Green Township School District Algebra I Curriculum - Revised 2017

Unit 1: Relationships Between Quantities & Reasoning with Their Graphs **(Approximate Instructional Time: 8 weeks)**		
NJ Student Learning Standards	**Suggested Standards for Mathematical Practice**	**Critical Knowledge & Skills** ***(Learning goals are for the Unit but may not necessarily be in sequential order.)***
● N.Q.A.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.A.2. Define appropriate quantities for the purpose of descriptive modeling. ● N.Q.A.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	MP.1 Make sense of problems and persevere in solving them. MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically.	Concept(s): Introduce linear, quadratic and exponential graphs through graphing stories. ● *Units are associated with variables in expressions and equations in context.* ● *Quantities may be used to model attributes of real world situations.* ● *Scales need to be in units and intervals appropriate to the situation.* Students are able to: ● define appropriate quantities from a situation (“graphing story”) ● choose and interpret the scale and origin for the graph. ● graph a piecewise function for a given situation. ● choose levels of accuracy appropriate to limitations on measurement. ● refine skills in interpreting the meaning of features in graphs. **Learning Goal 1**: Build conceptual understanding of linear, quadratic and exponential functions through graphing real world situations and develop descriptive models by defining appropriate quantities.
● A.CED.A.2. Create equations in two or more variables to represent relationships between quantities; Graph equations on coordinate axes with labels and scales. ● N.Q.A.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. ● A.REI.D.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in	MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.7 Look for and make use of structure.	Concept(s): Graphs and equations represent relationships Students are able to: ● represent graphically a nonlinear relationship between two quantities and interpret features of the graph. ● conceptually understand the relationship between physical quantities via the graph. ● choose and interpret a scale on a graph to appropriately represent a linear, quadratic or exponential function. ● recognize and identify solutions to two-variable equations and inequalities. ● create linear equations in two variables, including those from a context. ● identify and describe the solutions in the graph of an equation. **Learning Goal 2:** Create linear equations in two variables to represent relationships

the coordinate plane, often forming a curve (which could be a line). [Focus on linear equations.]		between quantities; graph equations & inequalities on coordinate axes with labels and scales.
• A.SSE.A.2. Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.* • A.SSE.B.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.	MP.1 Make sense of problems and persevere in solving them. MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.7 Look for and make use of structure	Concept(s): Generate equivalent expressions Students are able to: • use the structure of an expression to identify ways to rewrite it • use the distributive property to prove equivalency of expressions • use the commutative and associative properties to recognize structure within expressions and to prove equivalency of expressions **Learning Goal 3:** Use properties to produce equivalent forms of exponential expressions in one variable.
• A.APR.A.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.SSE.A.2. Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.*	MP.2 Reason abstractly and quantitatively. MP.7 Look for and make use of structure.	Concept(s): Add, subtract and multiply polynomials • *Polynomials form a system analogous to the integers.* • *Polynomials are closed under the operations of addition, subtraction, and multiplication.* Students are able to: • add and subtract polynomials. • multiply polynomials. • understand the sum or difference of two polynomials produces another polynomial • relate polynomials to the system of integers • understand that the product of two polynomials produces another polynomial. **Learning Goal 4:** Add, subtract, and multiply polynomials, relating these to arithmetic operations with integers.
• A.REI.B.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. • A.REI.A.1. Explain each step in solving a simple equation as following from the equality of	MP 2 Reason abstractly and quantitatively. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s). • Literal equations can be rearranged using the properties of equality. Students are able to. • learn “if-then” moves using the properties of equality to solve equations • explore moves that may result in more solutions than the original equation.

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.CED.A.4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R. ● A.SSE.A.1. Interpret expressions that represent a quantity in terms of its context. A.SSE.A.1a. Interpret parts of an expression, such as terms, factors, and coefficients.		● learn "if-then" moves using the addition and multiplication properties of inequality to solve inequalities and graph the solution on the number line. ● learn to think of some of the letters in a formula as constants in order to define a relationship between two or more quantities, where one is "in terms of" another. ● identify different parts of an expression, including terms, factors and constants. ● explain the meaning of parts of an expression in context. **Learning Goal 5.** Solve linear equations and inequalities in one variable (including literal equations); justify each step in the process.
● A.CED.A.1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.* ● A.REI.A.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.	MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.7 Look for and make use of structure.	Concept(s): Foundations of solving equations and inequalities ● *Equations and inequalities describe relationships.* ● *Equations can represent real-world and mathematical problems*. Students are able to: ● identify and describe relationships between quantities in word problems. ● create linear equations in one variable. ● create linear inequalities in one variable. ● use equations and inequalities to solve real world problems. ● explain each step in the solution process. **Learning Goal 6:** Create linear equations and inequalities in one variable and use them in contextual situations to solve problems. Justify each step in the process and the solution.
● A.REI.C.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. ● A.CED.A.3. Represent constraints by equations or inequalities, and by	MP.1 Make sense of problems and persevere in solving them. MP 2 Reason abstractly and quantitatively.	Concept(s): Systems of equations can be solved exactly (algebraically) and approximately (graphically). Students are able to: ● identify and define variables representing essential features for the model. ● model real world situations by creating a system of linear equations.

systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*. ● A.REI.C.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.D.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.	MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics.	● solve systems of linear equations using the elimination or substitution method. ● solve systems of linear equations by graphing. ● interpret the solution(s) in context. **Learning Goal 7:** Solve multistep contextual problems by identifying variables, writing equations, and solving systems of linear equations in two variables algebraically and graphically. **Learning Goal 8:** Graph linear inequalities and systems of linear inequalities in two variables and explain that the solution to the system.
Interdisciplinary Connections: **NGSS Appendix for Alignment**	***Science:*** **MS-PS1 As part of this work, teachers should give students opportunities to work with ratios and proportional relationships, use signed numbers, write and solve equations, and use order of magnitude thinking and basic statistics:** *The Number System (6–8.NS). Science examples: Use positive and negative quantities to represent temperature changes in a chemical reaction (signs of energy released or absorbed).* *Statistics and Probability (6–8.SP). Science example: Compile all the boiling point measurements from the class into a line plot and discuss the distribution in terms of clustering and outliers. Why weren't all the measured values equal? How close is the average value to the nominal/textbook value? Show the average value and the nominal value on the line plot.* **MS-PS2 As part of this work, teachers should give students opportunities to work with signed numbers and interpret expressions:** *The Number System (6–8.NS). Science examples: (1) Represent a third-law pair of forces as a 100 N force on one object and a −100N force on the other object. (2) Represent balanced forces on a single object as equal and opposite numbers 5 N. (3) Represent the net result of two or more forces as a sum of signed numbers. For example, given a large force and an oppositely directed small force, represent the net force as (100 N) + (−5 N) = 95 N. Relate the number sentence to the fact that the net effect on the motion is approximately what it would have been with only the large force* *Expressions and Equations (6–8.EE). Science example: Interpret an expression in terms of a physical context, e.g., interpret the expression F1 + F2 in a diagram as representing the net force on an object.* **MS-LS1 As part of this work, teachers should give students opportunities to use order of magnitude thinking, write and solve equations & analyze data:** *Expressions and Equations (6–8.EE). Science examples: (1) Quantify the sizes of cells and parts of cells, using convenient units such as microns.(2) Appreciate the orders of magnitude that span the difference in size between cells, molecules, and atoms. (3) Write a number sentence that expresses the conservation of mass as food moves through an organism. Assign values to*	

