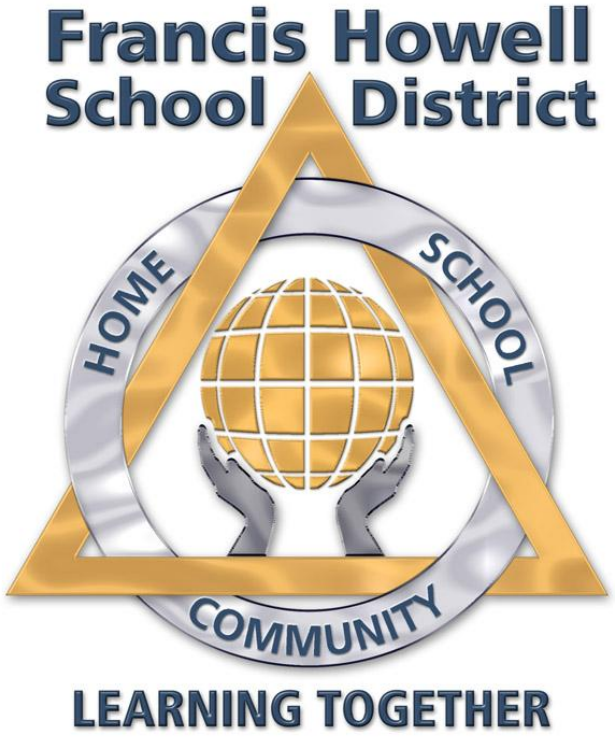
Algebra I
Curriculum



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Board Approved:
May 21, 2015

Francis Howell School District
Mission Statement

Francis Howell School District is a learning community where all students reach their full potential.

Vision Statement

Francis Howell School District is an educational leader that builds excellence through a collaborative culture that values students, parents, employees, and the community as partners in learning.

Values

Francis Howell School District is committed to:

- Providing a consistent and comprehensive education that fosters high levels of academic achievement for all
- Operating safe and well-maintained schools
- Promoting parent, community, student, and business involvement in support of the school district
- Ensuring fiscal responsibility
- Developing character and leadership

Francis Howell School District Graduate Goals

Upon completion of their academic study in the Francis Howell School District, students will be able to:

1. Gather, analyze and apply information and ideas.
2. Communicate effectively within and beyond the classroom.
3. Recognize and solve problems.
4. Make decisions and act as responsible members of society.

Mathematics Graduate Goals

Upon completion of their Mathematics study in the Francis Howell School District, students will be able to:

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.

Course Rationale

In order to be effective citizens in the 21st century, students need to understand mathematics. Students often encounter problem situations that require reasoning, computation, and communication. We regularly study the most efficient methods for reaching solutions, but also realize that examining different solution methods help develop more flexible problem solving skills. The instruction and assessment is focused on instilling students with enduring understandings of mathematics. Algebra I seeks to help students become efficient users of algorithms who can articulate their thinking and be able to apply mathematics in different contexts.

Course Description

This course develops an understanding of algebraic concepts. Students will learn to think logically and symbolically. Using experimentation and reasoning, students will develop the knowledge necessary to create and manipulate symbolic rules. Topics covered will include, but are not limited to: patterns, ratios and proportions, linear equations and inequalities and quadratic and exponential models.

Curriculum Committee

Paul Twombly	Bryan Middle School
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Dena Rulo	Francis Howell Central High
Rebecca Renken	Francis Howell High
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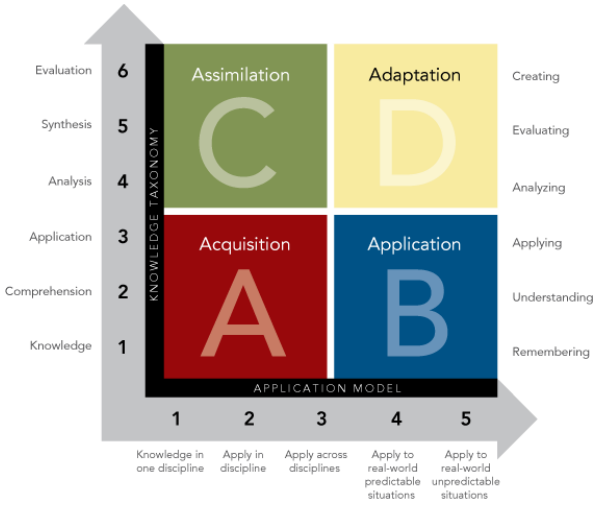
Director of Student Learning	Dr. Chris Greiner
Chief Academic Officer	Dr. Mary Hendricks-Harris
Superintendent	Dr. Pam Sloan

Curriculum Notes

All FHSD performance tasks and sample learning activities are aligned not only to understandings and standards, but also the Rigor and Relevance Framework and 21st Century Skills. Information on these two things is provided below or by clicking on the hyperlinks.



Rigor and Relevance Framework

The Rigor/Relevance Framework is a tool developed by the International Center to examine curriculum, instruction, and assessment along the two dimensions of higher standards and student achievement.

The Rigor/Relevance Framework has four quadrants.
Quadrant A represents simple recall and basic understanding of knowledge for its own sake. Examples of Quadrant A knowledge are knowing that the world is round and that Shakespeare wrote Hamlet.

Quadrant C represents more complex thinking but still knowledge for its own sake. Quadrant C embraces higher levels of knowledge, such as knowing how the U.S. political system works and analyzing the benefits and challenges of the cultural diversity of this nation versus other nations.

A	B	C	D
Students gather and store bits of knowledge and information. Students are primarily expected to remember or understand this knowledge.	Students use acquired knowledge to solve problems, design solutions, and complete work. The highest level of application is to apply knowledge to new and unpredictable situations.	Students extend and refine their acquired knowledge to be able to use that knowledge automatically and routinely to analyze and solve problems and create solutions.	Students have the competence to think in complex ways.

Quadrants B and D represent action or high degrees of application. Quadrant B would include knowing how to use math skills to make purchases and count change. The ability to access information in wide-area network systems and the ability to gather knowledge from a variety of sources to solve a complex problem in the workplace are types of Quadrant D knowledge.

21st Century Skills

These skills have been pared down from 18 skills to what are now called the 4Cs. The components include critical thinking, communication, collaboration, and creativity. Critical thinking is focused, careful analysis of something to better understand and includes skills such as arguing, classifying, comparing, and problem solving. Communication is the process of transferring a thought from one mind to others and receiving thoughts back and includes skills such as choosing a medium (and/or technology tool), speaking, listening, reading, writing, evaluating messages. Collaboration is working together with others to achieve a common goal and includes skills such as delegating, goal setting, resolving conflicts, team building, decision-making, and managing time. Creativity is expansive, open-ended invention and discovery of possibilities and includes skills such as brainstorming, creating, designing, imagining, improvising, and problem-solving.

Standards

Standards aligned to this course can be found:

Missouri Learning Standards for Algebra
http://www.corestandards.org/Math/Content/HSA/introduction/

National Educational Technology Standards
http://www.iste.org/STANDARDS

Units & Standards Overview
Semester 1

Unit 1:	**Unit 2:**	**Unit 3:**	**Unit 4:**	**Unit 5:**
Exponents	Representations of Functions	Solving Linear Equations & Inequalities	Polynomials	Solving Quadratic Equations
PE Assessment:	PE Assessment:	PE Assessment:	PE Assessment:	PE Assessment:
Exponents P.E.	Representation of Functions P.E.	Solving Linear Equations & Inequalities P. E.	Polynomials P.E.	Solving Quadratic Equations P.E.

Semester 2

Unit 6:	**Unit 7:**	**Unit 8:**	**Unit 9:**	**Unit 10:**
Graphing Functions	Systems of Equations & Inequalities	Sequences and their Related Functions	Descriptive Statistics	Analyzing & Modeling Functions
PE Assessment:	PE Assessment:	PE Assessment:	PE Assessment:	PE Assessment:
Graphing Functions	Systems of Equations	Sequences and their	Descriptive	Analyzing &

P.E	& Inequalities P.E.	Related Functions P.E.	Statistics P.E.	Modeling Functions P.E.

Course Map Algebra

	Unit Description	**Unit Timeline**	**PE Summary**	**PE Standards**
Semester 1 Unit 1: Exponents	Students will simplify expressions with exponents and powers with rational exponents. -Explain why the exponent rules work and demonstrate they still work with rational exponents. -Rewrite and simplify expressions with radicals as expressions with rational exponents and vice versa. -Use basic properties and equivalent forms of rational exponents with numerical and variable bases to simplify expressions. -Simplify square root and perfect higher-order roots.	2-3 Weeks	Students will simplify various complex expressions containing exponents and radicals. Teachers will evaluate the student's ability to completely simplify exponential and radical expressions. The elements assessed for the students ability to attend to precision and persevere	**N-RN.1** **N-RN.2** N-RN.3
Semester 1 Unit 2: Representations of Functions	Students will explore and interpret characteristics of functions, using graphs, tables, equations and verbal expressions. They will identify domain and range, from a variety of circumstances and explain the reasons a relation is or is not a function. Students will evaluate functions and understand the limitations of some functions.	3 Weeks	Students will be assessed on representing linear functions from a situation in the form of a table, a graph, and an equation. Students analyze graphs and their characteristics, and explain how they relate to real-life situations that compare time elapsed to distance traveled.	**F-IF.1** **F-IF.2** **F-IF.4** **F-IF.9** A-REI.10 F-IF.5

Semester 1 Unit 3: Solving Linear Equations	Students will be able to create and solve linear equations and inequalities in one variable. Students will be able to explain each step when solving an equation and justify their method as well as their solution. Mathematical fluency develops as students write, interpret and translate between various forms of linear equations and inequalities and use them to solve problems.	3Weeks	Students will model problems by writing algebraic equations and inequalities. Students must define the variable(s) in their equations. The equation created by the student must lead to a viable solution. Student should demonstrate correct computations.	**A-REI.1** **A-REI.3** A-CED.4 **A-CED.1** F-BF.4a
Semester 1 Unit 4: Polynomials	Students will become fluent in simplifying and identifying the parts of expressions. This includes using the order of operations, simplifying polynomial expressions, and simplifying expressions with exponents.	3 Weeks	All problems in this performance task are related to performing operations on polynomials expressions. The performance task will evaluate the student's ability to apply the concepts of area and perimeter to creating, simplifying, and factoring, polynomial expressions.	A-SSE.1 **A-SSE.2** **A-SSE.3.** **A-APR.1** **F-BF.1b**
Semester 1 Unit 5: Solving Quadratic Equations	Students will be able to create and solve quadratic equations.	4 Weeks	All problems in this performance task are related to solving and graphing a quadratic function. The performance task will evaluate the student's ability to solve a quadratic equation, change the form of a quadratic equation from standard form into vertex form, graphing the quadratic function, identify the characteristics of the graph, and make connections between the equation and the graph of the function.	**A-REI.4a & b** **A-SSE.1a & b** **A-SSE.2** **A-SSE.3a & b** **A-CED.1** **A-CED.2** **F-IF.8a** N-Q.1
Semester 2 Unit 6: Graphing Functions	Students will graph the following functions by hand using key features: Linear, quadratic, exponential, piecewise defined (including step and absolute value functions).	5 Weeks	The performance task assesses all the major focus standards for the unit. Students will perform multi-step analysis of quadratic functions and	**F-BF.3,** **F-IF.4,7a** **8.b**, **9** **F-LE.2,.3**

	Students should explore key features and transformations of these graphs using a graphing calculator. Given a set of bivariate data, students will be able to display it appropriately, describe key features, and relate the information in the context of the problem.		symbolically and verbally analyze and describe rates of growth between linear and exponential.	N-Q.1
Semester 2 Unit 7: Systems of Equations & Inequalities	Students will become fluent in solving systems of equations and inequalities. Students will need to justify their solving process, recognize the limitations of their process, and interpret the solutions in context of the problem.	4 Weeks	Students will be required to write and solve a system of linear equations and inequalities as applied to a real word problem and solve a system with a linear and a quadratic equation.	**A-CED.2** **A-REI.12** **A-REI.6** **A-REI.7** **A-REI.5** **A-CED.3** F-LE.5 A-REI.10 N-Q.1 N-Q.2 N-Q.3
Semester 2 Unit 8: Sequences and their Related Functions	Students will recognize, create and use arithmetic and geometric sequences and connect them to linear and exponential models. A graphing calculator should be used throughout this unit	2 weeks	Students will be assessed on representing arithmetic and geometric sequences and connect them to linear and exponential models. They will analyze tables and graphs for characteristics and explain how they relate to real-life situations.	**A-CED.1** **A-CED.2** **A-SSE.1b** **F-BF.1a** **F-BF.2** **F-IF.6** **F-LE.2**
Semester 2 Unit 9: Descriptive Statistics	Given a set of data, students will be able to display it appropriately, describe key features, and relate the information in the context of the problem. Students will be able to construct a two-way table, calculate probabilities, and recognize possible trends and associations in the data.	2 weeks	Students will make a box plot (single variable date) and a scatter plot (two variable data) and interpret these graphs.	**S-ID.1** **S-ID.2** **S-ID.3** **S-ID.6** S-ID.7
Semester 2: Unit 10:	The basic modeling cycle is summarized as	3-4 weeks	The students will model a linear function using a scatter plot. They will use a	**F-LE.1** **F-LE.2**

Analyzing & Modeling Functions	(1) identifying variables in the situation and selecting those that represent essential features, (2) formulating a model by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between the variables, (3) analyzing and performing operations on these relationships to draw conclusions, (4) interpreting the results of the mathematics in terms of the original situation, (5) validating the conclusions by comparing them with the situation, and then either improving the model or, if it is acceptable, (6) reporting on the conclusions and the reasoning behind them.		graphing calculator to identify the linear regression equation. The students will make predictions using the equation. The students will identify the three different equations: linear, quadratic, and exponential. The students will model an exponential function based on three different scenarios. The students will use a graphing calculator to find a line of regression based on scatter plots.	**F-LE.5** **S-ID.6** **S-ID.7** **S-ID.8**

Content Area: Mathematics	Course: Algebra I	UNIT 1: Exponents
Unit Description: Students will simplify expressions with exponents and powers with rational exponents. -Explain why the exponent rules work and demonstrate they still work with rational exponents. -Rewrite and simplify expressions with radicals as expressions with rational exponents and vice versa. -Use basic properties and equivalent forms of rational exponents with numerical and variable bases to simplify expressions. -Simplify square root and perfect higher-order roots.		**Unit Timeline:** **2 -3 weeks**

DESIRED RESULTS
<u>Transfer Goal</u> - Students will be able to independently use their learning to… 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.

<u>Understandings</u> – Students will understand that… (Big Ideas)

1. Rational and integer exponents follow the same rules, but rational exponents may be rewritten as root functions.
2. Quantities involving radicals and rational exponents can be rewritten and simplified by using the properties of exponents.
3. Relationships exist between number sets when doing operations.
4. The properties of real numbers are applied when performing operations. There are specific properties for rational and irrational numbers that also apply when performing operations with those numbers.

<u>Essential Questions</u>: Students will keep considering…
How can we use properties of exponents to relate radical expressions to expressions with rational exponents?
How can the properties of exponents be used to develop a meaning for powers that are not integers?
What does a negative exponent mean and how does it apply in the real world?
What is simplest form?
What does it really mean to "cancel" when simplifying?

