesthetic)
- Provide a variety of grouping
- Integrate language and content
- Use variety of modes of instruction
- Teach organizational skills
- Modify speech
- Encourage verbal interaction

Support for Special Education Students:

Extra time or modified versions of assignments will be given. The District will provide an instructional assistant. Additional strategies will be developed through the Individual Education Plan process – such as:

- Realia
- Texts/materials in first language
- SDAIE strategies
- Flexible grouping
- Peer pairing
- Audio & visual aids
- Individualized academic instruction
- Modified assignments
- Modified texts
- Testing accommodations
- Tutoring (peer & teacher)

Support for Struggling Learners:

- Guided practice
- Structured peer tutoring
- After-school tutoring
- Note taking handouts / copy of teacher's notes
- Highlight / color code key words
- Use of calculator or chart of basic facts for computation
- Use graphic organizers
- Cooperative learning
- Graphic organizers
- Use realia
- Explicit vocabulary development
- Comprehensive input
- Repetition and practice
- Prior knowledge
- Relate to life experience
- Encourage oral and written language
- Teach strategies to learn new vocabulary such as flash cards and word walls
- Have students explain their process out loud
- Interact reading and writing through interactive journals
- Use explicit instruction
- Deliver multi-sensory lessons (visual, auditory, tactile, and kinesthetic)
- Provide a variety of grouping

Stretching the Lesson for GATE Students:

Differentiated curriculum will be provided to challenge the student and provide the student with opportunities to develop their identified talent. Teachers will use a variety of the following:

- Independent study supplemented with mentoring/tutoring
- Compacting
- Acceleration
- Depth & Complexity icons
- Modified texts
- Modified assignments
- Flexible grouping
- Inquiry-based Learning
- Enriched materials and learning experiences
- Exploring, inventing, and comparing algorithms
- Utilize higher-level questions – ask "why" and "what if"
- Assign more challenging problems
- Utilize technology as an exploration tool to solve complex and interesting problems