	the arrows in a diagram to show flows quantitatively. (4) Infer an unknown mass by using the concept of conservation to write and solve an equation with a variable. **MS-LS2 As part of this work, teachers should give students opportunities to work with ratios and proportional relationships, write and solve equations, and use basic statistics:** *Expressions and Equations (6–8.EE). Science examples: (1) Write a number sentence that expresses the conservation of total matter or energy in a system as matter or energy flows into, out of, and within it. Assign values to the arrows in a diagram to show flows quantitatively. (2) Infer an unknown matter or energy flow in a system by using the concept of conservation to write and solve an equation with a variable.* **MS-ESS2 As part of this work, teachers should give students opportunities to work with positive and negative numbers, and use order of magnitude thinking:** *The Number System (6–8.NS). Science examples: (1) Use positive and negative quantities to quantify changes in physical quantities such as atmospheric pressure and temperature; for example, if the temperature dropped from 24oC to 11oC, then the temperature change was −13oC. (2) Solve word problems relating to changes in signed physical quantities. For example, a shift in the jet stream caused a 10oC temperature increase in a single day; if the temperature before was −32oC, what was the temperature after?* ***English-Language Arts:*** **RI.8.4**. Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts. **RI.8.5**. Analyze the structure an author uses to organize a specific paragraph in a text, including the role of particular sentences, to develop and to refine a key concept. **RI.8.6.** Determine an author's point of view or purpose in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints. **RI.8.7.** Evaluate the advantages and disadvantages of using different mediums (e.g., print or digital text, video, multimedia) to present a particular topic or idea. **W.8.2.** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. A. Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia). B. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples. C. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts. D. Use precise language and domain-specific vocabulary to inform about or explain the topic. E. Establish and maintain a formal style/academic style, approach, and form. F. Provide a concluding statement or section that follows from and supports the information or explanation presented. **W.8.4**. Produce clear and coherent writing in which the development, organization, voice and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.) **W.8.5.** With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed. **W.8.6.** Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others. **W.8.7**. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

	SL.8.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. A. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion. B. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed. C. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas. D. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented. **SL.8.2**. Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate the motives (e.g., social, commercial, political) behind its presentation. **SL.8.3**. Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced. **SL.8.5**. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
21st Century Skills/ Career Ready Practices:	**CRP1. Act as a responsible and contributing citizen and employee.** **CRP2. Apply appropriate academic and technical skills.** **CRP3. Attend to personal health and financial well-being.** **CRP4. Communicate clearly and effectively and with reason.** **CRP5. Consider the environmental, social and economic impacts of decisions.** **CRP6. Demonstrate creativity and innovation.** **CRP7. Employ valid and reliable research strategies.** **CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.** **CRP9. Model integrity, ethical leadership and effective management.** **CRP10. Plan education and career paths aligned to personal goals.** **CRP11. Use technology to enhance productivity.** **CRP12. Work productively in teams while using cultural global competence.**
2014 NJ Technology Standards:	**8.1 Educational Technology** (Word | PDF) All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge. **8.2 Technology Education, Engineering, Design and Computational Thinking - Programming** (Word | PDF) All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment. Please see relevant projects for technology standards 8.1 and 8.2:

Green Township School District Algebra I Curriculum - Revised 2017

District/School Primary and Supplementary Resources	
Primary Resource: **Eureka Math (Unbound Ed - Module 1)**	**Supplementary Resources:** *Algebra I Common Core* (Pearson 2012) *Understanding Algebra I* (The Critical Thinking Company) **Khan Academy** eMath Instruction Desmos Traveling to School Graphing Activity **Performance Tasks are available for use from the following sites:** Illustrative Mathematics Coherence Map Inside Mathematics Problems of the Month Algebra YouCubed Tasks PARCC Released test items
Materials:	**Suggested Tasks for Use During Unit**
❑ *Graph paper*	**Topic A: The Aquarium** N.Q.A.1 Runners' World N.Q.A.2 Giving Raises N.Q.A.3 Calories in a Sports Drink A.REI.A.1 Zero Product Property 1 A.REI.B.3, A.REI.A.1 Reasoning with linear inequalities A.REI.C.5 Solving Two Equations in Two Unknowns A.REI.C.6 Cash Box A.REI.D.12 Fishing Adventures 3 A.SSE.A.1 Kitchen Floor Tiles A.SSE.A.1 Mixing Candies A.CED.A.1 Planes and wheat A-CED.A.1 Paying the rent A.CED.A.2 Clea on an Escalator A.CED.A.3 Dimes and Quarters A.CED.A.4 Equations and Formulas

District/School Formative Assessment Plan	**District/School Summative Assessment Plan**
• Teacher observation of students engaged in group and independent activities. • Individual and small group conferences/interviews to assess understanding with rubric • Self-assessment by students with guidance from teacher. • Eureka Math Sprints • Exit tickets	• Teacher created assessments and projects • ***Eureka Math*** Mid- and End- Module Assessments (Constructed response item with rubric) • Teacher/District created Quarterly Assessments
Instructional Best Practices and Exemplars	**Mathematical Terms/Vocabulary**
• *Facilitate partner and group collaborations* • *Inquiry based tasks introduced before direct teaching* • *Small and large group discussions* • *Have students use a variety of representations or methods to show and explain their understanding.* • *Build fluency over time.*	• **Piecewise-Linear Function** (Given a finite number of non-overlapping intervals on the real number line, a (real) piecewise-linear function is a function from the union of the intervals to the set of real numbers such that the function is defined by (possibly different) linear functions on each interval.) • **Numerical Symbol** (A numerical symbol is a symbol that represents a specific number.) • **Variable Symbol** (A variable symbol is a symbol that is a placeholder for a number. It is possible that a question may restrict the type of number that a placeholder might permit, maybe integers only or a positive real number, for instance.) • **Numerical Expression** (A numerical expression is an algebraic expression that contains only numerical symbols (no variable symbols) and that evaluates to a single number.) • **Algebraic Expression** (An algebraic expression is either: (1) a numerical symbol or a variable symbol or (2) the result of placing previously generated algebraic expressions into the two blanks of one of the four operators ((__) (__), (__) (__), (__) (__), (__) (__)) or into the base blank of an exponentiation with an exponent that is a rational number.) • **Equivalent Numerical Expressions** (Two numerical expressions are equivalent if they evaluate to the same number.) • **Equivalent Algebraic Expressions** (Two algebraic expressions are equivalent if we can convert one expression into the other by repeatedly applying the commutative, associative, and distributive properties and the properties of rational exponents to components of the first expression.)

	• **Polynomial Expression** (A polynomial expression is either: (1) a numerical expression or a variable symbol or (2) the result of placing two previously generated polynomial expressions into the blanks of the addition operator (__ __) or the multiplication operator (__ __).) • **Monomial** (A monomial is a polynomial expression generated using only the multiplication operator (__ __). Monomials are products whose factors are numerical expressions or variable symbols.) Degree of a Monomial (The degree of a non-zero monomial is the sum of the exponents of the variable symbols that appear in the monomial.) • **Standard Form of a Polynomial Expression in One Variable** (A polynomial expression with one variable symbol is in standard form if it is expressed as where is a non-negative integer, and are constant coefficients with . A polynomial expression in that is in standard form is often called a polynomial in .) • **Degree of a Polynomial in Standard Form** (The degree of a polynomial in standard form is the highest degree of the terms in the polynomial, namely .) • **Leading Term and Leading Coefficient of a Polynomial in Standard Form** (The term is called the leading term, and is called the leading coefficient.) • **Constant Term of a Polynomial in Standard Form** (The constant term is the value of the numerical expression found by substituting into all the variable symbols of the polynomial, namely .) • **Solution** (A solution to an equation with one variable is a number in the domain of the variable that, when substituted for all instances of the variable in both expressions, makes the equation a true number sentence.) • **Solution Set** (The set of solutions of an equation is called its solution set.) • **Graph of an Equation in Two Variables** (The set of all points in the coordinate plane that are solutions to an equation in two variables is called the graph of the equation.) • **Zero Product Property** (The Zero Product Property states that given real numbers, and if then either or or both and .)