Students Will Know…	Standard	Students Will Be Able to …	Standard
● base ● exponent ● radical ● nth root ● cube root ● square root ● properties of exponents o product rule o power of a power rule o negative exponents o quotient rule o zero power o power of a quotient o power of a product ● rational number; Irrational number; ● how to add/multiply rational and irrationals numbers ● add or multiply two rational numbers ● add rational and irrational numbers ● multiply rational (non-zero) and irrational ● See Appendix for definitions	N-RN.1 N-RN.2 N-RN.3	**Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.** **Rewrite expressions involving radicals and rational exponents using the properties of exponents.** Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. Research and information fluency: Students apply digital tools to gather, evaluate, and use information. Technology operations and concepts students demonstrate a sound understanding of technology concepts, systems, and operations.	**N-RN.1** **N-RN.2** N-RN.3 ISTE 3 ISTE 6

EVIDENCE of LEARNING			
Understanding	**Standards**	**Unit Performance Assessment**:	**R/R Quadrant**
1,2,3,4	**N-RN.1** **N-RN.2** N-RN.3	unit_1_performance_assessment-exponents **Description of Assessment Performance Task(s):** Students will simplify various complex expressions containing exponents and radicals. **Teacher will assess:** What criteria will be used in each assessment to evaluate attainment of the desired results? 1. Teachers will evaluate the student's ability to completely simplify exponential and radical expressions. 2. The elements assessed for the students ability to attend to precision and persevere. **Performance:** **Mastery:** Students will show that they really understand when they… 3. Complete the assessment with 75% or greater **Scoring Guide:** See Appendix Scoring Guide for Unit 1 Performance Assess	C Critical Thinking

SAMPLE LEARNING PLAN				
Pre-assessment: District Algebra I Unit 1 Formative Assessment				
Understanding	**Standards**	**Major Learning Activities:** Middle school Algebra teachers will need to cover the concepts in Activities 1-4 as the Pre-Algebra 7 Curriculum does not include. High School Algebra teachers begin at Activity 5 including review of the rules of exponents if needed as determined by the pre-test.	**Instructional Strategy:**	**R/R Quadrant:**
1, 2	**N-RN.1** **N-RN.2** MP2,3,8	1. Activity: **Exploring the Product Rule of Exponents** In this activity students construct & communicate a rule for multiplying exponents by writing the factors in expanded form, simplifying, & then analyze the results looking for similarities between each of the problems. The activity also contains problems using a Sage N Scribe to practice the product rule and evaluate a peer's work. Students will have the opportunity to formally defend their results. Objective: Students will be able to use the Product Rule of Exponents to simplify exponential expressions. Know how to apply the Product Rule in different situations. Understand why the Product Rule works. Appendix Documents: Exploration worksheets & Key	Cooperative Learning: Think, Pair, Share & Sage N Scribe Feedback	B Critical Thinking, Collaboration, Communication
1, 2	**N-RN.1** **N-RN.2** MP2, 3,6,8	2. Activity: **Exploring the Quotient Rule of Exponents** In this activity students construct & communicate a rule for dividing exponents by writing numerator and denominators in expanded form, simplifying, & then analyzing the results looking for similarities between each of the problems. The activity also contains problems using a Sage N Scribe to practice the product rule and evaluate a peer's work. Other Kagan strategies can be used: Think, Pair, Share, or Pairs Compare Objective: Students will be able to use the Quotient Rule of Exponents to simplify exponential expressions. Know how to apply the Quotient Rule in different situations. Understand why the Quotient Rule works. Appendix Documents: Exploration worksheet & Key	Cooperative Learning:	B Collaboration, Communication, Critical Thinking
1, 2	**N-RN.1** **N-RN.2** MP2,3, 6,8	3. Activity: **Exploring the Power of a Product/Quotient Rule** In this activity students evaluate & communicate a rule for an exponent raised to a power by writing the expression in expanded form, simplifying, & then evaluating the results looking for similarities between each of the problems.	Cooperative Learning Feedback	C Collaboration, Communication, Critical Thinking

		The activity also contains problems using a Sage N Scribe to practice the product rule and evaluate a peer's work. Students can defend solutions during this activity. Objective: Students will be able to use the Power Rule to simplify exponential expressions. Know how to apply the Power Rule in different situations. Understand why the Quotient Rule works. Appendix Documents: Exploration worksheet & Key		
1, 2	**N-RN.1** **N-RN.2** MP6,8	4. Activity: **Exploring Zero & Negative Exponents** In this activity students construct & communicate a rule for Zero and Negative Exponents by extending the pattern in a table containing exponential expressions with the same base and descending exponents, comparing the results looking for similarities between each of the patterns. This activity also contains practice problems for Zero and Negative Exponents (Think, Pair, Share & Sage N Scribe or Pairs Compare). Objective: Student will be able to simplify exponential expressions containing zero & negative exponents. Know how to apply the rules in different situations. Understand the pattern that determines the value of the exponential expression. Appendix Documents: Exploration worksheet & Key	Cooperative Learning	C Collaboration, Communication, Critical Thinking
1, 2	**N-RN.1** MP1, 2, 4, 7, 8 ISTE.3 ISTE.6	**5.** Activity: Flipped Classroom or in class notes: **Relate rational exponents to integer exponents, use radical notation.** This activity contains a link to help students use prior knowledge of the exponent rules to analyze and solve for variables with rational exponents and to synthesize the meaning of fractional exponents by relating them to integer exponents. Students will view this link and summarize what they have learned about the standards within the link. The will apply this knowledge to other activities and build upon prior knowledge. https://learnzillion.com/lessonsets/551-relate-rational-exponents-to-integer-exponents-use-radical-notation ● Objective: Students will be able to explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. Be able to rewrite expressions involving	Graphic Organizers and Summarizing	A Communication

		radicals and rational exponents using the properties of exponents. Understand how rational exponents apply to physical models. Appendix Documents: Learnzillion Notes Template		
1, 2, 4, 5	**N-RN.2** MP 1, 2, 4, 7, 8 ISTE.3 ISTE .6	6. Activity: Flipped Classroom or in class notes: **Rewrite expressions involving radicals and rational exponents.** This activity contains a link to help students use prior knowledge of the exponent rules to analyze and rewrite expressions involving radicals and rational exponents using the properties of exponents. Students will view this link and summarize what they have learned about the standards within the link. The will apply this knowledge to other activities the following day and build upon prior knowledge. https://learnzillion.com/lessonsets/646-rewrite-expressions-involving-radicals-and-rational-exponents • Ojective: Students will be able to rewrite expressions involving radical and rational exponents. Know how to simplify exponents. Understand how they apply to area and volume. Appendix Document: Learnzillon notes template.	Graphic Organizers & Summarizing	A Communication
1, 2	**N-RN.1** **N-RN.2** MP5, 6 ISTE 3	7. Activity: **Exploration of Rational Exponents** This activity uses a calculator to develop a rule for fractional exponents. By comparing the numerical values of the expressions looking for similarities in the patterns. This activity also contains practice problems for rational exponents (Round Table and Consensus). Objective: Student will be able to simplify rational exponents. Know how to apply the rules in different situations. Understand the pattern that determines the value of the exponential expression. Appendix Documents: Exploration worksheet & practice.	Cooperative Learning Cues and Questions	C Collaboration, Communication
3, 4	N-RN.3 MP5 ISTE 6	8. Activity: **Flipped classroom video's: Rational & Irrational Numbers** https://learnzillion.com/lessons/2902-distinguish-between-rational-and-irrational-numbers Students will watch various Learnzillion video's and take notes outside of the classroom. As a result, students will be able to practice and apply the concepts from the video's in various cooperative learning structures.	Graphic Organizers & Summarizing	A Communication

		Distinguish between rational and irrational numbers. Predict the result of adding and subtracting rational and irrational numbers. Multiply rational and irrational numbers. Rationalize the denominator. Objective: Students will be able to predict whether the sum or product of rational and/or irrational numbers will result in a rational or irrational number. Understand why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. Appendix Document: Learnzillion Notes Template		
1	N-RN.3 MP3,7,8	9. Changing Rational Exponents to Radical Form practice. Students will practice changing between rational exponents & radicals by using the Kagan Structure Quiz-Quiz-Trade. Students will have an opportunity to formally defend their solutions as they work through this activity. Objective: Students will be able to rewrite rational exponents as radicals and radicals as rational exponents. Appendix Document Quiz-Quiz-Trade cards	Cooperative Learning Feedback	A Communication Critical thinking
1, 2, 3, 4	**N-RN.1** **N-RN.2** N-RN.3 MP1,3,5	10. Unit Review Students will practice the skills developed in this unit by engaging in the Kagan structure Show Down King. Students will practice their skills while constructing viable arguments and critiquing the reasoning of others. Objective: Students will be able to demonstrate their knowledge of simplifying exponential & radical expressions by comparing answers between team members, discussing then determining whose answer is correct. Appendix: Show Down King Cards	Cooperative Learning	B Collaboration

UNIT RESOURCES
Teacher Resources: Explanation of determining irrational numbers http://www.mathsisfun.com/numbers/irrational-finding.html IXL Algebra I common core Exponents Online practice problems http://www.ixl.com/standards/common-core/math/high-school Simplifying Radical expression www.youtube.com/watch?v=DsNj04BwCns&index=2&list=PL6787C7F5EE3BDD2F Exponential Functions Rhino's & MM's http://www.pbslearningmedia.org/resource/083780b3-767c-456c-8c82-f36ba465ee4a/083780b3-767c-456c-8c82-f36ba465ee4a/ Complete Teaching Module Radicals http://teachers.henrico.k12.va.us/math/HCPSAlgebra1/module11.html Cube Root Explanation and online quiz http://www.mathsisfun.com/numbers/cube-root.html nth roots Explanation and online quiz http://www.mathsisfun.com/numbers/nth-root.html Surds another word for irrational numbers Explanation and online quiz http://www.mathsisfun.com/surds.html Irrational numbers Explanations and online quiz http://www.mathsisfun.com/irrational-numbers.html Fractional exponent's explanation and online quiz http://www.mathsisfun.com/algebra/exponent-fractional.html Complete Notes on Exponents including practice with keys. http://themathpage.com/alg/exponents.htm Holt Algebra I Textbook/online resources Chapter 7 lessons 1-4 My.hrw.com Also available in the Appendix
Student Resources: Holt Algebra I Textbook/online Chapter 7 lessons 1-4 My.hrw.om Kahn Academy IXL Algebra I Learnzillion Also see Appendix
Vocabulary:

Base, exponent, power, coefficient, radical, rational exponent, exponent rules, order of operations, radicand, root, root index, cube root, square root Definitions in Appendix

Content Area: Mathematics	**Course: Algebra I**	**UNIT 2: Representation of Functions**
Unit Description: Students will explore and interpret characteristics of functions, using graphs, tables, equations and verbal expressions. They will identify domain and range, from a variety of circumstances and explain the reasons a relation is or is not a function. Students will evaluate functions and understand the limitations of some functions.		**Unit Timeline:** 3 Weeks

DESIRED RESULTS

<u>Transfer Goal</u> - Students will be able to independently use their learning to…

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.

<u>Understandings</u> – Students will understand that… (Big Ideas)

1. functions can be used to interpret, analyze and model relationship in mathematical and real-life contexts.
2. every point on a graph is a solution.
3. functions have key characteristics that can be used to describe the relation.

4. domain values may be limited for functions with a real-world context.
5. parent functions have specific characteristics that are key in creating its graph.
6. functions can be represented algebraically, graphically, verbally and in tables.
7. using appropriate units is necessary to determine an appropriate algebraic model.
8. appropriate scale and label must be used.

<u>Essential Questions</u>: Students will keep considering…

1. What are the characteristics of a function and how can you use those characteristics to represent the function in multiple ways?
2. Why are relations and functions represented in multiple ways?
3. How are the properties of functions and functional operations useful? (They model and analyze real-world applications and quantitative relationships)
4. What is function notation and how is it used?
5. What are the different types of functions and what do their graphs look like?
6. What are some key characteristics of the different type of functions?
7. Can you identify the different functions and distinguish their shape based on key characteristics?

Students Will Know…	Standard	Students Will Be Able to …	Standard
• domain definition • range definition • definition of a function • f(x) represents y • vertical line test	**F-IF.1**	• **Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).**	**F-IF.1**
• definition of a function, domain/input, range/output • substitution • order of operations • function notation	**F-IF.2**	• **Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.**	**F-IF.2**
• x-intercepts • y-intercepts • increasing • decreasing • constant • relative maximum • relative minimum	**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; and end behavior.**	**F-IF.4**
• the difference between independent and dependent variables • that coordinates represent a solution	A-REI.10	• Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	A-REI.10

• definition of:
  - slope
  - y-intercept
  - residual
  - independent and dependent variables
• how to plot ordered pairs
• how to find slope
• how to find y-intercept
• how to model functions
  - linear
  - quadratic
  - exponential
	S-ID.6	• Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.	S-ID.6

• key characteristics of functions • domain	F-IF.5	• Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.	F-IF.5

• how to construct a table of values
• how to plot points
• how to find key features from a linear equation in these forms
  - slope-intercept
  - point-slope
  - standard
• how to evaluate exponents
	F-IF.7a
	
	F-IF.7b
		• Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
		• a. Graph linear and quadratic functions and show intercepts, maxima and minima.
		• b. Graph piecewise-defined functions, including step functions and absolute value functions. (Compare and contrast domain, range and usefulness of each function.)
			F-IF.7a
			
			F-IF.7b

• concepts of linear and exponential functions
• translations of words to equations
• domain/range or input/output
• independent/dependent variables
• know meaning of increasing and decreasing
• forms of a linear equation
  - slope-intercept
  - point-slope
  - standard
	F-IF.9	• **Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).**	**F-IF.9**

• • how to solve for a variable • what an inverse is • a simple function has an inverse • when to restrict the domain in certain functions		• 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. (See page 12 of Functions Progressions Documents. This simply means given f(x), find x.)	F-BF.4a
• standard unit conversions • appropriate scaling • problem solving strategies • appropriate labels • unit/dimensional analysis • titles for graphic representations	F-BF.4a N-Q.1	• Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	N-Q.1
• Graphing calculators can model real life events	ISTE1	1. Creativity and innovation Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. a. Apply existing knowledge to generate new ideas, products, or processes b. Create original works as a means of personal or group expression c. Use models and simulations to explore complex systems and issues d. Identify trends and forecast possibilities	ISTE1
• Graphing calculators can be used to analyze data and generate statistical values for strength of relationships.	ISTE3	3. Research and information fluency Students apply digital tools to gather, evaluate, and use information. a. Plan strategies to guide inquiry b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media c. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks d. Process data and report results	ISTE3
• Graphing calculators can be used to solve real-life problems			

● Various functions of a graphing calculator can be useful in differing contexts	ISTE4 ISTE6	4. Critical thinking, problem solving, and decision making Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. a. Identify and define authentic problems and significant questions for investigation b. Plan and manage activities to develop a solution or complete a project c. Collect and analyze data to identify solutions and/or make informed decisions d. Use multiple processes and diverse perspectives to explore alternative solutionsiste.org/standards 6. Technology operations and concepts Students demonstrate a sound understanding of technology concepts, systems, and operations. a. Understand and use technology systems b. Select and use applications effectively and productively c. Troubleshoot systems and applications d. Transfer current knowledge to learning of new technologies	ISTE4 ISTE6

EVIDENCE of LEARNING			
Understanding	**Standards**	**Unit Performance Assessment**:	**R/R Quadrant & 21st Century:**
1, 2, 3, 4, 5, 7, 8, 9, 10	**F-IF.1** **F-IF.2** **F.IF.4** **F.IF.9** A-REI.10 F-IF.5	Unit 2 performance_event_v **Description of Assessment Performance Task(s):** **Unit Performance Assessment: Performance Event - Representation of Functions (See Appendix)** Students will be assessed on representing linear functions from a situation in the form of a table, a graph, and an equation. They will analyze graphs and their characteristics, and explain how they relate to real-life situations that compare time elapsed to distance traveled. **Teacher will assess:** The performance task will assess the students' knowledge of , and ability to, graph a function, write an equation, and analyze their characteristics, as applied to a real-world situation. **Performance:** **Mastery:** **Students will show that they really understand when they…** Complete the performance task with at least a 75% . **Scoring Guide:** See Appendix 1.B **Assessment Blueprint:** See Appendix 1.C	**D** Critical Thinking

SAMPLE LEARNING PLAN				
Pretest: Pretest for Linear Graphing (see appendix)				
Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy:**	**R/R Quadrant & 21st Century:**
1,2,6	**F-IF.1**,7a **F-IF.2** A-REI.10	Activity 1: Basic Modeling with Graphs, Charts & Linear Functions (see appendix) Objective: Review concepts from 8th grade with respect to linear graphing	Similarities and Differences	B

	F-IF.9 MP 2,7,8 ISTE6	Students compare their responses to graphs and tables in graphing calculators to solidly connect the relationships between real life scenarios, algebraic symbols, tables, and graphs. Students will be able to self-evaluate for accuracy by noting the agreement between calculations and tables in the graphing calculator. Appendix Documents: Basic Modeling with Graphs, Charts & Linear Functions		Collaboration and Critical thinking
1,2,6	F-IF.7.a N-Q.1 MP 2,7,8	Activity 2: Comparing linear rates/prices Objective: Students will understand how to compare linear rates and prices. Students compare their responses to graphs and tables in graphing calculators to solidly connect the relationships between real life scenarios, algebraic symbols, tables, and graphs. Students will self-evaluate for accuracy by noting the agreement between calculations and tables in the graphing calculator. Appendix Document: Heating with Natural Gas	Similarities and Differences	B Collaboration and Critical thinking
1,6,7,8	**F-.IF.4**,7b NQ.1 F.-F.5 MP 1,3,4,5,8 ISTE.1	Activity 3: NOTEBOOK and Dan Meyer Act 3 video activity: "Piecewise functions" Objective: Students will be able to explore piecewise functions and note domains of each piece. Whole class discussion will engage students in making estimations with respect to measurement and time evaluating, critiquing and defending conclusions. Appendix Documents: Piecewise Functions	Cooperative Learning	B Critical thinking
1,3,6,7,8	**F-IF.4** NQ.1 F-IF.5 MP 1,3,4,5,8 ISTE.1	Activity 4: NOTEBOOK and Dan Meyer Act 3 video activity: "Quadratic Functions" Objective: Students will understand quadratic motion can be represented as a mathematical graph. Whole class discussion will engage students in making estimations with respect to measurement and time, evaluating, critiquing and defending conclusions. Appendix Document: Quadratic Functions	Problem-based learning, open-ended questioning	B Critical thinking
1,4,6	F-IF.5 MP 6	Activity 5: All Relations (discrete and continuous) have Domains and ranges Students are given a wide variety of graphs to analyze their domains and ranges. In class it could be used as Sage-Scribe. Objective: Students will know how to identify Doman and Range Appendix Documents: Identifying Domain and Range with Graphs	Homework and Practice or Sage Scribe	A Collaboration Communication
1,2,3,6	**F-IF.1** MP 6	Activity 6: Functions are a Type of Relation: This section in the Holt textbook provides a thorough background on what distinguishes a function from other types of ranges. Objective: Students will understand the characteristics of functions Holt textbook page 236-241	Summarizing and Note Taking Homework and Practice	B Critical thinking

1,3,4,7,8	N-Q.1 **F.IF.2**, 5 MP 1,2,4,5,6,7,8	Activity 7: Landscape Architecture Students engage in dimensional analysis to solve landscaping problems. Students discover through repeated reasoning that these situations can be described by writing a function. Then they write the function. Lastly they generalize the process so that it would fit similar contexts. This will be a great opportunity for students to share their results and defend their solutions. Objective: Students will be able to connect functions to the field of landscape architecture found in the real world. Appendix Document: Landscape Architecture	Homework and Practice Cooperative Learning Feedback	C Critical thinking, Collaboration, Communication
1,2,3,4	**F-IF.1**,5 MP 1,2,6,7	Activity 8: Understanding Function terminology Objective: Students will practice reading and interpreting function terminology Holt Textbook sections 4.3 and 4.4	Summarizing and Note Taking Homework and Practice	A Critical thinking
1,2,3,4,5,6,7,8	Prep for **F-IF.1,2** 4,7a ISTE 4,6	Activity 9: Exponential functions. Students use their graphing calculators to connect various representations of exponential functions: tables, graphs, equations. Students will self-evaluate for accuracy by noting the agreement between calculations and tables in the graphing calculator. Page 776 in Holt Textbook Objective: Students will know how to connect exponential functions from real life with symbolic, numeric, and graphical representations.	Summarizing and Note Taking Homework and Practice	C Critical Thinking
1,6	**F-IF.1** F-IF.5 MP 1-8 **ISTE** 1,3,4,6	Activity 10: Hour of Code Students visit Code.org and complete "The Hour of Code" by choosing a theme to develop code for. They enter the teacher as their coach and the teacher is able to track their progress. Students observe the results of their coding through the movement of graphical characters, self-correct their code, and proceed in levels. Objective: Students will be able to understanding that writing computer code (computer programming) is related to writing algebraic functions in that input (code) generates output (animation). This is also preparation for function composition in Algebra 2.	Nonlinguistic Representations	D Creativity, Critical thinking
1,7,8	S-ID.6 MP 1,2,4,7	Activity 11 Section 4.5 Holt textbook Objective: Students will create scatter plots that appropriately represent data	Summarizing and Note Taking Homework and Practice	B Critical thinking
1,6	F-BF.4a MP 2,7	Activity 12 Output - Input	Cooperative Learning	B

		Objective: Students are given Quiz-Quiz trade cards with which they are able to engage in analyzing functions, thinking backwards, and communicate conclusions. Feedback requires students to formally defend and critique each other's conclusions. Students will understand that if the output of a function is known, it is possible to know the input. Appendix Document: Output-Input	Feedback	Critical thinking, Collaboration, Communication

UNIT RESOURCES
Teacher Resources: Online free grapher: DESMOS.com Relate functions with computer coding on "The Hour of Code": code.org EngageNY https://www.engageny.org/resource/high-school-algebra-i emathinstruction.com free online textbook and videos, fairly well aligned and simple to use Daily downloadable lesson plans including presentations, homework assignments, and videos: staff websites Lane Walker
Student Resources: Online free grapher: DESMOS.com Holt online textbook: my.hrw.com Explanations: Purplemath.com Instructional videos and practice: https://www.khanacademy.org/
Vocabulary: UNIT VOCABULARY (see appendix) domain, range, element, evaluate, function, input, output, integer, notation, set, subset

Content Area: Mathematics	Course: Algebra I	UNIT: 3 Solving Linear equations and Inequalities
Unit Description: Students will be able to create and solve linear equations and inequalities in one variable. Students will be able to explain each step when solving an equation and justify their method as well as their solution. Mathematical fluency develops as students write, interpret and translate between various forms of linear equations and inequalities and use them to solve problems.		**Unit Timeline:** 3 weeks

DESIRED RESULTS
<u>Transfer Goal</u> - Students will be able to independently use their learning to improve on the following Standard 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.

<u>Understandings</u> – Students will understand that… (Big Ideas)

1. it is important to be able to justify/support the solution (steps) while solving an equation.
2. an equation is a record of a computation with numbers, symbols that represent numbers, arithmetic operations and exponentiation. Numeric relationships can be symbolically represented as equations and fluency in transforming these equations/formulas is a tool for solving problems
3. the solution for an equation makes the statement true, the solution set for an inequality describes all of the solutions that make the statement true. An equation/inequality can have limitations on its solutions. (For example: no solutions, one or more solutions, or solutions with boundaries)
4. unit and scale can be used as a tool to effectively model context and solve problems while understanding that results may or may not be reasonable given the context of the problem.
5. there is a unique relationship between a function and its inverse.

<u>Essential Questions</u>: Students will keep considering…

1. In what ways can a problem be solved, and why should one method be chosen over another?
2. How can the choice of units, quantities and levels of accuracy impact a solution?
3. How can equations and inequalities be used to model real-world problems?
4. How is the inverse of a linear function related to the function?

Students Will Know…	Standard	Students Will Be Able to …	Standard
○ constant difference ○ slope ○ common ratio ○ how to translate words into mathematical symbols (sum, difference, product, equals, at least, at most, etc.) ○ independent and dependent variables	**A-CED.1**	**Create equations and inequalities in one variable and use them to solve problems.**	**A-CED.1**
● properties of numbers ○ inverse properties ● order of operations ● structure of a proof ● how to solve a multi-step equation	**A-REI.1**	**Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solutioN- Construct a viable argument to justify a solution method.**	**A-REI.1**
● properties of equations ● properties of inequalities ● when to reverse the inequality symbol	**A-REI.3**	**Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.**	**A-REI.3**
● properties of equality ● how to solve multi-step equations	A-CED.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.	A-CED.4
● constraint ● viable and non-viable solutions	A-CED.3	Represent constraint by equations and inequalities and interpret solutions as viable or non-viable options in a modeling context.	A-CED.3
● standard unit conversions ● appropriate scaling ● problem solving strategies ● appropriate labels ● unit/dimensional analysis ● titles for graphic representations	N-Q.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas.	N-Q.1
● appropriate scaling			

● problem solving strategies ● significant figures ● unit analysis ● appropriate labels ● titles for graphical representations ● place values ● how to solve for a variable ● what an inverse is ● a simple function has an inverse ● when to restrict the domain in certain functions	N-Q.2 N-Q.3 F.BF.4a	Define appropriate quantities for the purpose of descriptive modeling. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. Identify the inverse (Identify an input given an output). A- Solve an equation of the form f(x) = c for a simple function f that has an inverse Students use critical thinking skills to plan and solve problems, an make informed decisions using appropriate digital tools and resources.	N-Q.2 N-Q.3 F-BF.4a ISTE-4

EVIDENCE of LEARNING			
Understanding	Standards	**Unit Performance Assessment**:	**R/R Quadrant**
1-4	**A-REI.1** **A-REI.3** A-CED.4 **A-CED.1** F-BF-4a	district_performance assessment_solving__ **Description of Assessment Performance Task(s):** Students will model problems by writing algebraic equations and inequalities. **Teacher will assess:** 4. Students must define the variable(s) in their equations. 5. The equation created by the student must lead to a viable solution 6. Student should demonstrate correct computations. **Performance:** **Mastery:** Students will show that they really understand when they… 1. Create equations and inequalities in one variable and use them to correctly solve problems. 2. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. 3. Complete the common assessment with at least a 75%. **Scoring Guide:** See Appendix Unit 3(3 point rubric) and attached to link above	B Critical Thinking

SAMPLE LEARNING PLAN				
Pre-assessment: Solving Linear Equations and Inequalities (see appendix Unit 3 Common Assessments)				
Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy:**	**R/R Quadrant & 21st Century**
1,2,3,	**A-REI.1** **A-REI.3**	Activity: Solving Linear Equations Card Game- The student will communicate the steps used in simplifying expressions and solving equations and inequalities then their partner will critique their reasoning through formal arguments. Justifications will include the use of concrete objects,	Cues and Questions	B Collaboration, Communication

	MP2 MP7 MP8	pictorial representations, and the properties of real numbers, equality, and inequality (Round Robin). Objective: Students will be able to evaluate, justify, and match the steps for solving an equation within this activity. The cards should be shuffled and placed face up on a flat surface. The objective is to match the steps for solving an equation. Students should determine the order of play. On an individual's turn, the student should pick the card with the equation on it and pick a card with the first step in solving the equation. The next player would pick a card that would be the next step in solving the equation. Continue play until the equation is solved. Students will justify their reasoning for their select as the game moves towards a solution. After solving the equation, players pick another equation to be solved and continue. Appendix Documents: Solving Linear Equations Card Game	Practice and Homework Feedback	
1,2,3,4	**A-CED.1**, N-Q.1, N-Q.2, N-Q.3 A-CED.3 MP1, MP2,MP3, MP4MP6	11. Activity: Writing Equations and Inequalities in One Variable Read the word problem carefully and figure out what it is asking you to find. Assign a variable to the quantity you are trying to find. Re-read the problem and write an equation or inequality for the quantities given in the problem. At each step in the problem solving process partners will critique each other's reasoning. At the conclusion of the activity, this would be a good opportunity for students to formal reflect on his/her learning and mastery of objective and students to defend their solutions (Sage n Scribe, Round Robin, Rally Coach). Objective: Students will be able to read through word problems, develop strategies to solve the word problem, and critique other's work as they demonstrate the ability to write an equation or inequality for the quantities given in the problem. Appendix Documents: Activity 2	Cues and Questions Feedback Generating and Testing Hypothesis	C Collaboration, Communication, Critical Thinking Creativity
2	A-CED.4 MP2	12. Activity: Changing the Subject – The "subject" of a formula is the single variable (usually on the left of the "=") that everything else is equal to. One of the very powerful things that Algebra can do is to "rearrange" a formula so that another variable is the subject. In this	Cooperative Learning	B Collaboration, Communication Creativity

		activity students will–Draw one card from the deck and follow the directions on the card. – When you finish check with a neighbor to see if he/she agrees. Objective: Students will understand how to rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations while recognizing and critiquing other's work. Appendix Documents: PowerPoint; Cards		
5	F-BF-4a MP1,MP2, MP3,MP4, MP5 ISTE.4	13. Activity: Functions and Inverses This lesson involves grabbing and dragging point P along graphs of different functions to determine the relationship that exists between its ordered pairs and the ordered pairs of point P' that change as point P changes. ● Objective: Using technology like graphing calculators, students will know how to examine a set of data points. They will then be able to examine a line and will use the ordered pairs to determine the equation of the line containing point P and the line containing point P'. They will then generate the graphs of two new lines and will write the equations of both. From this, the students will make a conjecture about how to find the inverse of a function algebraically and have an opportunity to collaborate in order to defend solutions. ● Optional: Students will examine the ordered pairs of a graph of a quadratic function and its inverse. They will be given the equation of the quadratic function in vertex form and will find the inverse of it algebraically. ● Students will algebraically find the inverses of three functions.	Homework and Practice Cooperative Learning Feedback	D Collaboration, Communication, Critical Thinking

UNIT RESOURCES
Teacher Resources A-REI.1 A-REI.3 Some rules of algebra •The rule of symmetry •Commutative rules •Inverses •Two rules for equations. Linear equations •The law of inverses •Transposing •A logical sequence of statements • Simple fractional equations. INEQUALITIES •The number line •"or" versus "and" •A continued inequality •Some theorems of inequalities •Solving inequalities Literal Equations Solving One-Step Equations Kuta Worksheet 30 problems Solving Two-Step Equations Kuta Worksheet 24 problems Solving Multi-Step Equations Kuta Worksheet 20 problems; 15 problems Linear Equations Game A.CED.1 Linear Equation Word Problems Worksheet Verbal statements to mathematical expressions and vice versa Activity: Chocolate Milk: This investigation introduces the notion of changing percent mixtures through a fun class day that ends with a yummy treat. Students set up and solve equations to solve mixture problems. Words to Algebraic Expressions Translate Word Equations Create equations and inequalities in one variable and use them to solve problems. Includes 14 question MC quiz with answers Word Problems Word problems that lead to equations with fractions •The whole is equal to the sum of the parts. •Same time problem: Upstream-downstream. •Total time problem. •Job problem. A-CED.1 & A-REI.3 Solving One_step Inequalities Kuta Worksheet Solving Two-Step Inequalites Kuta Worksheet Multi-Step Inequalities Kuta Worksheet A-CED.4 & F.BF.4 Solving Literal Equations Worksheet 1 Solving Literal Equations Worksheet 2 Solving Literal Equations Textbook Problems Module on Solving Equations Regents Exam Prep Center Literal Equations A-REI.3 Compound Inequalities Worksheet Linear Inequalities in One Variable and Absolute Value Equations & Inequalities pg 8-11

Absolute Value Equations Worksheet
Absolute Value Equations Kuta Worksheet
Absolute Value Inequalities Worksheet
Absolute Value Inequalities Worksheet 2
Linear Inequalities in One Variable and Absolute Value Equations & Inequalities pg 12-20
The Math Page: Absolute Value
Linear Equations Word Problems
N.Q.1
Problem Solving: Linear Inequalities: Fishing Limits Problem
How to Solve Algebra Word Problems: Numerous examples of every type of word problem using linear equations
N.Q.2 -N.Q.3
Solving Word Problems using Algebra
Analysis and Significant Figures
Translate real world problems into Algebraic expressions and equations
Missouri Model Curriculum – Reasoning with Equations and Inequalities
Linear Equation Worksheets
Live Binders Linear Equations and Inequalities Unit
Performance Task – The Cycle Shop
Solving Equations Module – 5 Complete Lessons with PP Notes, Interactive Notes, Classwork WS, Practice WS, Review and Quiz
Solving Inequalities Module – 4 Complete Lessons with PP Notes, Interactive Notes, Classwork WS, Practice WS, Review and Quiz

Student Resources:
A-REI.1 A-REI.3
Quizlet Flashcards (Algebraic Properties)
Onlinemathlearning.com Multi-step Equations Interactive Practice & more practice
Onlinemathlearning.com Variable on Both Sides Interactive Practice

A-CED.1 & A-REI.3
Khan Academy Video/Lesson Solving Equations with Variables on Both Sides
Activity - Bernardo and Sylvia Play a Game:
This task presents a simple but mathematically interesting game whose solution is a challenging exercise in creating and reasoning with algebraic inequalities.
Equations with fractions: Clearing of fractions

Vocabulary: Appendix: Unit 3 vocabulary
equation, inequality, (all properties of equality), literal equation, variable, coefficient, term, like terms, equivalent, linear equation, linear inequality, independent variable, dependent variable, solution

Content Area: Mathematics	Course: Algebra I	UNIT 4: Polynomials
Unit Description: Students will become fluent in simplifying and identifying the parts of expressions. This includes using the order of operations, simplifying polynomial expressions, and simplifying expressions with exponents. -Identify: terms, factors, coefficients, bases, and exponents -Operations with polynomials (add, subtract, and multiply). Students will become fluent in factoring quadratic expressions. -Include GCF's, difference of squares, trinomials method for all values of A. Students will be able to translate a verbal expression to an algebraic expression.		**Unit Timeline:** 3 weeks

DESIRED RESULTS

<u>Transfer Goal</u> - Students will be able to independently use their learning to…

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.

<u>Understandings</u> – Students will understand that… (Big Ideas)

1. Each part of an expression has a function/purpose related to a real world context.
2. Symbolic statements can be manipulated by mathematical rules to produce equivalent statements.
3. Adding, subtracting, and multiplying polynomials follow a similar process as the operations of integers.
4. Students will factor a polynomial expression.

<u>Essential Questions</u>: Students will keep considering…

- What is a polynomial?

- What is the distinction between an expression and an equation?
- How are operations performed on polynomial expressions?
- What are the various techniques to factoring polynomial expressions?