Focus Mathematical Concepts

Grade Level Fluency Requirement:

The PARCC Model Content Frameworks recommend the following fluencies for Algebra I students:

- ***A/G*** *Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).*
- ***A-APR.A.1*** *Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.*

- ***A-SSE.A.1b*** *Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations*

Prerequisite skills

Refer to Achieve the Core Coherence Map for full detail on vertical and horizontal alignment to prerequisite skills & future skills.

Coherence Map

Apply and extend previous understandings of numbers to the system of rational numbers.

6.NS.C.7 Understand ordering and absolute value of rational numbers.

a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. For example, interpret –3 > –7 as a statement that –3 is located to the right of –7 on a number line oriented from left to right.

b. Write, interpret, and explain statements of order for rational numbers in real-world contexts. For example, write –3°C > –7°C to express the fact that –3°C is warmer than –7°C

Apply and extend previous understandings of arithmetic to algebraic expressions.

6.EE.A.3 Apply the properties of operations to generate equivalent expressions. For example, apply the distributive property to the expression 3(2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6(4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.

6.EE.A.4 Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for. Reason about and solve one-variable equations and inequalities.

6.EE.B.5 Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or depending on the purpose at hand, any number in a specified set.

6.EE.B.7 Solve real-world and mathematical problems by writing and solving equations of the form x + p = q and px = q for cases in which p, q and x are all nonnegative rational numbers.

6.EE.B.8 Write an inequality of the form x > c or x < c to represent a constraint or condition in a realworld or mathematical problem. Recognize that inequalities of the form x > c or x < c have infinitely many solutions; represent solutions of such inequalities on number line diagrams. Use properties of operations to generate equivalent expressions.

7.EE.A.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

7.EE.A.2 Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. For example, a + 0.05a = 1.05a means that “increase by 5%” is the same as “multiply by 1.05.” Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

7.EE.B.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each

edge; this estimate can be used as a check on the exact computation.

Differentiation/Accommodations/Modifications

Gifted and Talented

(content, process, product and learning environment)

Extension Activities

- Conduct research and provide presentation of various topics.
- Design surveys to generate and analyze data to be used in discussion.
- Debate topics of interest / cultural importance.
- Authentic listening and reading sources that provide data and support for speaking and writing prompts.
- Exploration of art and/or artists to understand society and history.
- Implement RAFT Activities as they pertain to the types / modes of communication (role, audience, format, topic).

Anchor Activities

- Use of Higher Level Questioning Techniques
- Provide assessments at a higher level of thinking

English Language Learners

Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice.
- Model skills/techniques that need to be mastered.
- Extended time to complete class work
- Visual dictionaries to help build vocabulary
- Provide copy of classnotes
- Pair with a peer for assistance during class

Modifications for Homework/Assignments

- Modified Assignments
- Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary)

- Extended time for assignment completion as needed
- Highlight key vocabulary
- Use graphic organizers

Students with Disabilities

(**appropriate accommodations, instructional adaptations, and/or modifications as determined by the IEP or 504 team**)

Modifications for Classroom
- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice
- Model skills / techniques to be mastered.
- Extended time to complete class work
- Provide copy of classnotes
- Preferential seating to be mutually determined by the student and teacher
- Student may request to use a computer to complete assignments.
- Establish expectations for correct spelling on assignments.
- Extra textbooks for home.
- Student may request books on tape / CD / digital media, as available and appropriate.
- Assign a peer helper in the class setting
- Provide oral reminders and check student work during independent work time
- Assist student with long and short term planning of assignments
- Encourage student to proofread assignments and tests
- Provide regular parent/ school communication
- Teachers will check/sign student agenda daily
- Student requires use of other assistive technology device

Modifications for Homework and Assignments
- Extended time to complete assignments.
- Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases.
- Provide the student with clearly stated (written) expectations and grading criteria for assignments.
- Implement RAFT activities as they pertain to the types / modes of communication (role, audience, format, topic).

Modifications for Assessments
- Extended time on classroom tests and quizzes.
- Student may take/complete tests in an alternate setting as needed.
- Restate, reread, and clarify directions/questions
- Distribute study guide for classroom tests.
- Establish procedures for accommodations / modifications for assessments.

Students at Risk of School Failure

Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice
- Model skills / techniques to be mastered.
- Extended time to complete class work
- Provide copy of classnotes
- Preferential seating to be mutually determined by the student and teacher
- Student may request to use a computer to complete assignments.
- Establish expectations for correct spelling on assignments.
- Extra textbooks for home.
- Student may request books on tape / CD / digital media, as available and appropriate.
- Assign a peer helper in the class setting
- Provide oral reminders and check student work during independent work time
- Assist student with long and short term planning of assignments
- Encourage student to proofread assignments and tests
- Provide regular parent/ school communication
- Teachers will check/sign student agenda daily
- Student requires use of other assistive technology device

Modifications for Homework and Assignments

- Extended time to complete assignments.
- Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases.
- Provide the student with clearly stated (written) expectations and grading criteria for assignments.
- Implement RAFT activities as they pertain to the types / modes of communication (role, audience, format, topic).

Modifications for Assessments

- Extended time on classroom tests and quizzes.
- Student may take/complete tests in an alternate setting as needed.
- Restate, reread, and clarify directions/questions
- Distribute study guide for classroom tests.
- Establish procedures for accommodations / modifications for assessments.

Green Township School District Algebra 1 Curriculum - Revised 2017

Unit 2: Descriptive Statistics **(Approximate Instructional Time: 4 weeks)**		
NJ Student Learning Standards	**Suggested Standards for Mathematical Practice**	**Critical Knowledge & Skills** ***(Learning goals are for the Unit but may not necessarily be in sequential order.)***
● S.ID.A.1. Represent data with plots on the real number line (dot plots, histograms, and box plots).	MP.1 Make sense of problems and persevere in solving them. MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.	Concept(s): Represent and interpret data with dot plots, histograms and box plots. Students are able to: ● represent data with dot plots on the real number line. ● represent data with histograms on the real number line. ● represent data with box plots on the real number line. **Learning Goal 1:** Represent data with plots (dot plots, histograms, and box plots) on the real number line.
● S.ID.A.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.A.3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	MP.1 Make sense of problems and persevere in solving them. MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.	Concept(s):Represent and interpret data with dot plots, histograms and box plots. ● Appropriate use of a statistic depends on the shape of the data distribution. ● Standard deviation Students are able to: ● represent two or more data sets with plots and use appropriate statistics to compare their center and spread. ● interpret differences in shape, center, and spread in context. ● explain possible effects of extreme data points (outliers) when summarizing data and interpreting shape, center and spread. ● calculate the standard deviation for a set of data and interpret it as a typical distance from the mean. **Learning Goal 2:** Compare center and spread of two or more data sets, interpreting differences in shape, center, and spread in the context of the data, taking into account the effects of outliers.