Students Will Know…	Standard	Students Will Be Able to …	Standard
● vocabulary: exponents, factors, terms, bases, coefficients, expression ● identify like terms ● degrees of polynomials ● the meaning of symbols indicating mathematical operations, implied operations, the meaning of exponents, and grouping symbols. ● exponential growth and decay ● vocab: GCF, like terms ● properties of exponents ● factoring skills ● balancing equations ● graphing concepts of quadratics ● exponential growth and decay	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.	A-SSE.1
	A-SSE.2	**Use the structure of an expression to identify ways to rewrite it.**	**A-SSE.2**
	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** **b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.**	**A-SSE.3**.
● vocabulary: monomial, binomial, trinomial ● like terms ● distributive property ● operations on integers ● properties of integers	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.1**

● properties of exponents ● write algebraic functions from verbal expressions ● properties of functions - domain and range - input and output - types of functions… ● linear ● quadratic ● exponential ● how to interpret a graph ● understand concept of function and use function notation ● how to combine like terms ● explicit/recursive formulas	**F-BF.1b**	**Combine standard function types using arithmetic operations.** Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students apply digital tools to gather, evaluate, and use information. Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.	**F-BF.1b** ISTE-1 ISTE-3 ISTE-4

EVIDENCE of LEARNING

Understanding	Standards	**Unit Performance Assessment**: **Description of Assessment Performance Task(s):**	**R/R Quadrant/21st Century**
1- 4	A-SSE.1 **A-SSE.2** **A-SSE.3.** **A-APR.1** **F-BF.1b**	district_common_assessment-Unit 4 polyno Unit Performance Assessment: Operations on Polynomials All problems in this performance task are related to performing operations on polynomials expressions. The performance task will evaluate the student's ability to apply the concepts of area and perimeter to creating, simplifying, and factoring, polynomial expressions. **Teacher will assess:** Student's ability to create a polynomial expression to represent the perimeter or area of a geometric figure, to simplify the polynomial using operations, and to be able to factor a polynomial for a given area. **Performance:** **Mastery:** Students will show that they really understand when they… 1. Can correctly create an algebraic expression to represent perimeter and area. 2. Can correctly simplify polynomial expressions using operations. 3. Can factor a polynomial expression. 4. Complete the common assessment with at least a 75%. **Scoring Guide:** See Appendix 4 Common Assessment Folder (4-point Rubric Scoring Guide). Can be located at bottom of embedded file above too.	B Critical Thinking

SAMPLE LEARNING PLAN

Pre-assessment: Polynomial Pre-assessment (See Appendix Unit 4 Common Assessments)

Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy:**	**R/R Quadrant/21st Century:**
1-4	A-SSE.1 A-SSE.2 A-SSE.3 A-APR.1 F-BF.1b MP 1,2,3,4 ISTE. 1,3,4	Activity: Polynomial Farm Objective: Students will be able to express area and perimeter of geometric figures by applying properties of exponents and operations on polynomial expressions, including factoring polynomial expressions. This activity provides a real-world situation where a plot of land for a garden is divided up into various sections with dimensions that are given as polynomials. Students can self-reflect and formally critique and defend others on applying the proper techniques to performing operations on polynomials. Students will then also be able to construct a perimeter and area model that fits various criteria, and use the graphing calculator to verify their model. This activity provides an opportunity to do research on other real world applications Appendix Documents: Unit 4 Resources	Providing Practice; Generating and Testing Hypothesis Feedback	D Communication Critical Thinking Creativity
2,4	A-SSE.2 A-SSE.3 MP3,8	Activity: Factoring Flip-Book Objective: Students will know and summarize the methods of factoring by creating a flow-chart and flip-book to help determine the appropriate factoring method to apply to a polynomial. Information can be shared in a Round Table format. This will also allow students to self-reflect on each method of factoring, the process used for each, and for comparing/contrasting one method to another. Appendix Documents: Unit 4 Resources	Summarizing; Note Taking	A Communication Collaboration
2,4	A-SSE.2 A-SSE.3 MP 3,7	Activity: Factoring Inside-Outside Circle (or Quiz-Quiz-Trade) Objective: Students will work together as pairs and will be able to recognize the type of factoring that should be applied to factoring a polynomial into factors. Students will be able to critique others reasoning behind which source of factoring, as well as coach peers through a formal evaluation process where students can defend their soltuions.	Cooperative Learning Feedback	C Collaboration

		Appendix Documents: Unit 4 Resources		
2,4	A-SSE.1 A-SSE.2 A-SSE.3. MP 3,5,7	Factoring Sorting Activities Objective: Given various polynomial expressions, students will be able to evaluate the type of factoring method that will be used in order to factor the expression. Students will then demonstrate their ability to factor the expressions. This activity will allow students to critique others' arguments about which process of factoring should be utilized on a certain polynomial. Appendix Document: Unit 4 Resource	Summarizing Feedback Cooperative Learning	B Communication Critical Thinking Collaboration

UNIT RESOURCES
Teacher Resources: ● Holt Algebra Text book, Chapter 8 ● Holt On-Line Resources (http://my.hrw.com) ● Appendix Resources Unit 4 ● Kuta On-line worksheets (for additional practice) o Adding and Subtracting Polynomials o Multiplying Polynomials o Factoring Polynomials WS 1 o Factoring Polynomials WS 2
Student Resources: ● Holt Algebra Text book ● Holt On-line resources ● Study Island (www.studyisland.com) ● iXL (www.ixl.com)
Vocabulary (see Appendix) exponents, factors, terms, bases, coefficients, expression, like terms, degree of a monomial, degree of polynomials, GCF, monomial, binomial, trinomial, distributive property, standard form

Content Area: Mathematics	Course: Algebra I	UNIT 5: Solving Quadratic Equations
Unit Description: Students will be able to create and solve quadratic equations.		**Unit Timeline:** 4 weeks

DESIRED RESULTS

Transfer Goal - Students will be able to independently use their learning to…

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.

Understandings – Students will understand that… (Big Ideas)

1. There is a relationship between the various methods for solving a quadratic equation.
2. Quadratic functions have a symmetric property (parabolic shape).
3. Every point on a graph is a solution.
4. There are many equivalent forms of an equation.
5. Different representations of the same function can be used to find key information.
6. Unit and scale can be used as a tool to effectively model context and solve problems while understanding that results may or may not be reasonable given the context of the problem.

Essential Questions: Students will keep considering…

- Why should we factor?
- How can you use a quadratic equation to model a real-world situation?
- What are the different methods of solving a quadratic equations and when is each appropriate?
- What does the graph of a quadratic function look like, and what are the pieces that characterize the graph?

Students Will Know…	Standard	Students Will Be Able to …	Standard

● how to complete the square ● how to factor ● quadratic formula ● discriminant	**A-REI.4a & b**	**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 $x^2 = 49$), 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.**	**A-REI.4a** **A-REI.4b**
● vocabulary: exponents, factors, terms, bases, coefficients, expression ● identify like terms ● degrees of polynomials ● the meaning of symbols indicating mathematical operations, implied operations, the meaning of exponents, and grouping symbols. ● exponential growth and decay	**A-SSE.1a & b**	**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.**	**A-SSE.1a** **A-SSE.1b**
● vocab: GCF, like terms ● properties of exponents	**A-SSE.2**	**Use the structure of an expression to identify ways to rewrite it.**	**A-SSE.2**
● factoring skills ● balancing equations ● graphing concepts of quadratics ● exponential growth and decay ● linear ● quadratic ● exponential	**A-SSE.3a & b** **A-CED.1**	**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.**	**A-SSE.3a** **A-SSE.3b** **A-CED.1**

• constant difference • slope • common ratio • how to translate words into mathematical symbols (sum, difference, product, equals, at least, at most, etc.) • independent and dependent variables		**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.**	
• slope • common ratio • how to translate words to an expression • independent and dependent variables • how to graph a point on a coordinate plane • the standard forms of a linear, quadratic and exponential equations	**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.2**
• quadratic formula • factor • how to complete the square	**F-IF-8a**	**Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the functioN-** **A- Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.**	**F-IF-8a**
• standard unit conversions • appropriate scaling • problem solving strategies • appropriate labels • unit/dimensional analysis • titles for graphic representations	N-Q.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	N-Q.1
• appropriate scaling • problem solving strategies	N-Q.2	Define appropriate quantities for the purpose of descriptive modeling.	N-Q.2
• significant figures • unit analysis	N-Q.3		N-Q.3

• appropriate labels • titles for graphical representations • place values		Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students apply digital tools to gather, evaluate, and use informatioN- Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.	ISTE-1 ISTE-3 ISTE-4

EVIDENCE of LEARNING			
Understanding 1-6	**Standards** **A-REI.4a & b** **A-SSE.1a & b** **A-SSE.2** **A-SSE.3a & b** **A-CED.1** **A-CED.2** **F-IF-8a** N-Q.1	**Unit Performance Assessment**: **Description of Assessment Performance Task(s):** Solving and Graphing Quadratic Functions district_common_assessment_-_Unit 5 qua All problems in this performance task are related to solving and graphing a quadratic function. The performance task will evaluate the student's ability to solve a quadratic equation, change the form of a quadratic equation from standard form into vertex form, graphing the quadratic function, identify the characteristics of the graph, and make connections between the equation and the graph of the function. **Teacher will assess:** Student's ability to factor a quadratic expression, understand the relationship between factoring and solving a quadratic equation, translate a quadratic equation from standard to vertex form, their	**Rigor/Relevance & 21st Century:** B Critical Thinking

		understanding of how these characteristics translate to the graph of the equation, and identifying the characteristics of a graph of a quadratic equation. **<u>Performance:</u>** **Mastery:** Students will show that they really understand when they… 1. can factor a quadratic expression 2. solve a quadratic equation 3. change from standard form of a quadratic into vertex form 4. graph a quadratic function 5. score at least 75% on the common assessment **Scoring Guide:** See Unit 5Appendix Common Assessment Folder (4-point Rubric Scoring Guide). Also located in the embedded file above.	

SAMPLE LEARNING PLAN				
Pre-assessment: Quadratic Pre-Assessment (See Appendix 5Common Assessments)				
Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy:**	**R/R Quadrant:**
2,3,5,6	A-REI.4a & b A-SSE.1a & b A-SSE.2 A-SSE.3a & b A-CED.1 F-IF-8a N-Q.3 MP 1,2,4,6,7 ISTE.1,2,4	1. Activity: Applications of Solving Quadratic Equations: Where Would the Angry Birds Land? ● Objective: Students will be able to analyze a real-world application that relates the pathway of an angry bird to a quadratic function. Students will see a situation develop through an Angry Bird scenario, be asked to make predictions, and to evaluate their hypotheses as the scenario unfolds. Through the video and gaming system, the characteristics of a parabolic function will be developed and realized. Students will be able to critique each other's hypotheses about the pathway of the angry bird and hear and defend their arguments on how far it will travel. ● Appendix Documents: See Unit 5(Quadratics) Resources	Nonlinguistic representation; Generating and testing hypotheses Feedback	C Critical Thinking Creativity Communication
1,2,3,5,6	A-REI.4a & b A-SSE.1a & b A-SSE.3a & b A-CED.1 F-IF-8a N-Q.1 N-Q.2 N-Q.3 MP 1,2,4,6,7 ISTE.1,2,4	2. Activity: Applications of Solving Quadratic Equations: Cutting Corners ● Objective: Students will analyze a real-life problem that involves the amount of space needed for a school bus to make a turn. Students will create a quadratic equation, solve using a variety of methods, and interpret the answer(s) as it/they relate to the problem. This activity also spirals the concept of the Pythagorean Theorem for application. Students will be able to critique each other's mathematical approaches to a problem as well as self-reflect on whether their calculations are correct. Students may need to research the activity to develop their hypothesis. ● Appendix Documents: See Unit 5(Quadratics) Resources	Generating and testing hypotheses; cues, questions, and advanced organizers	D Critical Thinking Communication Collaboration
1,2,3,4, 5,6	A-REI.4a & b A-SSE.1a & b A-SSE.3a & b A-SSE.2 A-CED.1	3. Activity: Quadratic Sales ● Objective: This activity explores the quadratic relationship that occurs in predicting the equation of a quadratic function based off the optimal amount of memory in a cell phone. The graphing calculator is used as a supplement to this activity, as the students will also explore the idea of curve fitting and	Identifying Similarities and Differences; Cooperative	D Critical Thinking

	F-IF-8a N-Q.1 N-Q.2 N-Q.3 MP 1,2,4,6,7 ISTE.1,2,4	creating a hypothesis about the equation for a quadratic function and how it affects the characteristics of a parabola. Students will work collaboratively to test hypotheses and compare/contrast the various equations that are produced. ● Appendix Documents: See Unit 5 (Quadratics) Resources	learning; generating and testing hypotheses	Communication Collaboration
2,3,5	A-SSE.3a & b F-IF-8a MP 3,8	4. Activity: Quiz-Quiz-Trade: Properties of Quadratics Quiz-Quiz Trade-Properties of quadratics ● Objective: Students will work collaboratively to practice and reinforcement the main characteristics of a parabola. Students will be asked to recognize the vertex, axis of symmetry, and values of quadratic functions. ● Appendix Documents: See Unit 5 (Quadratics) Resources	Cooperative Learning; homework and practice	B Collaboration
2,3,5,6	A-SSE.3a & b A-CED.1 A-CED.2 F-IF-8a N-Q.1 MP 1,2,4,6,8 ISTE.1,3,4	5. Activity: Oil's Not Well; A quadratic Investigation ● Objective: Students will explore a situation where an oil tanker is leaking. They will find the area of the oil as it expands, and compare and contrast the resulting information with a linear function. Teachers will also have the opportunity to spiral finding the area of a circle in this activity. ● Appendix Documents: See Unit 5 (Quadratics) Resources	Identifying similarities and differences; homework and practice	C Critical Thinking Communication
1,2,3,5,6	A-REI.4a & b A-SSE.1a & b A-SSE.3a & b A-CED.2 F-IF-8a MP 2,3,8 ISTE.1,4	6. Activity: Quadratic Graphing Calculator Exploration ● Objective: Students will use a graphing calculator to explore the relationships of the characteristics of a parabola related to the quadratic equation. This use of technology will help students master the content. They will investigate the zeros, y-intercept, vertex, and axis of symmetry. They will use the capabilities of the graphing calculator to support the characteristics of the quadratic equation. ● Appendix Document: See Unit 5 (Quadratics) Resources	Summarizing & Note taking; Generating & Testing Hypothesis	B Critical Thinking Communication
1-6	A-REI.4a & b A-SSE.1a & b A-SSE.2	7. Activity: Quadratic Transformation Graphing Calculator Exploration	Summarizing & Note taking; Generating &	B

	A-SSE.3a & b A-CED.2 F-IF-8a MP 2,3,8 ISTE.1,4	• Objective: Students will explore transformations of quadratic functions using the graphing calculator as an integrated technology resource to engage students' learning. This activity will also help students investigate the connection between the graph and the standard (vertex) form of the equation. • Appendix Document: See Unit 5 (Quadratics) Resources	Testing Hypothesis	Critical Thinking Communication

UNIT RESOURCES
Teacher Resources: Holt Textbook and Online Resources: my.hrw.com Kuta math supplemental worksheets: https://www.kutasoftware.com/free.html Online Free Graphing Calculators: DESMOS.com Engage NY: engageny.org
Student Resources: Holt Algebra 1 Textbook and Online Resources: my.hrw.com Online Free Graphing Calculator: DEMOS.com Free Graphing Calculator App for iPhone or Android Online tutorials: khanacademy.com
Vocabulary: (See Appendix) exponent, square, equation, expression, factor, coefficient, variable, term, quadratic, zeros, root, solution, function

Content Area: Mathematics	Course: Algebra I	UNIT 6: Graphing Functions
Unit Description: Students will graph the following functions by hand using key features: Linear, quadratic, exponential, piecewise defined (including step and absolute value functions). Students should explore key features and transformations of these graphs using a graphing calculator. Given a set of bivariate data, students will be able to display it appropriately, describe key features, and relate the information in the context of the problem.		**Unit Timeline:** 5 weeks

DESIRED RESULTS

<u>Transfer Goal</u> - Students will be able to independently use their learning to…

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.

<u>Understandings</u> – Students will understand that… (Big Ideas)

1. When representing real-life functions algebraically, graphically, verbally and in tables, labels with appropriate units are important. Every point on a graphed function is a solution to its related equation.
2. Functions have key characteristics that describe the relation, and different forms of the same algebraic function reveal different characteristics. End behavior reveals that linear functions are outpaced by quadratics which are outpaced by exponentials.
3. Linear functions have a constant rate of change (slope), such that a consistent change in input produces a consistent difference between outputs. Exponential functions have a constant multiplier such that a consistent change in input produces a consistent ratio between outputs

4. A function's domain and range values are associated with the horizontal and vertical axes and may be limited, either by the nature of the function itself or by a real-world context.
5. A graph can be translated and dilated by altering parameters of the parent functions.
6. Bi-variate data can be modeled with mathematical functions that describe the relation, approximate the data, and help justify predictions. The correlation coefficients (r) rate how closely data follows a function.

<u>Essential Questions</u>: Students will keep considering…

- How do graphs assist with solving problems in real life?
- How are various functions related to their graphs, their tables of values, and their real life origins?
- What are key features in different kinds of function graphs?
- How can real life bivariate data be analyzed since it does not fall exactly on the graph a function?