● S.ID.B.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.	MP.1 Make sense of problems and persevere in solving them. MP.5 Use appropriate tools strategically. MP.7 Look for and make use of structure.	Concept(s): Interpret categorical data Students are able to: ● construct two-way frequency tables for categorical data. ● interpret **joint, marginal and conditional** relative frequencies in context. ● explain possible associations between categorical data in two-way tables. ● identify and describe trends in the data. Learning Goal 3: Summarize and interpret categorical data for two categories in two-way frequency tables; explain possible associations and trends in the data.
● S.ID.B.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. S.ID.B.6a. Fit a function to the data (including the use of technology); 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.B.6b. Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.	MP.1 Make sense of problems and persevere in solving them. MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.	Concept(s): Using scatter plots to describe relationships between data Students are able to: ● fit a function to data using graphing calculators. ● solve problems using functions fitted to data (prediction equations). ● interpret the intercepts of models in context. ● plot residuals of linear and non-linear functions. ● analyze residuals in order to informally evaluate the fit of linear and non-linear functions. **Learning Goal 4:** Fit functions to data using technology, plot residuals and informally assess the fit of linear and non-linear functions by analyzing residuals.
● S.ID.B.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. S.ID.B.6a. Fit a function to the data (including the use of technology);	MP.1 Make sense of problems and persevere in solving them. MP 2 Reason abstractly and quantitatively.	Concept(s): Using scatter plots to describe relationships between data ● *Scatter plots represent the relationship between two variables.* ● *Scatter plots can be used to determine the nature of the association between the variables.* ● *Linear models may be developed by fitting a linear function to approximately linear 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.B.6c. Fit a linear function for a scatter plot that suggests a linear association. ● S.ID.C.7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. ● S.ID.C.8. Compute (using technology) and interpret the correlation coefficient of a linear fit. ● S.ID.C.9. Distinguish between correlation and causation.	MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.	● *The correlation coefficient represents the strength of a linear association.* Students are able to: ● distinguish linear models representing approximately linear data from linear. equations representing "perfectly" linear relationships. ● create a scatter plot and sketch a line of best fit. ● fit a linear function to data using technology. ● solve problems using prediction equations. ● interpret the slope and the intercepts of the linear model in context. ● determine the correlation coefficient for the linear model using technology. ● determine the direction and strength of the linear association between two variables. **Learning Goal 5:** Represent data on a scatter plot, describe how the variables are related and use technology to fit a function to data. **Learning Goal 6:** Interpret the slope, intercept, and correlation coefficient of a data set of a linear model; distinguish between correlation and causation.
Interdisciplinary Connections: **NGSS Appendix for Alignment**	***Science:*** **MS-PS1 As part of this work, teachers should give students opportunities to work with ratios and proportional relationships, use signed numbers, write and solve equations, and use order of magnitude thinking and basic statistics:** *The Number System (6–8.NS). Science examples: Use positive and negative quantities to represent temperature changes in a chemical reaction (signs of energy released or absorbed).* *Statistics and Probability (6–8.SP). Science example: Compile all the boiling point measurements from the class into a line plot and discuss the distribution in terms of clustering and outliers. Why weren't all the measured values equal? How close is the average value to the nominal/textbook value? Show the average value and the nominal value on the line plot.* **MS-PS2 As part of this work, teachers should give students opportunities to work with signed numbers and interpret expressions:** *The Number System (6–8.NS). Science examples: (1) Represent a third-law pair of forces as a 100 N force on one object and a −100N force on the other object. (2) Represent balanced forces on a single object as equal and opposite numbers 5 N. (3) Represent the net result of two or more forces as a sum of signed numbers. For example, given a large force and an oppositely directed small force, represent the net force as (100 N) + (−5 N) = 95 N. Relate the number sentence to the fact that the net effect on the motion is approximately what it would have been with only the large force* *Expressions and Equations (6–8.EE). Science example: Interpret an expression in terms of a physical context, e.g., interpret the expression F1 + F2 in a diagram as representing the net force on an object.* **MS-LS1 As part of this work, teachers should give students opportunities to use order of magnitude thinking, write and solve equations & analyze data:** *Expressions and Equations (6–8.EE). Science examples: (1) Quantify the sizes of cells and parts of cells, using convenient units such as microns.(2) Appreciate the orders of magnitude that span the difference in size between cells, molecules, and atoms. (3) Write a number sentence that expresses the conservation of mass as food moves through an organism. Assign values to*	

	the arrows in a diagram to show flows quantitatively. (4) Infer an unknown mass by using the concept of conservation to write and solve an equation with a variable. **MS-LS2 As part of this work, teachers should give students opportunities to work with ratios and proportional relationships, write and solve equations, and use basic statistics:** *Expressions and Equations (6–8.EE). Science examples: (1) Write a number sentence that expresses the conservation of total matter or energy in a system as matter or energy flows into, out of, and within it. Assign values to the arrows in a diagram to show flows quantitatively. (2) Infer an unknown matter or energy flow in a system by using the concept of conservation to write and solve an equation with a variable.* **MS-ESS2 As part of this work, teachers should give students opportunities to work with positive and negative numbers, and use order of magnitude thinking:** *The Number System (6–8.NS). Science examples: (1) Use positive and negative quantities to quantify changes in physical quantities such as atmospheric pressure and temperature; for example, if the temperature dropped from 24oC to 11oC, then the temperature change was −13oC. (2) Solve word problems relating to changes in signed physical quantities. For example, a shift in the jet stream caused a 10oC temperature increase in a single day; if the temperature before was −32oC, what was the temperature after?* ***English-Language Arts:*** **RI.8.4**. Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts. **RI.8.5**. Analyze the structure an author uses to organize a specific paragraph in a text, including the role of particular sentences, to develop and to refine a key concept. **RI.8.6.** Determine an author's point of view or purpose in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints. **RI.8.7.** Evaluate the advantages and disadvantages of using different mediums (e.g., print or digital text, video, multimedia) to present a particular topic or idea. **W.8.2.** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. A. Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia). B. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples. C. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts. D. Use precise language and domain-specific vocabulary to inform about or explain the topic. E. Establish and maintain a formal style/academic style, approach, and form. F. Provide a concluding statement or section that follows from and supports the information or explanation presented. **W.8.4**. Produce clear and coherent writing in which the development, organization, voice and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.) **W.8.5.** With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed. **W.8.6.** Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others. **W.8.7**. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

	SL.8.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. A. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion. B. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed. C. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas. D. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented. **SL.8.2**. Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate the motives (e.g., social, commercial, political) behind its presentation. **SL.8.3**. Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced. **SL.8.5**. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
21st Century Skills/ Career Ready Practices:	**CRP1. Act as a responsible and contributing citizen and employee.** **CRP2. Apply appropriate academic and technical skills.** **CRP3. Attend to personal health and financial well-being.** **CRP4. Communicate clearly and effectively and with reason.** **CRP5. Consider the environmental, social and economic impacts of decisions.** **CRP6. Demonstrate creativity and innovation.** **CRP7. Employ valid and reliable research strategies.** **CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.** **CRP9. Model integrity, ethical leadership and effective management.** **CRP10. Plan education and career paths aligned to personal goals.** **CRP11. Use technology to enhance productivity.** **CRP12. Work productively in teams while using cultural global competence.**
2014 NJ Technology Standards:	**8.1 Educational Technology** (Word | PDF) All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge. **8.2 Technology Education, Engineering, Design and Computational Thinking - Programming** (Word | PDF) All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment. Please see relevant projects for technology standards 8.1 and 8.2:

Green Township School District Algebra 1 Curriculum - Revised 2017

District/School Primary and Supplementary Resources	
Primary Resource: **Eureka Math (Unbound Ed - Module 2)**	**Supplementary Resources:** *Algebra I Common Core* (Pearson 2012) *Understanding Algebra I* (The Critical Thinking Company) Khan Academy eMath Instruction **Performance Tasks are available for use from the following sites:** Illustrative Mathematics Coherence Map Inside Mathematics Problems of the Month Algebra YouCubed Tasks PARCC Released test items
Tools & Materials	**Suggested Tasks for Use During Unit**
❑ *Graphing calculator* ❑ *Spreadsheet software* ❑ *Dot plot* ❑ *Box plot* ❑ *Histogram* ❑ *Residual plot*	S.ID.A.1-3 Haircut Costs S.ID.A.1-3 Speed Trap S.ID.A.2-A.3 Measuring Variability in a Data Set S.ID.A.3 Identifying Outliers S.ID.B.5 Support for a Longer School Day? S.ID.B.6 Laptop Battery Charge 2 S.ID.B.6,S.ID.C.7-9 Coffee and Crime
District/School Formative Assessment Plan	**District/School Summative Assessment Plan**
• Teacher observation of students engaged in group and independent activities. • Individual and small group conferences/interviews to assess understanding with rubric • Self-assessment by students with guidance from teacher. • Eureka Math Sprints • Exit tickets	• Teacher created assessments and projects • ***Eureka Math*** Mid- and End- Module Assessments (Constructed response item with rubric) • Teacher/District created Quarterly Assessments