Students Will Know…	Standard	Students Will Be Able to …	Standard
• factoring skills • balancing equations • graphing concepts of quadratics • exponential growth and decay • slope • common ratio • how to translate words to an expression • independent and dependent variables • how to graph a point on a coordinate plane • the standard forms of a linear, quadratic and exponential equations • know the difference between independent and dependent variables • know that coordinates represent a solution • x-intercepts • y-intercepts • increasing • decreasing • constant • relative maximum • relative minimum • key characteristics of functions • domain • slope formula	A-SSE.3 a,b&c A-CED.2 A-REI.10 **F-IF.4** F-IF.5	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. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). **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; and end behavior.** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.	A-SSE.3 A-CED.2 A-REI.7 A-REI.10 **F-IF.4** F-IF.5

• definition of slope/rate of change • graph/plot points • how to construct a table of values	F-IF.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. (focus on linear and exponential functions)	F-IF.6
• how to plot points • how to find key features from a linear equation in these forms - slope-intercept - point-slope - standard • how to evaluate exponents	F-IF.7a,b, e	**Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. A** a. **Graph linear and quadratic functions and show intercepts, maxima, and minima**. b. Graph (square root, cube root Algebra 2) and piecewise-defined functions, including step functions and absolute value functions. (Compare and contrast domain, range and usefulness of each function.) e. Graph exponential functions showing intercepts and end behavior.	**F-IF.7a** F-IF.7b F-IF.7e
• quadratic formula • factor • how to complete the square • how to graph functions • identify key aspects of a graph o y-intercept o vertex o slope • the parent graphs of each function o linear o quadratic o exponential o absolute value o • difference between even and odd functions • dilation	F-IF.8a F-IF.9 F-BF.3	**Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.** **a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.** **Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).**	**F-IF.8a** **F-IF.9**

● translation ● how to plot points ● how to utilize a table to generate inputs/outputs for a function ● how to graph linear, quadratic, and exponential functions	F-LE.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. (focus on linear, quadratic and exponential functions)**	**F-BF.3**

● concepts of linear and exponential functions
● translations of words to equations
● domain/range or input/output
● independent/dependent variables
● know meaning of increasing and decreasing
● forms of a linear equation
    o slope-intercept
    o point-slope
    o standard
	F-IF.9	**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. (Given output, find the input on a graph, table, or in an equation).
			F-BF.4.a

		Construct linear and exponential functions…given a graph, a description of a relationship, or two input-output pairs.	**F-LE.2**

● definition of:
    o slope
    o y-intercept
    o residual
    o independent and dependent variables
● how to plot ordered pairs
● how to find slope
● how to find y-intercept
● how to model functions
    o linear
    o quadratic
    o exponential
	S-ID.6	**Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.**	**F-LE.3**

● definition of slope as a rate of change		Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals.	S-ID.6

● definition of y-intercept ● difference between no slope (undefined) and zero slope ● know how to create a scatterplot on a graphing calculator ● know definition of correlation coefficient ● know the meaning and give examples of positive, negative and no correlation ● standard unit conversions ● appropriate scaling ● problem solving strategies ● appropriate labels ● unit/dimensional analysis ● titles for graphic representations	S-ID.7 S-ID.8 N-Q.1	c. Fit a linear function for a scatter plot that suggests a linear association. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. Compute (using technology) and interpret the correlation coefficient of a linear fit. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. <u>I.S.T.E. Standards</u> 1. Creativity and innovation Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. a. Apply existing knowledge to generate new ideas, products, or processes b. Create original works as a means of personal or group expression c. Use models and simulations to explore complex systems and issues d. Identify trends and forecast possibilities 3. Research and information fluency Students apply digital tools to gather, evaluate, and use information. a. Plan strategies to guide inquiry b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media c. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks d. Process data and report results 4. Critical thinking, problem solving, and decision making Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. a.	 S-ID.7 S-ID.8 N-Q.1 ISTE.1 ISTE.3 ISTE.4

		Identify and define authentic problems and significant questions for investigation b. Plan and manage activities to develop a solution or complete a project c. Collect and analyze data to identify solutions and/or make informed decisions d. Use multiple processes and diverse perspectives to explore alternative solutionsiste.org/hip 6. Technology operations and concepts Students demonstrate a sound understanding of technology concepts, systems, and operations. a. Understand and use technology systems b. Select and use applications effectively and productively c. Troubleshoot systems and applications d. Transfer current knowledge to learning of new technological data analysis	ISTE.6

EVIDENCE of LEARNING			
Understanding	**Standards**	**Unit Performance Assessment**:	**R/R Quadrant & 21st Century:**
1-6	**F-BF.3, F-IF.4,7a 8.b, 9 F-LE.2,.3** N-Q.1	Unit 6 performance_event_fr **Description of Assessment Performance Task:** The performance task assesses all the major focus standards for the unit. Students will perform multi-step analysis of quadratic functions and symbolically and verbally analyze and describe rates of growth between linear and exponential. **Teacher will assess:** A detailed scoring rubric is provided with the Performance Event document. Teacher will analyze student work and assign points based upon evidence the standard is met. Results will be entered into an electronic data base for individual and whole-class analysis. **Performance:** **Mastery:** Students will show that they really understand when they achieve 85% or above, consistently, for a particular standard.	C Critical Thinking

		Scoring Guide: A detailed scoring rubric is provided with the Performance Event document (above and in appendix).	

SAMPLE LEARNING PLAN				
Pre-assessment: Graphing Unit Pre-test is in Schoology Appendix Folder				
Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy:**	**R/R Quadrant:** **&** **21st Century**
		● Define: Function, domain and range, input-output Discuss how to translate from one representation to all of the others, synthesizing the connections between the Graph, Numeric (tables/points), Algebraic (analytic, expressions), and Words ● Understand and write function notation ● Emphasize a point is a solution and the graph of a two-variable equation is the set of all its solutions.		
2	F-BF.3 MP7	Activity 1 Discover Graph Shapes Students will look at different types of graphs and shapes. From these examples, students will work through equations and graphs to identify what type of graph the equation and graphs are being represented. Objective: Students know how to use pattern recognition (comparing graphs with algebra symbols and synthesizing the connections) to discover graph shapes, and poetry to remember how the algebraic symbols are related to the graphs. Appendix: Discover Graph Shapes	Non-linguistic representation	A critical thinking
1,3	**F-IF.7a, b** ISTE 4 ISTE.6	Activity 2 Graphing by building point tables linear, quadratic, exponential, absolute value	Similarities & Differences, Homework and	B

	MP 5,6,8	Objective: Students will be able to graph linear, quadratic, exponential, and absolute value graphs by hand by creating point tables by evaluating expressions by substituting numbers for variables. Students verify their work using graphing calculators and online graphing utilities. Problem solving is employed to analyze inconsistencies with graph shapes, manual calculations, and graphing calculator results. Appendix documents: Graph Quest I, Graph Quest II, Graph Quest III	Practice, Cooperative Learning, Feedback, Advanced Organizer	Critical thinking, & problem solving,
1,2,3,4,5	**F-IF.7a, b** ISTE.4 MP 7	Activity 3 Graphing by key features Objective: Students will graph functions and equations by developing familiarity with different ways to write equations to reveal key features. Problem solving is employed to analyze inconsistencies with graph shapes, manual calculations, and graphing calculator results. Students should have an opportunity to defend their solutions as they work through the problems. Holt Algebra I Sections 5.2, 5.6, 9.3, 11.2	Homework and Practice Feedback	B Critical thinking, problem solving, technology operations and concepts
1,2,3,4,5	**F-IF.4** ,5,6, **7e** MP 7 ISTE.1	Activity 4 Exponential Functions worksheet from: http://www.charleston.k12.il.us/cms/Teachers/math/Algebra/aunit4/L4-2.PDF Objective: Students will understand by reading non-fiction and study examples to learn about key features of exponential functions and how to graph them. Appendix document: Exponential Functions	Homework and Practice	B Critical thinking
4	F-IF.5 MP 1	Activity 5 Domain and Range Objective: Students work in groups of 2 or 3 and be able to coordinate synchronized, concurrent graph tracing in order to synthesize connections between domain, range, curve, and axes. One student traces the graph while another student mirrors the left-right or up-down progress on the related axis. Then they switch. A third student can serve as coach to make sure the two tracers stay together. Students will critique each other's work while engaged in the activity allowing students to defend their solutions. Appendix document: Domain and Range Activity	Cooperative Learning, Feedback, Identifying similarities and differences	B Critical thinking Collaboration, Communication

8	F-IF.5 F-BF.3 ISTE.1,6 MP 5,7	Activity 6: Domain and Range with DESMOS.com Students visit the free on-line graphing utility to create a picture by typing in equations and restricting domains/ranges. Similar to learning a new game app, students must "research" and experiment to see which algebra symbols produce graph shapes needed for their creations such as circles, hyperbolas, ellipses, etc., Students' products can be electronically sent to teacher. Objectives: Students will be able to analyze how changing parameters, domains, and ranges on functions changes shapes on the graph. Appendix document: Domain and Range with Desmos	Generating and Testing Hypotheses	C Creativity
1,2,4,5	**F-IF.4** F-IF.5 F-BF.3 ISTE.1,6 MP 5,7	Activity 7: Photograph Graph Shapes Students describe shape, domain, range, increasing and decreasing functions. This is similar to Activity 6 except students can upload a selfie or other desirable picture onto their graph and add geometric shapes by typing in equations. Objective: Students will be able to analyze how parameters, domains, and ranges on functions changes shapes on the graph. Appendix document: Photograph Graph Shapes	Generating and Testing Hypotheses	C Creativity & Innovation Technology Operations and Concepts
1,2,5	F-IF.9 F-BF.3 Prep for A-SSE.3 and F-IF.8 MP 1,2,3,4,5,7	Activity 8: Test Engineering: Project for Equivalent Forms Students work in groups of four. Each student is given a real life scenario related to interesting careers such as pyrotechnics, materials testing, safety related to sports equipment, lab analysis. The group is given a packet of cut up squares with algebraic functions, scatter plots, tables, and graphs to sort through and find which match their real-life scenario. Students then make posters that formaly defend their solutions and answer a series of exploratory questions regarding key features that assisted in identifying related pieces. Objective: Students are able to observe key features in graphs and learn about how math is related to STEM careers. Appendix documents: Test Engineering	Cooperative Learning, identifying similarities and differences, summarizing,	C Collaboration, Communication, Critical Thinking
1,2,4,5	A-CED.2 **F-IF.4** ,5,7,9	Activity 9: Quadratic Sales Patterns Students observe a 30-second video of engineers discussing sales possibilities for different size memories in cell phones. The sales patterns	Cooperative learning,	C Collaboration

	F-BF.3 S-ID.6.a N-Q.1 ISTE.4 ISTE.6 MP 1-8	are quadratic. Students fit a quadratic function to a set of data in their graphing calculators by adjusting parameters as indicated in the directions. Objectives: Students will be able to address many standards through analysis, synthesis and exploration. Appendix documents: Quadratic Sales two versions, one cooperative with Kagan, one as individual or pair-share project) also homework 2 Video introduction Cell Phone Memory	Problem-based learning	
2	A-SSE.3 **F-IF.7a** MP 2,7	Activity 10 Graphs of Quadratic Functions Objective: Students will know how to observe various representations of the same function observing the features of the graph revealed in the structure of each representation. Appendix document: Illustrative Mathematics A-SSE.3	Identifying similarities and differences	A Critical Thinking
1,2,3,5	**F- IF.4,** 5,6,9 F-BF.3,4a F-LE.2,3 A-REI.7 ISTE.4 ISTE.6 MP 2,3,5,7,8	Activity 11 Borrowing from Grandma Objective: Students evaluate loan costs with various interest rates and compare linear with exponential (compounded). Through analysis, students determine that exponentially (compounded) is more expensive in the long run. Appendix document: Borrowing from Grandma	Cooperative Learning and Problem-based learning	B ITSE 4,6 Critical Thinking
2	F-BF.4 MP 7	Activity 12 Invertible or Not? Objective: Students will understand what kinds of functions are invertible. This activity is an enrichment as progressions documents explain that students in Algebra need only identify x given y. Appendix document: Illustrative Mathematics F-BF.4	Homework and Practice	B Critical Thinking
1,3	F-IF.6 MP 7	Activity 13 Graphing Piecewise Functions The activity allows students to analyze slope in a variety of contexts. Objective: Students will know how to identify the changing slope of a piecewise function Appendix document: Graphing Piecewise Functions	Homework and practice, identifying similarities and differences	A Critical Thinking

1,3,4	F-IF.6 S.ID.6 MP 1,2,3	Activity 14 Recharging the laptop battery Objective: Students use reasoning and problem solving skills to analyze the recharging process of a laptop which turns out to be linear. Statistics and modeling functions are part of the process. There are several ways to solve the problem and screenshots on the worksheet help them visualize what is happening. Appendix document: Illustrative Mathematics	Cooperative Learning	C Critical Thinking
1,2,4,5	**F-IF.4**,**7a, 7b** N-Q.1 A.CED.2 F-BF.3 ISTE.4 ISTE.6 MP 1,2,3,5,7,8	Activity 15 Quality Assurance and Absolute Value related to Metrology Objectives: Students will be able to use measurements in real employment situations to see how it is related to absolute value. They measure parts, determine their "tolerance," and explore shifts of related absolute value functions and synthesize understanding of those shifts with that of quadratics. Students will have the opportunity to critique and evaluate each other's work. Appendix documents: Quality Assurance and Absolute Value worksheet Quality Assurance Absolute Value Manufactured Parts	Cooperative Learning, Providing Feedback	D Critical Thinking, Problem Solving,
1,2,3,4,5,6	A-SSE.3 A-REI.10 **F-IF.4**-9 F-BF.3 F-LE.3 N-Q.1 F-BF.4 MP 1-8	Activity 16 Math Joke: Scenario where a joke is emailed to 50 friends and then each friend emails to 8 more friends. What mathematical and real world questions arise from this scenario? Students will use this scenario to connect to standards and build questions. Objective: Students will be able to consider what might happen and modify the scenario to entertain a variety of math questions. Standards covered depend on questions asked. One option is to provide students with student-friendly version of the standards and have them design questions that meet the standards. During the next class they could answer them. Students have an opportunity to critique each other's arguments and work. Appendix document: Math Joke	Cues and Questions, Advance Organizers	D Critical thinking, Collaboration, Communication, Creativity
3,6	S-ID.7 MP 1,2,3	Activity 17 Texting and Grades Objective: Students will understand how to provide a basis for rich discussion (comparison, analysis) on the meaning of the slope of a regression line. Appendix document: Illustrative Mathematics S.ID.7	Cooperative Learning and Feedback	B Critical thinking, Collaboration, Communication

1,3,4,6	S-ID.7 MP 1,4	Activity 18 Slope in Various Contexts Objective: Students will be able to explore, compare, and analyze slope in a wide variety of contexts in order to synthesize their understanding. Appendix document: Slope Various Contexts	Cooperative Learning and	B Critical thinking, Collaboration, Communication
1,6	S-ID.6-9 1,2,5	Activity 19 Coffee and Crime Are coffee shops related to an increase in crime? Do they cause crime? Objective: Students know how to explore the implications of a linear regression line to make since of the data it provides. Appendix document: Illustrative Mathematics S.ID.6-9	Cooperative Learning	A Critical thinking, Collaboration, Communication
1,3,	N-Q.1 MP 1,2,3,5,6	Activity 20 Fuel Efficiency Objective: Students will be able to explore conversions to compare linearly related quantities measured with different units as it relates to real world situations. Students will have to research how fuel is measured in Germany and how to convert the units. This exercise will carry students beyond simple liters to gallons conversions because they will have to think through information given as volume per distance. Other constraints will be included to engage and challenge students at this task. Students will formally defend their positions. Illustrative Mathematics N-Q.1	Cooperative Learning Generating & Testing Hypothesis Summarizing and Note taking Feedback	D Critical thinking, Collaboration, Communication
1-6	A-SSE.3 A-CED.2 A-REI.10 **F-IF.4**-8a F-BF.3 F-LE.3 ISTE.1	Activity 212 Holt Algebra I Chapters 4, 5, 8, 11 These units contain much information that transfers from the old MLS to the new MLS. All of three units would be helpful in developing graphing skills at a procedural level. Objective: Students will understand how to use graphing calculators to verify accuracy of calculations, particularly by using the point table to compare inputs with calculated outputs. Graphing calculators can be used to explore "graphical equality." This means that a different form of the same function has the same graph. Graphing calculators are also used to make conjectures regarding shifts of graphs based on changes in parameters of the equations.	Presented or explored in various ways.	B Creativity Critical Thinking

UNIT RESOURCES
<u>Teacher Resources</u>: Learn Zillions: https://learnzillion.com/lessons/295-determine-the-end-behavior-of-a-polynomial-or-exponential-expression

Online free grapher: DESMOS.com
Relate functions with computer coding on "The Hour of Code": code.org
EngageNY https://www.engageny.org/resource/high-school-algebra-i
emathinstruction.com free online textbook and videos, fairly well aligned and simple to use
Daily downloadable lesson plans including presentations, homework assignments, and videos: staff websites Lane Walker

Student Resources:

Online free grapher: DESMOS.com
Holt online textbook: my.hrw.com
Explanations: Purplemath.com
Instructional videos and practice: https://www.khanacademy.org/
emathinstruction.com free online textbook and videos, fairly well aligned and simple to use

Vocabulary:

Monomial, binomial, trinomial, linear function, slope, intercept, quadratic function, vertex, relative maximum, relative minimum, axis of symmetry, exponential function, end behavior, transformations, scatter plot, residuals, correlation coefficient, increasing, decreasing (see appendix)

Content Area: Mathematics	Course: Algebra I	UNIT: 7 Systems of Equations and Inequalities
Unit Description: Students will become fluent in solving systems of equations and inequalities. Students will need to justify their solving process, recognize the limitations of their process, and interpret the solutions in context of the problem. -Solve systems of linear equations using the intersection of graphs, substitution and elimination. -Explain why the process of elimination produces that same solution as the original system. -Explain why the x-coordinate of intersection of y=f(x) and y=g(x) is the solution to f(x)=g(x), limited to linear and exponential equations. -Find approximate solutions to system equations consisting of linear, quadratic and/or exponential functions by finding the intersection using technology. -Solve systems of linear inequalities using the intersection of graphs and determine if the boundaries are part of the solution. -Identify points as solutions or non-solutions for linear systems and systems of linear inequalities. .		**Unit Timeline:** 4 weeks

DESIRED RESULTS
<u>Transfer Goal</u> - Students will be able to independently use their learning to… 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.

<u>Understandings</u> – Students will understand that… (Big Ideas)

1. There are situations that require two or more equations to be satisfied simultaneously and there are several methods for solving systems of equations.
2. A solution of a system of equations is the point or points that are common to both equations if it exists. An equation/inequality can have limitations on its solutions. (For example: no solutions, one or more solutions, or solutions with boundaries)
3. There are many equivalent forms of an equation, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
4. There is an infinite number of solutions for an inequality that can be found within the shaded region of its graph in the coordinate plane. The overlapping shaded region represents the solutions to a system of inequalities.
5. Functions have real-world limitations and meanings. Unit and scale can be used as a tool to effectively model context and solve problems while understanding that results may or may not be reasonable given the context of the problem.

<u>Essential Questions</u>: Students will keep considering…

What is a system of equations?
How can I translate a problem situation into a system of equations?
What does the solution to a system tell me about the answer to a problem situation?
How can I interpret the meaning of a "system of equations" algebraically and geometrically?

Students Will Know…	Standard	Students Will Be Able to …	Standard

• simplify expressions
  o add like terms
  o distributive property
• equality properties
• substitution
	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.5**

• graph a linear equation • identify a point as an ordered pair • solve an equation in one variable • parallel lines never intersect (no solution) • coincidental lines (infinite solutions) • a solution to a system of equations is written as an ordered pair	**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.6**
• graph a linear equation • graph a quadratic equation • solve an equation in one variable • solve by graphing • solve by factoring • solve by quadratic formula	**A-REI.7** ISTE-4	**Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.**	**A-REI.7**
• slope • common ratio • how to translate words to an expression • independent and dependent variables • how to graph a point on a coordinate plane • the standard forms of a linear, quadratic and exponential equations	**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.2**
• system of equations/inequalities • constraint • viable and non-viable solutions	A-CED.3	**Represent constraints by equations or inequalities, and by systems of equations and /or inequalities, and interpret**	**A-CED.3**

		solutions as viable or non-viable options in a modeling context.	
• how to distinguish between the independent and dependent variable	F-LE.5	Interpret the parameters in a linear or exponential function in terms of context.	F-LE.5
• know the difference between independent and dependent variables • know that coordinates represent a solution	A-REI.10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	A-REI.10

• how to graph linear equations
• how to graph exponential equations
• function notation
• how to use a graphing calculator
  o graph a function
  o trace a graph to find ordered pairs
  o generate a table of values for a function
	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 and exponential.	A-REI.11

• graph linear equations • boundary lines • half-planes • graphing linear inequalities • possible types of solution sets to a linear systems of equations	**A-REI.12**	**Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.**	**A-REI.12**
• standard unit conversions • appropriate scaling • problem solving strategies • appropriate labels • unit/dimensional analysis • titles for graphic representations	N-Q.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	N-Q.1
• appropriate scaling • problem solving strategies • significant figures	N-Q.2	Define appropriate quantities for the purpose of descriptive modeling.	N-Q.2
• unit analysis	N-Q.3		N-Q.3

• appropriate labels • titles for graphical representations • place values		Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. Students use critical thinking skills to solve problems, and make informed decisions using appropriate digital tools and resources. Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students demonstrate a sound understanding of technology concepts, systems, and operations.	ISTE-4 ISTE-1 ISTE-6

EVIDENCE of LEARNING			
Understanding	Standards	**Unit Performance Assessment**:	**R/R Quadrant**
1,2,3,5	**A-CED.2** **A-REI.12** **A-REI.6** **A-REI.7** **A-REI.5** **A-CED.3** F-LE.5 A-REI.10 N-Q.1 N-Q.2 N-Q.3	Unit 7 Performance event with score guide **Description of Assessment Performance Task(s):** Students will be required to write and solve a system of linear equations and inequalities as applied to a real word problem and solve a system with a linear and a quadratic equation. **Teacher will assess:** What criteria will be used in each assessment to evaluate attainment of the desired results? 7. Does the student define their choice of variable? 8. Is the student able to model the real world problem with a system of equations or inequalities? 9. Is the student able to use their system of equations or inequalities to compare and contrast given scenarios?	D Critical Thinking

		Performance: **Mastery:** Students will show that they really understand when they… 1. Complete the common assessment with at least 75% **Scoring Guide:** See Appendix Unit 7 Common Assessments at the end of the assessment document	

SAMPLE LEARNING PLAN				
Pre-assessment: See Appendix Unit 7 Common Assessments				
Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy:**	**R/R Quadrant & 21st Century:**
1,2,3	A-REI.6 A-REI.10 MP1 MP2 MP3 MP5 MP6	2. Activity 1: This activity uses Kagan's Simultaneous Round Table. Solve each system using the given method, then check your answer with your partners (have them initial your paper if they got the same answer). If you do not get the same answer, work together to figure out the correct answer. Teachers can use Simultaneous Round Table. ● Objective: Students will know how to cooperatively solve systems of equations by graphing, substitution and elimination. Appendix Documents: See Unit 7 Resources Activity 1	Practice and Homework Cooperative Learning Feedback	A Collaboration, Communication, Critical Thinking
2	A-REI.6 A-REI.10 N-Q.2 N-Q.3 F-LE.5 ISTE-1 ISTE-4 ISTE-6 MP1 MP2	Activity 2: (Optional-Need TNspires)How Many Solutions to the System? This lesson involves graphing systems of linear equations. The emphasis is on helping students understand the difference between systems that have one, infinitely many, or no solutions. Could find a way to borrow from another school if find this activity as something worth trying. As a result, students will: ● Manipulate a movable line in the coordinate plane in relation to a fixed line to satisfy certain conditions. ● Observe the slope and y-intercept changing as they manipulate the line.	Similarities and Difference	C Collaboration, Communication, Critical Thinking

	MP3 MP4 MP5 MP6	● Discover what must be true for a system of equations to have one, infinitely many, or no solutions. ● Critique peer results. The TNspire allows students to manipulate graphs to discover features of different types of linear system of equations and their solutions. This requires them to think critically about changing the graphs to solve problems. Objective: Students will understand that a system of two linear equations in two variables can have one solution, no solution, or infinitely many solutions. ● Appendix Documents: See Unit 7 Resources Activity 2		
3	A-REI.5 A-REI.6 A-CED.3 ISTE-1 ISTE-4 ISTE-6 MP1 MP2 MP4	Activty 3: This lesson involves solving a system of linear equations in two variables. The emphasis is on helping students understand how to use equivalent equations and the method of elimination to solve a system. Students will use slider arrows to change multipliers for a system of equations. They will use linear combinations in an effort to produce a zero sum coefficient for one of the variables and solve the resulting equation for the other. Students will find values for x and y that satisfy the original equations. Students can combine elimination and substitution to solve systems more efficiently. Students can collaboratively determine which method is most appropriate for solving a system. The TINspire calculator allows students to manipulate multipliers on a system of equations so they can discover how the method of elimination will solve a system of equations. Objective: Students will understand how to identify equivalent expressions and solve a system of linear equations in two unknowns by adding equivalent equations to eliminate one variable.	Similarities and Differences Cues and Questions Cooperative Learning Feedback	B Collaboration, Communication, Critical Thinking
1,2	A-REI.7 A-REI.11 ISTE.3 MP2 MP4 MP5	Activity 4: Linear Quadratic Systems – Regents Prep Center This website (in appendix) explains how to solve Linear Quadratic Systems Algebraically and Graphically and then provides practice problems so students can self-reflect on their process of solving. Lesson Solving Algebraically - Linear Quad Lesson Solving Graphically - Linear Quadra	Providing Practice	B Critical Thinking

		Practice Practice Problems for Linear Quadra Teacher Investigating Linear Quadratic Syste Objective: Students will be able to solve a system of equations involving one linear equation and one quadratic equation algebraically and graphically.		
1,2,3,5	A-CED.2 N-Q.1 N-Q.2 N-Q.3 F-LE.5 A-CED.3 MP1, 2, 3, 5, 6	Activity 5: Systems of Equations Word Problems Kuta Worksheet -This worksheet can be used with students in pairs using the Kagan Structure Rally Coach; students coach each other in how to use the problem solving process of assigning variables and writing equations to model the situation and then solving and making sure the solution is reasonable (Rally Coach, Sage n Scribe). Students will be able to critique and defend their solutions. Objective: Students will be able to model given situations by writing a system of equations and then solve the system and then check to see if their solution is viable while forming arguments to support their work.	Cues and Questions Cooperative Learning Feedback	C Collaboration, Communication, Critical Thinking
4	A-REI.12 N-Q.1 N-Q.2 N-Q.3 F-LE.5 A-CED.3 ISTE-1, 4, 6 MP1, 2, 3, 5, 6	Activity 6: Students will work collaboratively to see how the solution to a system of linear inequalities is the intersection of each of the corresponding half planes. · Students will see how the solution region can be one of four regions on the graph. · Students will understand how a system of linear inequalities can be used to solve an application. Objective: Students will be able to solve systems of inequalities by graphing.	Identify Similarities and Differences Cooperative Learning	C Collaboration, Communication, Critical Thinking
3	A-REI.5 A-REI.6 A-CED.3 MP1 MP2 MP4	Activity 7: This lesson involves solving a system of linear equations in two variables. The emphasis is on helping students understand how to use equivalent equations and the method of elimination to solve a system. They will use linear combinations in an effort to produce a zero sum coefficient for one of the variables and solve the resulting equation for the other. Students will find values for x and y that satisfy the original equations (Sage and Scribe). Objective: Students will understand how to solve a system of linear equations in two unknowns by adding equivalent equations to eliminate one variable. Appendix Documents: See Unit 7 Resources Activity 7	Cooperative Learning	B Collaboration, Communication, Critical Thinking

2	A-REI.6 A-REI.10 N-Q.2 N-Q.3 F-LE.5 MP1 MP2 MP3 MP4 MP5 MP6	Activity 8: "Solutions to Systems of Equations by Graphing: Sorting Activity" This lesson involves graphing systems of linear equations. The emphasis is on helping students understand the difference between systems that have one, infinitely many, or no solutions. Students will communicate and cooperate to understand the tasks. Objective: Students will understand that a system of two linear equations in two variables can have one solution, no solution, or infinitely many solutions. ● Appendix Documents: See Unit 7 Resources Activity 8	Similarities and Difference	C Collaboration, Communication, Critical Thinking
4	A-REI.12 N-Q.1 N-Q.2 N-Q.3 F-LE.5 A-CED.3 MP1, 2, 3, 5, 6	Activity 9: This activity is a great way for students to practice graphing systems of linear inequalities and identifying the solution region. Students are put into groups of 3-4 and assigned a starting problem (there are 8 total). The back of the scavenger hunt problems are numbered with 1-8, in the exact order they appear in the file. This way the students knew which box to start with on their worksheet. They write down and graph the system on their worksheet. They identify the letter that lies within their solution region. This letter will lead them to their next problem. An answer key is included for you to see the final product. Although they all start in different places, their papers should look the same in the end. Students will critique each other's progress in this activity as they all try to reach the same goal collaboratively. Objective: Students will be able to solve systems of inequalities by graphing. Appendix Documents: See Unit 7 Resources Activity 9	Identify Similarities and Similarities and Differences Cooperative Learning	C Collaboration, Communication, Critical Thinking

UNIT RESOURCES
Teacher Resources: A-REI.5 Solving Systems Using Elimination Kuta Worksheet; worksheet 2 What Does it Mean to "Solve a System"? How can it be done? – Teaching lesson with visual support and explanation

Teaching Lesson - Do These Systems Meet Your Expectations: 1-3 days. This concept development unit is designed to develop the topic of systems of equations. Students will be able to graph systems of equations to discover the three possible cases: intersecting, parallel or coinciding lines. Students will be able to identify how many solutions each system has by looking at the graphs.
SIMULTANEOUS LINEAR EQUATIONS
Algebra Lab **Solving Systems of Linear Equations**
Lesson with Worksheet - Prove that, given a system of 2 equations in 2 variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solution.

A-REI.6, A-REI.10
Solve systems graphically worksheet
Solve systems by substitution Kuta worksheet; mathworksheetsgo subsitution
Linear Systems Sticker Review
Activity – The task has students engaging in a simple modeling exercise, taking verbal and numerical descriptions of battery life as a function of time and writing down linear models for these quantities. To draw conclusions about the quantities, students have to find a common way of describing them.
Math.CCSS.Math.Content.HSA-REI.C.6
Road Rage In this lesson, students use remote-controlled cars to create a system of equations

A-REI.7, A-REI.10
Worksheet – Mixed Review Solving Systems:
Create an advertisement for one of the methods for solving systems of linear equations
Linear-Quadratic Systems

A-CED.2
Systems of Equations Word Problems Kuta Worksheet
Lost at Sea page 19
Performance Task: Pump it Up: Linear Systems in the Real World
Word Problems that lead to simultaneous equations
Students will use Systems of Equations to develop ideas relating to savings plans and a spending budget that they would use for their senior trip or any trip they would plan for.

A-CED.3
Performance Task – Souvenirs and Concessions at the Game

A-REI.6, A-CED.2, A-CED.3, N-Q.1, N-Q.2, N-Q.3
Systems of Equations Word Problems Worksheet
Word Problems: Distance II (Systems of Equations)

Activity - Real World Application: Cell Phones
Activity – Cash Box: The given solutions for this task involve the creation and solving of a system of 2 equations and 2 unknowns, with the caveat that the context of the problem implies that we are interested only in non-negative integer solutions.
Activity – Weighing Pennies: This problem involves solving a system of algebraic equations from a context: depending how the problem is interpreted, there may be one equation or 2. The main work in parts (a) and (b) is in setting
System of Equations Word Problems Purple Math
Simple Word Problems Resulting in a System of Equations
A-REI.12, A-CED.3
Graphing Inequalities Kuta Worksheet
TI Nspire: Application of Linear Systems
Activity – Dirt Bike Dilemma: This lesson develops conceptual understanding of linear programming by walking students through the process of linear programming. Students are asked to explain what is happening and why, which allows them to internalize the procedural skill necessary to solve linear programming problems.
Between the Extremes: Students will use the graphing calculator to analyze, write, and graph systems of inequalities from given data. Using real-life situations, students will collect and interpret data using graphing calculators.
A-REI.11
TI Nspire: Systems of Linear Equations The solution to a linear equation in two variables is an infinite set of ordered pairs that satisfy the constraints in the equation. These lessons develop this concept and use it to explore solutions to systems of two linear equations in two variables, including how to solve systems using linear combinations to eliminate one of the variables.
ADDITIONAL UNIT RESOURCES
Complete unit with lessons and tasks
Complete unit: basic problems, application problems, quiz included

Student Resources:
Interactive System of Linear Equations
Interactive Activity – Solving Word Problems Using Systems of Equations

Vocabulary: see Appendix-Unit 7 Vocabulary
Systems of equations, systems of inequality, solutions, solution types (one, infinite, no solution), elimination process, substitution process, intersection

Content Area: Mathematics	**Course: Algebra I**	**UNIT 8: Sequences and Their Related Functions**

Unit Description: Students will recognize, create and use arithmetic and geometric sequences and connect them to linear and exponential models. A graphing calculator should be used throughout this unit.	**Unit Timeline:** 3 weeks

DESIRED RESULTS

<u>Transfer Goal</u> - Students will be able to independently use their learning to…

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.

<u>Understandings</u> – Students will understand that… (Big Ideas)

1. Various sequences can be expressed and combined using explicit and recursive processes.
2. Sequences are functions and can be identified and written in different forms.
3. Linear and exponential functions model different situations and each has different characteristics.
4. Each part of an expression has a function/purpose related to a real world context.
   Linear and exponential functions have different specific characteristics.
5. Different representations of the same function can be used to find key information.
6. Unit and scale can be used as a tool to effectively model context and solve problems while understanding that results may or may not be reasonable given the context of the problem.

<u>Essential Questions</u>: Students will keep considering…

How can growth be represented mathematically?

Why do we need to use exponential notation to model situations?
How can sequences be expressed and manipulated as functions?
What are the benefits of modeling situations in the real world?