Green Township School District Algebra 1 Curriculum - Revised 2017

Instructional Best Practices and Exemplars	Mathematical Terms/Vocabulary
Facilitate partner and group collaborations *Inquiry based tasks introduced before direct teaching* *Small and large group discussions* *Have students use a variety of representations or methods to show and explain their understanding.* *Build fluency over time.*	• **Skewed Data Distribution** (A data distribution is said to be skewed if the distribution is not symmetric with respect to its mean. Left-skewed or skewed to the left is indicated by the data spreading out longer (like a tail) on the left side. Right-skewed or skewed to the right is indicated by the data spreading out longer (like a tail) on the right side.) • **Outlier** (An outlier of a finite numerical data set is a value that is greater than $Q3$ by a distance of $1.5 \cdot IQR$, or a value that is less than $Q1$ by a distance of $1.5 \cdot IQR$. Outliers are usually identified by an "*" or a "•" in a box plot.) • **Sample Standard Deviation** (The sample variance for a numerical sample data set of n-values is the sum of the squared distances the values are from the mean divided by $(n - 1)$. The sample standard deviation is the principle (positive) square root of the sample variance.) • **Interquartile Range** (The interquartile range (or IQR) is the distance between the first quartile and the second quartile: $IQR = Q3 - Q1$. The IQR describes variability by identifying the length of the interval that contains the middle 50% of the data values.) • **Association** (A statistical association is any relationship between measures of two types of quantities so that one is statistically dependent on the other.) • **Conditional Relative Frequency** (A conditional relative frequency compares a frequency count to the marginal total that represents the condition of interest.) • **Residual** (The residual of the data point (x_i, y_i) is the (actual y_i -value) − (predicted y-value) for the given x_i.) • **Residual Plot** (Given a bivariate data set and linear equation used to model the data set, a residual plot is the graph of all ordered pairs determined as follows: For each data point (x_i, y_i) in the data set, the first entry of the ordered pair is the x-value of the data point, and the second entry is the residual of the data point.) • **Correlation Coefficient** (The correlation coefficient, often denoted by r, is a number between −1 and +1, inclusively, that measures the strength and direction of a linear relationship between the two types of quantities. If $r = 1$ or $r = -1$, then the graph of data points of the bivariate data set lie on a line of positive or negative slope.)

Focus Mathematical Concepts

Grade Level Fluency Requirement:

The PARCC Model Content Frameworks recommend the following fluencies for Algebra I students:

- ***A/G*** *Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including*

modeling using systems of linear inequalities in two variables).

- ***A-APR.A.1*** *Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.*
- ***A-SSE.A.1b*** *Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations*

Prerequisite skills

Refer to Achieve the Core Coherence Map for full detail on vertical and horizontal alignment to prerequisite skills & future skills.

Coherence Map

Develop understanding of statistical variability.

6.SP.A.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.

6.SP.A.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

6.SP.A.3 Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

Summarize and describe distributions.

6.SP.B.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

6.SP.B.5 Summarize numerical data sets in relation to their context, such as by:

a. Reporting the number of observations.

b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

Investigate patterns of association in bivariate data.

8.SP.A.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

8.SP.A.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

8.SP.A.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.

8.SP-A.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?

Differentiation/Accommodations/Modifications

Gifted and Talented

(content, process, product and learning environment)

Extension Activities

- Conduct research and provide presentation of various topics.
- Design surveys to generate and analyze data to be used in discussion.
- Debate topics of interest / cultural importance.
- Authentic listening and reading sources that provide data and support for speaking and writing prompts.
- Exploration of art and/or artists to understand society and history.
- Implement RAFT Activities as they pertain to the types / modes of communication (role, audience, format, topic).

Anchor Activities

- Use of Higher Level Questioning Techniques
- Provide assessments at a higher level of thinking

English Language Learners

Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice.
- Model skills/techniques that need to be mastered.
- Extended time to complete class work
- Visual dictionaries to help build vocabulary
- Provide copy of classnotes
- Pair with a peer for assistance during class

Modifications for Homework/Assignments

- Modified Assignments
- Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary)
- Extended time for assignment completion as needed
- Highlight key vocabulary
- Use graphic organizers

Students with Disabilities

(**appropriate accommodations, instructional adaptations, and/or modifications as determined by the IEP or 504 team**)

Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice
- Model skills / techniques to be mastered.
- Extended time to complete class work
- Provide copy of classnotes
- Preferential seating to be mutually determined by the student and teacher
- Student may request to use a computer to complete assignments.
- Establish expectations for correct spelling on assignments.
- Extra textbooks for home.
- Student may request books on tape / CD / digital media, as available and appropriate.
- Assign a peer helper in the class setting
- Provide oral reminders and check student work during independent work time
- Assist student with long and short term planning of assignments
- Encourage student to proofread assignments and tests
- Provide regular parent/ school communication
- Teachers will check/sign student agenda daily
- Student requires use of other assistive technology device

Modifications for Homework and Assignments

- Extended time to complete assignments.
- Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases.
- Provide the student with clearly stated (written) expectations and grading criteria for assignments.
- Implement RAFT activities as they pertain to the types / modes of communication (role, audience, format, topic).

Modifications for Assessments

- Extended time on classroom tests and quizzes.
- Student may take/complete tests in an alternate setting as needed.
- Restate, reread, and clarify directions/questions
- Distribute study guide for classroom tests.
- Establish procedures for accommodations / modifications for assessments.

Students at Risk of School Failure

Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice
- Model skills / techniques to be mastered.
- Extended time to complete class work
- Provide copy of classnotes
- Preferential seating to be mutually determined by the student and teacher
- Student may request to use a computer to complete assignments.
- Establish expectations for correct spelling on assignments.
- Extra textbooks for home.
- Student may request books on tape / CD / digital media, as available and appropriate.
- Assign a peer helper in the class setting
- Provide oral reminders and check student work during independent work time
- Assist student with long and short term planning of assignments
- Encourage student to proofread assignments and tests
- Provide regular parent/ school communication
- Teachers will check/sign student agenda daily
- Student requires use of other assistive technology device

Modifications for Homework and Assignments

- Extended time to complete assignments.
- Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases.
- Provide the student with clearly stated (written) expectations and grading criteria for assignments.
- Implement RAFT activities as they pertain to the types / modes of communication (role, audience, format, topic).

Modifications for Assessments

- Extended time on classroom tests and quizzes.
- Student may take/complete tests in an alternate setting as needed.
- Restate, reread, and clarify directions/questions
- Distribute study guide for classroom tests.
- Establish procedures for accommodations / modifications for assessments.