Students Will Know…	Standard	Students Will Be Able to …	Standard
• what a sequence is • explicit and recursive formulas • definition of a function • domain	F-IF.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.	F-IF.3

• write algebraic functions from verbal expressions
• properties of functions
  - domain and range
  - input and output
  - types of functions…
• linear
• quadratic
• exponential
• how to interpret a graph
• understand concept of function and use function notation
• how to combine like terms
• explicit/recursive formulas
	F-BF.1a	**Write a function that describes a relationship between two quantities.**
		a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
			F-BF.1a

• difference between arithmetic and geometric sequences • what a sequence is • recursive vs. explicit formulas	F-BF.2	**Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.**	**F-BF.2**
• difference between exponential and linear situations • how to construct linear and exponential functions • how to read a table with input and output • difference between arithmetic and geometric sequences	F-LE.2	**Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).**	**F-LE.2**
• linear			**A-CED.1**

● quadratic ● exponential ● constant difference ● slope ● common ratio ● how to translate words into mathematical symbols (sum, difference, product, equals, at least, at most, etc.) ● independent and dependent variables	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.**	
● slope ● common ratio ● how to translate words to an expression ● independent and dependent variables ● how to graph a point on a coordinate plane ● the standard forms of a linear, quadratic and exponential equations	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.2**
● vocabulary: exponents, factors, terms, bases, coefficients, expression ● identify like terms ● degrees of polynomials ● the meaning of symbols indicating mathematical operations, implied operations, the meaning of exponents, and grouping symbols. ● exponential growth and decay	A-SSE.1b	Interpret expressions that represent a quantity in terms of its context. b. Interpret complicated expressions by viewing one or more of their parts as a single entity.	A-SSE.1b
● domain values may be limited for functions with a real-world context. ● key characteristics of functions ● domain	F-IF.5	**Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.**	F-IF.5
	F-IF.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval.	**F-IF.6**

● how to generate a table of inputs/outputs for linear and exponential functions	F-LE.1a,b &c	Estimate the rate of change from a graph. (focus on linear and exponential functions) Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	F-LE.1
● varying forms of polynomials increase at different rates.	F-LE.3		F-LE.3
	A-SSE.3c	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	A-SSE.3c
● factoring skills ● balancing equations ● graphing concepts of quadratics ● exponential growth and decay	F-IF.8b	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. c. Use the properties of exponents to transform expressions for exponential functions.	F-IF.8b
● quadratic formula ● factor ● how to complete the square	F-LE.5	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. b. Use the properties of exponents to interpret expressions for exponential functions.	F-LE.5
● how to distinguish between the independent and dependent variable	N-Q.1	Interpret the parameters in a linear or exponential function in terms of context.	N-Q.1
● standard unit conversions ● appropriate scaling ● problem solving strategies ● appropriate labels		Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units	

● unit/dimensional analysis ● appropriate scaling ● problem solving strategies ● significant figures ● unit analysis ● appropriate labels ● titles for graphical representations ● place values	N-Q.2 N-Q.3	consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Define appropriate quantities for the purpose of descriptive modeling. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. Creativity and Innovation -Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology Critical Thinking Problem Solving, and Decision Making	N-Q.2 N-Q.3 ISTE 1 . ISTE 4

EVIDENCE of LEARNING			
Understanding	Standards	**Unit Performance Assessment**:	**R/R Quadrant & 21st Century:**
1,2,3,4	**A-CED.1** **A-CED.2** A-SSE.1b **F-BF.1a** **F-BF.2** **F-IF.6** **F-LE.2** N-Q.3 MP 1-8	unit_8_performance_event_with_rubric.doc **Description of Assessment Performance Task(s):** How will students demonstrate their understanding through complex performance? Students will be assessed on representing arithmetic and geometric sequences and connect them to linear and exponential models. They will analyze tables and graphs for characteristics and explain how they relate to real-life situations. **Teacher will assess:** What criteria will be used in each assessment to evaluate attainment of the desired results? 1. Students will distinguish between situations that can be modeled with linear functions and with exponential functions. 2. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. 3. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.	C Critical Thinking Communication

		4. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. **Performance:** **Mastery:** Students will show that they really understand when they… 1. Compare linear, exponential and quadratic models 2. Decided which type of function models the data.. 3. Write an equation to describe the function. 4. Complete the Performance Event with at least a 75%. **Scoring Guide:** See Appendix Unit 8 and embedded document above A detailed scoring rubric is provided with the Performance Event document. Multiple standards address the same questions, but does not fit collectively into Mastery Connect.	

SAMPLE LEARNING PLAN

Pre-assessment: What pre-assessments will you use to check student's prior knowledge, skill levels, and potential misconceptions?
Assessing the students on representing arithmetic and geometric sequences and how they connect them to linear and exponential models.

Understanding	Standards	Major Learning Activities:	Instructional Strategy:	R/R Quadrant & 21st Century:
2,3,4	A-SSE.1b MP 1,7,8 ISTE 1,4	Activity 1 Bank Account Objective: Students will know how to collaboratively construct an exponential graph from given data. Students will be able to interpret expressions that represent a quality in terms of its context and expressions by viewing one or more of their parts as a single entity while providing feedback to each other. Students will generate and test solution hypothesis and formally defend solution to classmates before the final solution is provided. Appendix Documents: Activity: The Bank Account http://www.oercommons.org/courses/the-bank-account/view Instructional Video- Dan Meyer "The Incredible Shrinking Dollar" https://alg2blog.wordpress.com/2012/10/03/dan-meyers-three-act-problems-and-exponential-functions/	Practice Cooperative Learning Providing Feedback	C Critical thinking Collaboration Communication Creativity

		TI Nspire- this tool will provide opportunity for students to graph and develop a model of a real life situation that fits the criteria of an exponential function.		
2,3,4	F-LE.1 F-LE.2 F-BF.2 ISTE.1 MP 1-8	Activity 2 Algae Bloom Objective: Students will understand how to construct linear and exponential function to include arithmetic and geometric sequences given a graph, and evaluate the relationship or 2 input-output pairs Appendix Documents: Activity – Algae Bloom http://www.oercommons.org/courses/algae-blooms/view Activity: Quiz Quiz Trade (flash cards with problems) Students will understand exponential functions and be able to give the arithmetic and geometric sequence of a given table while providing feedback to each other.	Cooperative Learning Cues and Questions Feedback	B Critical thinking Collaboration Communication
1,2,3	F-LE.1 F-LE.2 F-BF.2 A-CED.2 MP 1-8 ISTE.4	Activity 3 Teaching Lesson Objective: Students will understand how to write a recursive notation. Instruction includes interactive lesson and practice, video, handouts. Appendix Documents: Students will use the links below to engage in learning the content and understanding the standards. Activity: Sequences and Their Related Functions: Instructional Lesson 1.4 http://math.kendallhunt.com/documents/daa1/CondensedLessonPlans/DAA_CLP_01.pdf Activity: Writing Sequence Rules Sequences and Their Related Functions: Instructional Arithmetic and Geometric Lesson 1.1 http://math.kendallhunt.com/documents/daa1/CondensedLessonPlans/DAA_CLP_01.pdf Activity: Match My Answer Students will be work with their face partner; working out individual problems; answers will match. (Quiz-Quiz Trade and/or Match My Answer)	Similarities and Differences Cooperative Learning Cues and Questioning Providing Feedback	B Collaboration Communication
1-6	F-BF.1a F-BF.2 F-IF.6	Activity 4 Recursively Defined Sequences Objective: Students will be able to determine an explicit expression, a recursive process, or steps for calculation from a context	Cooperative Learning	C Critical

	A-CED.1 A-CED.2 MP 1,4,5,6,7 ISTE 4	Kagan strategies to use: Simultaneity Round Table Rally Coach Appendix Documents: Activity: Recursion - students as they work with their table group to determine recursive expression and calculate loan investments. Students will peer evaluate each other's work; rally coach; and come to a consensus prior to moving on to next problem. http://a4a.learnport.org/page/comparing-functions recursion Video- http://a4a.learnport.org/video/recursion-1 Worksheet 1.1 Recursively Defined Sequences Worksheet – 1.5 Loan and Investments http://math.kendallhunt.com/documents/daa1/CondensedLessonPlans/DAA_CLP_01.pdf Practice 1 http://media.mivu.org/mvu_pd/a4a/resources/applets/recursion_practice1.html Practice 2 http://media.mivu.org/mvu_pd/a4a/resources/applets/recursion_practice2.html TI Nspire- This tool helps students graph data of a loan investment and observe the recursive sequencing of real world situations.	Cues and Questions Generating and Testing Hypothesis Feedback	Thinking Collaboration Communication
1,2,3	A-CED.1 F-IF.6 MP 1,7	Activity 5 Drug Filtering Objective: Students will be able to calculate the amount of a drug in the body over time, make and analyze the graphical representation of this exponential function. This would be an great opportunity for students to critique and defend work of each other along with self-reflection. Appendix Documents: Activity – Drug Filtering WS- http://illuminations.nctm.org/uploadedFiles/Content/Lessons/Resources/9-12/DrugFiltering-AS-Filtering.pdf Reflection questions- http://illuminations.nctm.org/Lesson.aspx?id=3081	Practice Cooperative Learning, Problem Based Learning	B Communication Collaboration
1,2,3	A-CED.1 A-CED.2 ISTE.1	Activity 6 Objective: Students will be able to relate equations and inequalities in one variable and use them to solve problems. Appendix Documents: Activity: Predict the Future	Practice Cues and Questions	B Communication Collaboration

	MP 1,5,6,7	http://alex.state.al.us/lesson_view.php?id=21153 Activity: Falling Glow Sticks Video- Dan Meyer: http://mrmeyer.com/threeacts/fallingglowsticks/: Students will use this technology integration to brainstorm the questions, create solutions to solve the problem, critique other's work, and evaluate if they were correct through self-reflection.	Feedback	
2,4	A-CED.2	Activity 7 Teaching Lesson Objective: Students will be able to create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Students will work collaboratively on this task and provide each other with peer feedback Appendix Documents: Activity: A-CED.1 and A-CED.2 Activities Unit 1&2	Cooperative Learning Cues & Questions Provide Feedback	B Critical Thinking Collaboration
1-6	F-BF.1a MP 1,3,4,7 ISTE 1 ISTE 4	Activity 8 – Flu on Campus Objective: Students will know how to write algebraic functions from verbal expressions properties of functions (domain and range; input and output; types of functions). Students will use data on a common illness to see how mathematics is used in the spreading of this illness. Student will Rally Coach within a group then have a gallery walk to see what other groups were able to determine about the Flu Virus. Finally, they will provide feedback and have class discussion on the relationship between math and spread of disease. Appendix Documents: https://www.illustrativemathematics.org/illustrations/671 http://ccssmath.org/?page_id=2117 TI Npire – this tool will help students graph the data and model the domain and range of an algebraic function.	Cooperative Learning Nonlinguistic Representation Cues and Questions	D Critical Thinking Communication Collaboration
2,4	F-LE.1 MP1-8 ISTE 1 ISTE 4	Activity 9 - Objective: Students will be able to analyze geometric sequences, find the nth term of a geometric sequence and prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.	Cooperative Learning Homework	D Critical Thinking Collaboration Creativity

		Students will understand situations in which one quantity changes at a constant rate per unit interval relative to another. Students will apply real life situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another and model criteria that fits the growth and decay structure. TI Nspire: this tool will help students collect data; solve problems, and manage activities if resource is available. Other graphic calculators may be a resource too.	and Practice	Communication
2,4	F-LE.1 MP 1,4,5,7 ISTE 1ISTE.4	Activity 10 – TI Nspire Sequence Graphs (Optional if you have the resource) Objective – Students will be able to work with both arithmetic and geometric sequences. Formulas will include both explicit and recursive forms. "see" the terms of a sequence, and will determine if it is arithmetic or geometric (linear or exponential).	Cooperative Learning Guided Practice	B Communication Collaboration
1,3,6	F-LE.2 MP 1-9 ISTE 4	Activity 11 Objective – Students will know the parts of exponential functions by graphing groups of graphs in different stations and identifying similarities and differences of the graphs. Students will be able to graph a set of four exponential function, providing an opportunity to compare and contrast the features of each graph and learn about the different parts of an exponential equation. http://a4a.learnport.org/page/exponential-functions Teacher video Activity – Exponential Station Activities Students will work with partner and rotate around room exploring exponential functions by comparing and contrasting their tables and graphs. Students will critique exponential real life situation and writing a viable argument if they agree/disagree with the function.	Cooperative Learning Station Activity	D Collaboration Communication Critical Thinking
1,2	F-IF.6 MP 1	Activity 12 Holt Algebra 1 Sections 11.1, 11.3, 11.4 Word Problems, extension activities	Homework and Practice	A Critical Thinking Communication

UNIT RESOURCES
Teacher Resources:

CK-12 Linear, Exponential, and Quadratic Models Practice
http://mathybeagle.com/2014/04/17/catwalk-mystery/
https://www.illustrativemathematics.org/HSF
https://www.khanacademy.org/search?page_search_query=explicit%20and%20recursive
https://www.khanacademy.org/search?page_search_query=geometric%20sequences
http://www.greatmathsteachingideas.com/tag/dan-meyer/
http://illuminations.nctm.org/Activity.aspx?id=6379
http://illuminations.nctm.org/Search.aspx?view=search&kw=rate%20of%20change
http://www.lessonplanet.com/lesson-plans/geometric-sequence
http://www.algebra1teachers.com/aced1/
http://www.algebra1teachers.com/unit-7-sequences-functions/
http://www.dunkerton.k12.ia.us/vimages/shared/vnews/stories/52125dc587852/Exponential%20Word%20Problems.pdf
http://www.ixl.com/math/algebra-1/exponential-growth-and-decay-word-problems
https://www.khanacademy.org/math/algebra2/exponential_and_logarithmic_func/exponential-modeling/v/word-problem-solving-exponential-growth-and-decay
http://www.algebralab.org/activities/activity.aspx
http://blog.mrmeyer.com/2011/wcydwt-russian-stacking-dolls/

TI-Inspire:
http://education.ti.com/en/us/activity/detail?id=1846F71224144B2B81AFC07FF0756523
http://education.ti.com/en/us/activity/detail?id=5F34BA147E194AE989DB90CEC5275058

Student Resources:

- CK-12 Linear, Exponential, and Quadratic Models Practice
- Study Island
- TI-Inspire
- Kahn Academy

Vocabulary:

domain, recursive, explicit, arithmetic sequence, geometric sequence, linear function, exponential function, rate of change, growth model, decay model
see appendix: Unit 8 Sequences and Their Related Functions Vocabulary

Content Area: Mathematics	Course: Algebra I	UNIT 9: Descriptive Statistics

Unit Description: Given a set of data, students will be able to display it appropriately, describe key features, and relate the information in the context of the problem. Students will be able to construct a two-way table, calculate probabilities, and recognize possible trends and associations in the data.	**Unit Timeline:** **2 weeks**

DESIRED RESULTS
<u>Transfer Goal</u> - Students will be able to independently use their learning to… 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.

<u>Understandings</u> – Students will understand that… (Big Ideas)

1. Data can be gathered, displayed and summarized in various ways.
2. Data can be examined and interpreted to discover patterns and deviations from patterns.
3. Data analysis makes use of graphical and numerical techniques to study patterns and deviations from patterns.
4. Using appropriate units is necessary to determine an appropriate algebraic model.
5. Appropriate scale and label must be used.
6. Data analysis makes use of graphical and numerical techniques to study associations and trends.

<u>Essential Questions</u>: Students will keep considering…

- How can distributions of univariate and categorical data be summarized or described?
- What are the differences among univariate, bivariate and categorical data?
- What different interpretations can be obtained from a particular data distribution?
- What is the importance of the normal distribution?
- How is the normal distribution used as a model for measurements?
- How are probability and relative frequency related?