Green Township School District Algebra 1 Curriculum - Revised 2017

Unit 3: Linear & Exponential Functions
(Approximate Instructional Time: 7 weeks)

NJ Student Learning Standards	**Suggested Standards for Mathematical Practice**	**Critical Knowledge & Skills** ***(Learning goals are for the Unit but may not necessarily be in sequential order.)***
• F.LE.A.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). *[Algebra 1 limitation: exponential expressions with integer exponents] • F.IF.A.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.*	MP 2 Reason abstractly and quantitatively. MP 4. Model with mathematics MP.1 Make sense of problems and persevere in solving them. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): Problem solving with sequences • *Sequences are functions, sometimes defined and represented recursively.* • *Sequences are functions whose domain is a subset of integers.* Students are able to: • create arithmetic and geometric sequences from verbal descriptions. • create arithmetic sequences from linear functions. • compare the rate of change for simple and compound interest and recognize situations in which a quantity grows by a constant percent rate per unit interval • create geometric sequences from exponential functions. • identify recursively defined sequences as functions. • create linear and exponential functions given – a graph; – a description of a relationship; – a table of values. **Learning Goal 1:** Write linear and exponential functions given a graph, table of values, or written description; construct arithmetic and geometric sequences.
• F.BF.A.1. Write a function that describes a relationship between two quantities. 1a. Determine an explicit expression, a recursive process, or steps for calculation from a context. • A.SSE.A.1. Interpret expressions that represent a quantity in terms of its context	MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics	Concept(s): Recursive and explicit formulas Students are able to: • given a context, write an explicit expressions, a recursive process or steps for calculation for linear and exponential relationships. • interpret parts of linear and exponential functions in context.

A.SSE.A.1a: Interpret parts of an expression, such as terms, factors, and coefficients. A.SSE.A.1b: Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P.* *[Algebra 1 limitation: exponential expressions with integer exponents]		**Learning Goal 2:** Write explicit expressions, recursive processes and steps for calculation from a context that describes a linear or exponential relationship between two quantities.
● F.LE.A.1. Distinguish between situations that can be modeled with linear functions and with exponential functions. F.LE.A.1a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. F.LE.A.1b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. F.LE.A.1c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	MP.3 Construct viable arguments and critique the reasoning of others. MP.6 Attend to precision.	Concept(s): ● *Linear functions grow by equal differences over equal intervals.* ● *Exponential functions grow by equal factors over equal intervals.* Students are able to: ● identify and describe situations in which one quantity changes at a constant rate. ● identify and describe situations in which a quantity grows or decays by a constant percent. ● show that linear functions grow by equal differences over equal intervals. ● show that exponential functions grow by equal factors over equal intervals. **Learning Goal 3**: Compare the rate of change for simple and compound interest and recognize situations in which a quantity grows by a constant percent rate per unit interval.
● F.IF.A.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.A.2. Use function notation, evaluate functions for inputs in their domains,	MP 2 Reason abstractly and quantitatively. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): Function notation, domain and range. ● *F(x) is an element in the range and x is an element in the domain.* Students are able to: ● use the definition of a function to determine whether a relationship is a function. ● use function notation once a relation is determined to be a function. ● evaluate functions for given inputs in the domain. ● explain statements involving function notation in the context of the problem.

and interpret statements that use function notation in terms of a context.		**Learning Goal 4:** Explain the definition of a function, including the relationship between the domain and range. Use function notation, evaluate functions and interpret statements in context.
● F.IF.B.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity*. *[Focus on exponential functions] ● F.LE.B.5. Interpret the parameters in a linear or exponential function in terms of a context. ● F.IF.B.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function*	MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.6 Attend to precision.	Concept(s): Analyzing and interpreting features of functions Students are able to: ● given a verbal description of a relationship, sketch linear and exponential functions. ● identify intercepts and intervals where the function is positive/negative. ● interpret parameters in context. ● determine the *practical* domain of a function. **Learning Goal 5:** Sketch graphs of linear and exponential functions expressed symbolically or from a verbal description. Show key features and interpret parameters in context.
● F.IF.B.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior;*	MP.4 Model with mathematics. MP.6 Attend to precision.	Concept(s): Analyzing key features of functions Students are able to: ● interpret maximum/minimum and intercepts of quadratic functions from graphs and tables in the context of the problem. ● sketch graphs of quadratic functions given a verbal description of the relationship between the quantities. ● identify intercepts and intervals where function is increasing/decreasing ● determine the practical domain of a function.

and periodicity. ● F.IF.B.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function*		**Learning Goal 6:** Interpret key features of quadratic functions from graphs and tables. Given a verbal description of the relationship, sketch the graph of a quadratic function, showing key features and relating the domain of the function to its graph.
● F.IF.C.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. F.IF.C.7a. Graph linear and quadratic functions and show intercepts, maxima, and minima. *[emphasize quadratic functions] ● F.IF.C.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum*.	MP.1 Make sense of problems and persevere in solving them. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.8 Look for and express regularity in repeated reasoning.	Concept(s): Graphing and comparing properties of functions Students are able to: ● graph quadratic functions expressed symbolically. ● graph more complicated cases of quadratic functions using technology. ● identify and describe key features of the graphs of quadratic functions. ● given two quadratic functions, each represented in a different way, compare the properties of the functions. **Learning Goal 7:** Graph quadratic functions by hand in simple cases and with technology in complex cases, showing intercepts, extreme values and symmetry of the graph. Compare properties of two quadratic functions, each represented in a different way.
● A.REI.D.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, quadratic or	MP.1 Make sense of problems and persevere in solving them. MP.5 Use appropriate tools strategically.	Concept(s): F(x) = g(x) concepts Students are able to: ● use graphs to approximate the solution(x) to a system of equations comprised of a linear and a quadratic function by using technology to graph the functions, by making a table of values and/or by finding successive approximations. **Learning Goal 8:** Find approximate solutions of f(x) = g(x), where f(x) is a linear function and g(x) is a quadratic function by making a table of values, using technology to

exponential.		graph and finding successive approximations.
• A.REI.D.11. Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.* [Focus on linear equations.]	MP.1 Make sense of problems and persevere in solving them. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.	Concept(s): F(x) = g(x) concepts • *y = f(x), y=g(x) represent a system of equations.* • *Systems of equations can be solved graphically (8.EE.C.8).* Students are able to: • explain the relationship between the x-coordinate of a point of intersection and the solution to the equation f(x) = g(x) for linear equations y = f(x) and y = g(x). • find approximate solutions to the system by making a table of values, graphing, and finding successive approximations. **Learning Goal 8:** Explain why the solutions of the equation f(x) = g(x) are the x-coordinates of the points where the graphs of the linear equations y=f(x) and y=g(x) intersect. ** function notation is not introduced here **Learning Goal 9:** Find approximate solutions of f(x) = g(x), where f(x) and g(x) are linear functions, by making a table of values, using technology to graph and finding successive approximations.
• F.BF.B.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.	MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.7 Look for and make use of structure.	Concept(s): Graphing transformations and understanding the structure of equations that create the translation. • *Characteristics of even and odd functions in graphs and algebraic expressions* • *Vertical and horizontal shifts* Students are able to: • perform transformations on graphs of linear and quadratic functions. • identify the effect on the graph of replacing f(x) by – $f(x) + k$; – $k\,f(x)$; – $f(kx)$; – *and* $f(x + k)$ for specific values of k (both positive and negative). • identify the effect on the graph of combinations of transformations. • given the graph, find the value of k. • illustrate an explanation of the effects on linear and quadratic graphs using technology. • recognize even and odd functions from their graphs and from algebraic expressions for

		them. **Learning Goal 10:** Identify the effects of transformations and combinations of transformations [$f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$] on a function; find the value of k given the graph.
• A.CED.A.1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear functions and quadratic functions, and simple rational and exponential functions.	MP 2 Reason abstractly and quantitatively. MP. 4 Model with mathematics	Concept(s): Modeling piecewise, step and exponential functions Students are able to: • create models and conceptually understand the differences between linear and exponential models that are represented in different ways • create piecewise and step functions that relate to real-life situations and use those functions to solve problems. **Learning Goal 11:** Create equations in one variable and use them to solve problems.
• F.IF.B.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. • F.LE.A.3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	MP.1 Make sense of problems and persevere in solving them. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.7 Look for and make use of structure.	Concept(s): Rate of change over different intervals • *A quantity increasing exponentially eventually exceeds a quantity increasing quadratically.* Students are able to: • calculate the rate of change of a quadratic function from a table of values or from a function presented symbolically. • estimate the rate of change from a graph of a quadratic function. • analyze graphs and tables to compare rates of change of exponential and quadratic functions. **Learning Goal 12:** Calculate and interpret the average rate of change of a quadratic function presented symbolically or as a table. Estimate and compare the rates of change from graphs of quadratic and exponential functions.
Interdisciplinary Connections: **NGSS Appendix for Alignment**	***Science:*** **MS-PS1 As part of this work, teachers should give students opportunities to work with ratios and proportional relationships, use signed numbers, write and solve equations, and use order of magnitude thinking and basic statistics:** *The Number System (6–8.NS). Science examples: Use positive and negative quantities to represent temperature changes in a chemical reaction (signs of energy released or absorbed).* *Statistics and Probability (6–8.SP). Science example: Compile all the boiling point measurements from the class into a line plot and discuss the distribution in terms of clustering and outliers. Why weren't all the measured values equal? How close is the average value to the nominal/textbook value? Show the average value and the nominal value on the line plot.*	

	MS-PS2 As part of this work, teachers should give students opportunities to work with signed numbers and interpret expressions: *The Number System (6–8.NS). Science examples: (1) Represent a third-law pair of forces as a 100 N force on one object and a −100N force on the other object. (2) Represent balanced forces on a single object as equal and opposite numbers 5 N. (3) Represent the net result of two or more forces as a sum of signed numbers. For example, given a large force and an oppositely directed small force, represent the net force as (100 N) + (−5 N) = 95 N. Relate the number sentence to the fact that the net effect on the motion is approximately what it would have been with only the large force* *Expressions and Equations (6–8.EE). Science example: Interpret an expression in terms of a physical context, e.g., interpret the expression F1 + F2 in a diagram as representing the net force on an object.* **MS-LS1 As part of this work, teachers should give students opportunities to use order of magnitude thinking, write and solve equations & analyze data:** *Expressions and Equations (6–8.EE). Science examples: (1) Quantify the sizes of cells and parts of cells, using convenient units such as microns.(2) Appreciate the orders of magnitude that span the difference in size between cells, molecules, and atoms. (3) Write a number sentence that expresses the conservation of mass as food moves through an organism. Assign values to the arrows in a diagram to show flows quantitatively. (4) Infer an unknown mass by using the concept of conservation to write and solve an equation with a variable.* **MS-LS2 As part of this work, teachers should give students opportunities to work with ratios and proportional relationships, write and solve equations, and use basic statistics:** *Expressions and Equations (6–8.EE). Science examples: (1) Write a number sentence that expresses the conservation of total matter or energy in a system as matter or energy flows into, out of, and within it. Assign values to the arrows in a diagram to show flows quantitatively. (2) Infer an unknown matter or energy flow in a system by using the concept of conservation to write and solve an equation with a variable.* **MS-ESS2 As part of this work, teachers should give students opportunities to work with positive and negative numbers, and use order of magnitude thinking:** *The Number System (6–8.NS). Science examples: (1) Use positive and negative quantities to quantify changes in physical quantities such as atmospheric pressure and temperature; for example, if the temperature dropped from 24oC to 11oC, then the temperature change was −13oC. (2) Solve word problems relating to changes in signed physical quantities. For example, a shift in the jet stream caused a 10oC temperature increase in a single day; if the temperature before was −32oC, what was the temperature after?* ***English-Language Arts:*** **RI.8.4**. Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts. **RI.8.5**. Analyze the structure an author uses to organize a specific paragraph in a text, including the role of particular sentences, to develop and to refine a key concept. **RI.8.6.** Determine an author's point of view or purpose in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints. **RI.8.7.** Evaluate the advantages and disadvantages of using different mediums (e.g., print or digital text, video, multimedia) to present a particular topic or idea. **W.8.2.** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. A. Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia).

	B. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples. C. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts. D. Use precise language and domain-specific vocabulary to inform about or explain the topic. E. Establish and maintain a formal style/academic style, approach, and form. F. Provide a concluding statement or section that follows from and supports the information or explanation presented. **W.8.4**. Produce clear and coherent writing in which the development, organization, voice and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.) **W.8.5.** With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed. **W.8.6.** Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others. **W.8.7**. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. **SL.8.1.** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. A. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion. B. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed. C. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas. D. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented. **SL.8.2**. Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate the motives (e.g., social, commercial, political) behind its presentation. **SL.8.3**. Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced. **SL.8.5**. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
21st Century Skills/ Career Ready Practices:	**CRP1. Act as a responsible and contributing citizen and employee.** **CRP2. Apply appropriate academic and technical skills.** **CRP3. Attend to personal health and financial well-being.** **CRP4. Communicate clearly and effectively and with reason.** **CRP5. Consider the environmental, social and economic impacts of decisions.** **CRP6. Demonstrate creativity and innovation.** **CRP7. Employ valid and reliable research strategies.** **CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.** **CRP9. Model integrity, ethical leadership and effective management.** **CRP10. Plan education and career paths aligned to personal goals.** **CRP11. Use technology to enhance productivity.**

	CRP12. Work productively in teams while using cultural global competence.
2014 NJ Technology Standards:	**8.1 Educational Technology** (Word | PDF) All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge. **8.2 Technology Education, Engineering, Design and Computational Thinking - Programming** (Word | PDF) All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment. Please see relevant projects for technology standards 8.1 and 8.2:

District/School Primary and Supplementary Resources	
Primary Resource: **Eureka Math (Unbound Ed - Module 3)**	**Supplementary Resources:** *Algebra I Common Core* (Pearson 2012) *Understanding Algebra I* (The Critical Thinking Company) **Khan Academy** eMath Instruction Supplemental Material for Transformations of Functions **Performance Tasks are available for use from the following sites:** Illustrative Mathematics Coherence Map Inside Mathematics Problems of the Month Algebra YouCubed Tasks PARCC Released test items
Tools & Materials	**Suggested Tasks for Use During Unit**
❑ *Coordinate Plane* ❑ *Equations and Inequalities* ❑ *Graphing Calculator* ❑ *Graphing paper*	F.IF.A.1 The Parking Lot F.IF.A.2 Yam in the Oven F.IF.B.4 Words – Tables - Graphs F.IF.B.4 Warming and Cooling