Students Will Know…	Standard	Students Will Be Able to …	Standard
• compare, order and graph real numbers on a number line • know five number summary: minimum, Q1 | lower quartile, median, Q3 |upper quartile and maximum • know the difference between quantitative and qualitative data	S-ID.1	**Represent data with plots on the real number line (dot plots, histograms, and box plots).**	**S-ID.1**
• definitions of measures of center and spread • how to find - spread/range - center - median - mean - interquartile range - standard deviation	S-ID.2	**Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.**	**S-ID.2**
• normal/bell distribution • skew distribution • outlier • center • spread • bimodal • uniform • multi-modal	S-ID.3	**Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).**	**S-ID.3**

• symmetric • standard unit conversions • appropriate scaling • problem solving strategies • appropriate labels • unit/dimensional analysis • titles for graphic representations	N-Q.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	N-Q.1
• definition of: • two-way table • relative frequency • joint • marginal • conditional • how to convert fractions to percents	S-ID.5	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.	S-ID.5
• definition of: - slope - y-intercept - residual - independent and dependent variables • how to plot ordered pairs • how to find slope • how to find y-intercept • how to model linear, quadratic, and exponential functions	S-ID.6	**Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Fit a function to the data; use functions fitted to data to solve problems in the context of the data.**	**S-ID.6**
• definition of slope as a rate of change • definition of y-intercept • difference between no slope (undefined) and zero slope	S-ID.7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.↔	S-ID.7

• definitions of causation and correlation	S-ID.9	Distinguish between correlation and causation. Critical Thinking, Problem Solving, and Decision Making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. a. Identify and define authentic problems and significant questions for investigation b. Plan and manage activities to develop a solution or complete a project c. Collect and analyze data to identify solutions and/or make informed decisions d. Use multiple processes and diverse perspectives to explore alternative solutions Creativity and Innovation-Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. a. Apply existing knowledge to generate new ideas, products, or processes b. Create original works as a means of personal or group expression c. Use models and simulations to explore complex systems and issues d. Identify trends and forecast possibilities	S-ID.9 ISTE-4 ISTE-1

EVIDENCE of LEARNING				
Understanding	**Standards**	**Unit Performance Assessment**:	**Instructional Strategy**	**R/R Quadrant**
1-5	**S-ID.1** **S-ID.2** **S-ID.3** **S-ID.6** S-ID.7	Unit 9 performance_event-st **Description of Assessment: Performance Task(s):** Students will make a box plot (single variable date) and a scatter plot (two variable data) and interpret these graphs **Teacher will assess:** 1. Ability of students to create the graphs 2. Ability of students to interpret graphs. **Performance:** **Mastery:** Students will show that they really understand when they… Complete the assessment at a minimum of a 75% level. **Scoring Guide:** Unit 9 statistics_pe_answer_ Rubric/answer key for each question in Appendix.	Critical Thinking	B

SAMPLE LEARNING PLAN				
Pre-assessment: What pre-assessments will you use to check student's prior knowledge, skill levels, and potential misconceptions? Have class discussion to assess prior knowledge of statistics. Assess student knowledge of mean, median, mode, box plot, scatter plot, single variable data, two variable data, correlation coefficient, line-of-best-fit.				
Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy:**	**R/R Quadrant & 21st Century:**
1-3,5	S-ID.5 S-ID.6 S-ID.7 S-ID.9 N-Q.1 MP 2, 5 ISTE-1	Activity: Guess the Age Game Objective: Students will be able to prepare a scatter plot on the graphing calculator using the estimated and actual ages of celebrities. After making guesses, students will make a scatter plot to find out how good of a guesser they were compared to others in the class. Students will use graphing calculators to enter data and make a scatter plot. They will use the technology to assess their guessing skills, tabulating their deviation from the mean. Appendix Documents: Names and Ages Student Handout Celebrity Power Point	Cues and Questions Generating and Testing Hypothesis Feedback	B Communication Creativity Critical Thinking
1-3	S-ID.3 MP 1,2,3 ISTE-4	Activity: Play It Objective: Students will know how to use measurements of central tendency and data summary models to analyze trends and make decisions. Students will analyze and interpret data summaries and statistics. They will produce graphical, verbal, and numerical representations of survey data. They also will interpret these representations of sample populations and make predictions about the larger population. Students will enter data in graphing calculator and make graphs to help make decisions about the data. Students will have an opportunity to critique each other's work and defend own solution Appendix Documents: Directions, Student Sheets	Generating and Testing Hypothesis Identifying Similarities and Differences Feedback	D Critical Thinking Creativity

1, 2, 4, 6	S-ID.1 S-ID.2 MP 1-4	Activity: The Measures of Central Tendency Objective: Students will collaboratively understand measures of central tendency and variance, line plots, frequency distribution tables, and interpretation, application, representation and presentation of data through Quiz-Quiz Trade strategy. Appendix Documents: Directions, Student Sheets	Cooperative Learning	B Collaboration
2, 5, 6	S-ID.6 S-ID.7 MP 1,3,4,6	Activity: Line of Best Fit Worksheet from: Charleston Math Objective: Students will be able to identify and draw a line of best fit in a scatter plot. Students will analyze the graphs by interpolating and extrapolating (thinking outside the box) using the given graphs. Students will understand how to write a line of best-fit as a linear equation and understand how the y-intercept and slope relate to the situation. When complete, students will compare results and defend their interpolation and extrapolations. Appendix Document: Line of Best Fit WS	Providing Practice and Assigning Homework Feedback	B Critical Thinking Collaboration Creativity
1, 2	S-ID.1 S-ID.2 S-ID.3 MP 2, 4	Activity: Human Box Plot Objective: Students will understand construction box plots by working with their classmates to make a human box plot in the classroom based on height of the students. Students will be able to use this statistical knowledge to relate and use in real world situations such as height, weight, gender, etc. Appendix Document: Human Box Plot	Identifying Similarities And Differences Cooperative Learning	C Creativity Collaboration
1, 3, 6	S-ID.5 MP 2, 6, 7	Activity: Notes for Relative Frequency Tables Objective: Students will understand how to analyze frequency tables and relative frequency tables. Students will work on this activity to determine statistical and how often an event happens relative to other events. Appendix Documents: Relative Frequency Tables	Providing Practice and Assigning Homework	A Critical Thinking

UNIT RESOURCES

Teacher Resources:

- Holt Algebra Textbook
- Engage NY Lessons
- Celebrity Age Scatter Plot
- US Crime Stats
- Info Please Almanac
- US Census Stats
- Education Stats
- NFL Stats
- MLB Stats
- NHL Stats
- NBA Stats
- Statistics Videos
- Plinko Machine (normal distribution)
- Measures of Central Tendancy Activity
- Play It Activity

Student Resources:

- Holt Algebra Textbook
- Khan Academy
- MasterMath
- Mathwarehouse
- Study Island
- ixL
- Math Forum
- Cool Math Games
- Algebra Help

Definitions data distribution, measures of central tendency, median, mean, mode, measures of spread, range, upper quartile, lower quartile, interquartile range, standard deviation, dot plot, histogram, box plot, skew, outliers, univariate data, categorical data, bivariate data, joint frequency, marginal frequency, conditional relative frequency

Definitions for these terms in the appendix.

Content Area: Mathematics	Course: Algebra I	UNIT 10: Analyzing and Modeling Functions
Unit Description: The basic modeling cycle is summarized as (1) identifying variables in the situation and selecting those that represent essential features, (2) formulating a model by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between the variables, (3) analyzing and performing operations on these relationships to draw conclusions, (4) interpreting the results of the mathematics in terms of the original situation, (5) validating the conclusions by comparing them with the situation, and then either improving the model or, if it is acceptable, (6) reporting on the conclusions and the reasoning behind them.		**Unit Timeline:** 3-4 weeks

DESIRED RESULTS

<u>Transfer Goal</u> - Students will be able to independently use their learning to…

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.

<u>Understandings</u> – Students will understand that… (Big Ideas)

1. Scatter plots are representations of data that are sometimes modeled by linear, quadratic and exponential functions.
2. Shape and number patterns can be used to distinguish between linear, quadratic, and exponential situations.
3. Domains and ranges for functions are sometimes restricted by real life constraints.
4. When a line of best fit can be associated with linear data the equations for those lines can be analyzed with a regression calculation.
5. Data that is increasing left to right is associated with a positive slope and data that is decreasing left to right is associated with a negative slope

<u>Essential Questions</u>: Students will keep considering…

How do we use mathematics to model situations in the real world?
How do we create, test and validate a model?
What models produce the best solutions for a given problem?
How are mathematical models helpful for representing concepts and solving problems?
What information is relevant or superfluous?

Students Will Know…	Standard	Students Will Be Able to …	Standard
Vocabulary: ● factoring skills ● balancing equations ● graphing concepts of quadratics ● exponential growth and decay ● slope ● common ratio ● how to translate words to an expression ● independent and dependent variables ● how to graph a point on a coordinate plane ● the standard forms of a linear, quadratic and exponential equations ● system of equations/inequalities ● constraint ● viable and non-viable solutions ● how to generate a table of inputs/outputs for linear and exponential functions ● x-intercepts ● y-intercepts ● increasing ● decreasing ● constant ● relative maximum ● relative minimum ● slope formula ● definition of slope/rate of change ● graph/plot points	A-SSE.3 A-CED.2 A-CED.3 F-LE.1 F-IF.4 F-IF.6 F-IF.8	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. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. 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. **Distinguish between situations that can be modeled with linear functions and with exponential functions.** **a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.** **b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.** **c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.** 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,	A-SSE.3 A-CED.2 A-CED.3 **F-LE.1** F-IF.4

● quadratic formula ● factor ● how to complete the square	F-IF.9	decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.	
● concepts of linear and exponential functions ● translations of words to equations ● domain/range or input/output ● independent/dependent variables ● know meaning of increasing and decreasing		Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. (focus on linear and exponential functions)	F-IF.6
● forms of a linear equation - slope-intercept - point-slope - standard	F-LE.2	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.	F-IF.8
● difference between exponential and linear situations ● how to construct linear and exponential functions ● how to read a table with input and output	F-LE.5		
● difference between arithmetic and geometric sequences		Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	F-IF.9
● how to distinguish between the independent and dependent variable	S-ID.6	**Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).**	**F-LE.2**
● definition of: - slope - y-intercept - residual - independent and dependent variables		**Interpret the parameters in a linear or exponential function in terms of context.**	**F-LE.5**
● how to plot ordered pairs ● how to find slope ● how to find y-intercept ● how to model functions - linear - quadratic - exponential		**Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.** **a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.**	**S-ID.6**

● definition of slope as a rate of change ● definition of y-intercept ● difference between no slope (undefined) and zero slope ● know how to create a scatterplot on a graphing calculator ● know definition of line of best fit and correlation coefficient ● know the meaning and give examples of positive, negative and no correlation	S-ID.7 S-ID.8	**b. Informally assess the fit of a function by plotting and analyzing residuals.** **c. Fit a linear function for a scatter plot that suggests a linear association.** **Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.** **Compute (using technology) and interpret the correlation coefficient of a linear fit.** Creativity and Innovation Critical Thinking, Problem Solving, and Decision Making Technology Operations and Concepts	**S-ID.7** **S-ID.8** ISTE-1 ISTE-4 ISTE-6

EVIDENCE of LEARNING			
Understanding 1,2,4,5	Standards **F.LE.1** **F.LE.2** **F.LE.5** **S.ID.6** **S.ID.7** **S.ID.8** ISTE-1 ISTE-4 ISTE-6	**Unit Performance Assessment**: unit_10 performance_assessm **Description of Assessment Performance Task(s):** The students will model a linear function using a scatter plot. They will use a graphing calculator to identify the linear regression equation. The students will make predictions using the equation. The students will identify the three different equations: linear, quadratic, and exponential. The students will model an exponential function based on three different scenarios. The students will use a graphing calculator to find a line of regression based on scatter plots. **Teacher will assess:** 10. The teacher will assess the student's ability to identify the types of functions modeled. 11. The teacher will assess the student's ability to graph lines of regression.	**R/R Quadrant & 21st Century:** C Critical Thinking

		12. The teacher will assess if students can make predictions from the line of regression. **Performance:** **Mastery:** Students will show that they really understand when they… 1. Are able to compare and contrast the three different equations. 2. Are able to graph a line of regression and make predictions. **Scoring Guide:** See Appendix and embedded document above	

	SAMPLE LEARNING PLAN				
	Pre-assessment: 10 questions on Socrative (Access code for pre-test is SOC15054595) Assess the students on the three main functions; linear, quadratic, and exponential. Check to see if the students can identify the three types of functions given different representations.				
	Understanding	**Standards**	**Major Learning Activities:**	**Instructional Strategy:**	**R/R Quadrant & 21st Century:**
	1,2,3	F.LE.1 F.LE.2 ISTE-1 MP-2 MP-4 MP-7	Activity: M&M's and Rhino Population changes Objective: Students will collaboratively understand how to explore the patterns of exponential models in tables, graphs, and symbolic forms and to apply what they have learned to make predictions in a real situation. Students can model the functions using a graphing calculator. Students will also look at these real-world items and use mathematical standards to represent changes occurring. See Appendix	Problem Based Learning Cooperative Learning Feedback	B Collaboration Critical Thinking
	2,3	A-SSE.3 A-CED.2 A-CED.3 F-IF.9 ISTE-4 ISTE-6 MP-1 MP-3	Activity: Egg Launch Contest Objective: Students will understand how to move between representations of a function as a table, a graph, and an equation, determine the maximum value of a quadratic function, and compare quadratic functions. Students will watch a video on Khan Academy to reinforce how to find the maximum height of a quadratic function. Next, they will create within a group their design for the Egg Launch Contest, test the design, then formally defend solution, peer critique and self-reflect on the outcome.	Problem Based Learning Cooperative Learning Feedback	B Creativity Critical Thinking

			See Appendix	Generating and Testing Hypothesis	
	2,3	F-IF.6 ISTE-4 MP-4	Activity: Fuel for Thought Objective: Students will understand how to use mathematical reasoning to determine patterns in fuel consumption. The analysis requires care in using appropriate units of measure while developing a mathematical model to be analyzed. Students will work collaboratively and reflect on each group's solution. Students will identify and define authentic problems and significant questions for investigation. See Appendix	Problem Based Learning Cooperative Learning Cues and Questions Feedback	D Collaboration Critical Thinking
	2	A-CED.3 MP-4 MP-8	Activity: Dimes and Quarters Objective: Students will know the pairs of linear equations in two variables that would be used to solve the system. Students will use the values of dimes and quarters to create linear equations to solve a system. See Appendix	Practice and Homework	A Communication
	5	F-LE.5 MP-2 MP-3	Activity: Taxi! Objective: A taxi rider keeps track of the distance traveled and how much they pay. This simple conceptual problem does not require algebraic manipulation, but requires students to articulate the reasoning behind each statement (Jot Thoughts). Students will understand how to reflect and explain their reasoning to the problem. See Appendix	Cues and Questions Frontloading Providing Practice and Homework	C Communication Critical Thinking
	3	A-SSE.3 F-IF.8 ISTE-1 MP-7	Activity: Profit of a Company Objective: Students will understand how to compare the usefulness of different forms of a quadratic expression.	Cooperative Learning Feedback	B Communication

			Students will collaboratively, through Numbered Heads Together strategy, use models and technological simulations to explore complex systems and issues. The class will share their findings and come to a consensus on what is the correct solution. See Appendix	Generating and testing hypothesis	
	2	A-SSE.3 F-IF.8 MP-2 MP-4 MP-8	Activity: Ice Cream Objective: Students will know how to illustrate the process of rearranging the terms of an expression to reveal different aspects about the quantity it represents. This task illustrates the process of rearranging the terms of an expression to reveal different aspects about the quantity it represents, precisely the language being used in standard A-SSE.B.3. Students are provided with an expression giving the temperature of a container at a time , and have to use simple inequalities (e.g., that for all) to reduce the complexity of an expression to a form where bounds on the temperature of a container of ice cream are made apparent. See Appendix	Problem Based Learning Cooperative Learning	B Creativity
	1,2,4	S-ID.6 S-ID.7 S-ID.8 F-IF.6 ISTE-4 ISTE-6 MP-1 MP-4 MP-5	Activity: Laptop Battery Charge 2 Objective: Students will understand how long it will take until an electronic device has a fully charged battery. Students will collaboratively reflect on the process used to solve this problem and explain their reasoning while using graphing calculators to facilitate the learning and student engagement (Jot Thoughts). This task uses a situation that is familiar to students to solve a problem they probably have all encountered before: How long will it take until an electronic device has a fully charged battery? A linear model can be used to solve this problem. The task combines ideas from statistics, functions and modeling. It is a nice combination of ideas in different domains in the high school curriculum. Focus in high school means finding connections between the different topics that are covered. Lines of best fit are a perfect example of this idea since you are using linear functions to analyze data. See Appendix	Cooperative Learning Feedback Generating & Testing Hypothesis	C Collaboration Critical Thinking

	2	F-IF.4 F-IF.9 ISTE-1 ISTE-4 MP-4 MP-6	Activity: Throwing Baseballs Objective: Students will understand how to compare characteristics of two quadratic functions that are each represented differently, one as the graph of a quadratic function and one written out algebraically. Students will use multiple processes and diverse perspectives to explore alternative solutions. This will allow the students to compare characteristics of two quadratic functions that are each represented differently, one as the graph of a quadratic function and one written out algebraically. Specifically, we are asking the students to determine which function has the greatest maximum and the greatest non-negative root. Graphic calculators will integrate learning of the standards throughout the activity See Appendix	Cooperative Learning Feedback Generating & Testing Hypothesis	C Collaboration Critical Thinking

UNIT RESOURCES
Teacher Resources: ● In the Real World – Problems Solving Slope ● Matchstick Math: Using Manipulatives to Model Linear, Quadratic, and Exponential Functions. ● Means of Growth ● Exploring Linear Data ● Khan Academy – Common Core Map ● Engage NY – Module 5:A Synthesis of Modeling with Equations and Functions
Student Resources: ● Khan Academy – Common Core Map ● Thatquiz.org ● Desmos Graphing Calculator
Vocabulary: scatter plot, linear model, linear fit, quadratic model, exponential model, bivariate data, slope, rate of change, intercepts, relative maximum, relative minimum, end behavior, correlation coefficient, residuals, viable, non-viable See Appendix