	F.IF.B.5 The restaurant F.IF.B.4, F.IF.B.5 Average Cost F.LE.B.5 US Population 1982-1988 F.IF.C.7a Graphs of Quadratic Functions F.IF.IF.B.6 Temperature Change F.IF.B.9 Throwing Baseballs F.BF.A.1a Skeleton Tower F.LE.A.3 Population and Food Supply F.BF.B.3 Identifying Even and Odd Functions F.BF.B.3 Transforming the graph of a function F.LE.A.1 Finding Linear and Exponential Models F.LE.A.2 Interesting Interest Rates A.REI.D.11 Introduction to Polynomials – College FundF.B.6 Mathemafish Population
District/School Formative Assessment Plan	**District/School Summative Assessment Plan**
• Teacher observation of students engaged in group and independent activities. • Individual and small group conferences/interviews to assess understanding with rubric • Self-assessment by students with guidance from teacher. • Eureka Math Sprints • Exit tickets	• Teacher created assessments and projects • ***Eureka Math*** Mid- and End- Module Assessments (Constructed response item with rubric) • Teacher/District created Quarterly Assessments
Instructional Best Practices and Exemplars	**Mathematical Terms/Vocabulary**
Facilitate partner and group collaborations *Inquiry based tasks introduced before direct teaching* *Small and large group discussions* *Have students use a variety of representations or methods to show and explain their understanding.* *Build fluency over time.*	• **Function** (A function is a correspondence between two sets, X and Y, in which each element of X is matched (or assigned)16 to one and only one element of Y. The set X is called the domain; the set Y is called the range.) • **Domain** (Refer to the definition of function.) Range (Refer to the definition of function.) • **Linear Function** (A linear function is a polynomial function of degree 1.) • **Average Rate of Change** (Given a function f whose domain includes the closed interval of real numbers $[a, b]$ and whose range is a subset of the real numbers, the average rate of change on the interval $[a, b]$ is $f(b)-f(a)\ b-a$.) • **Parameter of an Exponential Function:** (The parameter **a** is called the function's **y-intercept** and the parameter **b** is called the **base**. Together, they completely

	determine an exponential function's input-output behavior.) • **Piecewise Linear Function** (Given non-overlapping intervals on the real number line, a (real) piecewise linear function is a function from the union of the intervals to the set of real numbers such that the function is defined by (possibly different) linear functions on each interval.)

Focus Mathematical Concepts

Grade Level Fluency Requirement:

The PARCC Model Content Frameworks recommend the following fluencies for Algebra I students:

- ***A/G*** *Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).*
- ***A-APR.A.1*** *Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.*
- ***A-SSE.A.1b*** *Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations*

Prerequisite skills

Refer to Achieve the Core Coherence Map for full detail on vertical and horizontal alignment to prerequisite skills & future skills.

Coherence Map

Work with radicals and integer exponents.

8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, 3 2 × 3 −5 = 3 −3 = 1/3 3 = 1/27.

8.EE.A.2 Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.

Define, evaluate, and compare functions.

8.F.A.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. 13

8.F.A.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.

8.F.A.3 Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.

Use functions to model relationships between quantities.

8.F.B.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation

it models, and in terms of its graph or a table of values.

8.F.B.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Reason quantitatively and use units to solve problems.

N-Q.A.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.A.2 [14] Define appropriate quantities for the purpose of descriptive modeling.

N-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

[14] *This standard will be assessed in Algebra I by ensuring that some modeling tasks (involving Algebra I content or securely held content from Grades 6–8) require the student to create a quantity of interest in the situation being described.*

Interpret the structure of expressions.

A-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.★

a. Interpret parts of an expression, such as terms, factors, and coefficients.

b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret $P(1 + r)^n$ as the product of P and a factor not depending on P.

A-SSE.A.2 Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.

Create equations that describe numbers or relationships.

A-CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★

A-CED.A.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. ★

A-CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law $V = IR$ to highlight resistance R. ★

Understand solving equations as a process of reasoning and explain the reasoning.

A-REI.A.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.

Solve equations and inequalities in one variable.

A-REI.B.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Solve systems of equations.

A-REI.C.6 [15] Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

Represent and solve equations and inequalities graphically.

A-REI.D.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).

[15] *Tasks have a real-world context. In Algebra I, tasks have hallmarks of modeling as a mathematical practice (e.g., less-defined tasks, more of the modeling cycle, etc.).*

Differentiation/Accommodations/Modifications

Gifted and Talented

(content, process, product and learning environment)

Extension Activities

- Conduct research and provide presentation of various topics.
- Design surveys to generate and analyze data to be used in discussion.
- Debate topics of interest / cultural importance.
- Authentic listening and reading sources that provide data and support for speaking and writing prompts.
- Exploration of art and/or artists to understand society and history.
- Implement RAFT Activities as they pertain to the types / modes of communication (role, audience, format, topic).

Anchor Activities

- Use of Higher Level Questioning Techniques
- Provide assessments at a higher level of thinking

English Language Learners

Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice.
- Model skills/techniques that need to be mastered.
- Extended time to complete class work
- Visual dictionaries to help build vocabulary
- Provide copy of classnotes
- Pair with a peer for assistance during class

Modifications for Homework/Assignments

- Modified Assignments
- Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary)
- Extended time for assignment completion as needed
- Highlight key vocabulary

- Use graphic organizers

Students with Disabilities

(**appropriate accommodations, instructional adaptations, and/or modifications as determined by the IEP or 504 team**)

Modifications for Classroom
- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice
- Model skills / techniques to be mastered.
- Extended time to complete class work
- Provide copy of classnotes
- Preferential seating to be mutually determined by the student and teacher
- Student may request to use a computer to complete assignments.
- Establish expectations for correct spelling on assignments.
- Extra textbooks for home.
- Student may request books on tape / CD / digital media, as available and appropriate.
- Assign a peer helper in the class setting
- Provide oral reminders and check student work during independent work time
- Assist student with long and short term planning of assignments
- Encourage student to proofread assignments and tests
- Provide regular parent/ school communication
- Teachers will check/sign student agenda daily
- Student requires use of other assistive technology device

Modifications for Homework and Assignments
- Extended time to complete assignments.
- Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases.
- Provide the student with clearly stated (written) expectations and grading criteria for assignments.
- Implement RAFT activities as they pertain to the types / modes of communication (role, audience, format, topic).

Modifications for Assessments
- Extended time on classroom tests and quizzes.
- Student may take/complete tests in an alternate setting as needed.
- Restate, reread, and clarify directions/questions
- Distribute study guide for classroom tests.
- Establish procedures for accommodations / modifications for assessments.

Students at Risk of School Failure

Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice
- Model skills / techniques to be mastered.
- Extended time to complete class work
- Provide copy of classnotes
- Preferential seating to be mutually determined by the student and teacher
- Student may request to use a computer to complete assignments.
- Establish expectations for correct spelling on assignments.
- Extra textbooks for home.
- Student may request books on tape / CD / digital media, as available and appropriate.
- Assign a peer helper in the class setting
- Provide oral reminders and check student work during independent work time
- Assist student with long and short term planning of assignments
- Encourage student to proofread assignments and tests
- Provide regular parent/ school communication
- Teachers will check/sign student agenda daily
- Student requires use of other assistive technology device

Modifications for Homework and Assignments

- Extended time to complete assignments.
- Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases.
- Provide the student with clearly stated (written) expectations and grading criteria for assignments.
- Implement RAFT activities as they pertain to the types / modes of communication (role, audience, format, topic).

Modifications for Assessments

- Extended time on classroom tests and quizzes.
- Student may take/complete tests in an alternate setting as needed.
- Restate, reread, and clarify directions/questions
- Distribute study guide for classroom tests.
- Establish procedures for accommodations / modifications for assessments.

Green Township School District Algebra 1 Curriculum - Revised 2017

Unit 4: Polynomial & Quadratic Expressions, Equations, & Functions **(Approximate Instructional Time: 6 weeks)**		
NJ Student Learning Standards	**Suggested Standards for Mathematical Practice**	**Critical Knowledge & Skills** ***(Learning goals are for the Unit but may not necessarily be in sequential order.)***
● A.SSE.A.1. Interpret expressions that represent a quantity in terms of its context. A.SSE.A.1a. Interpret parts of an expression, such as terms, factors, and coefficients.	MP.1 Make sense of problems and persevere in solving them. MP 2 Reason abstractly and quantitatively.	Concept(s): Understand the structure of quadratic equations Students are able to: ● identify different parts of a quadratic expression, including terms, factors and constants. ● explain the meaning of parts of an expression in context. **Learning Goal 1:** Interpret terms, factors, coefficients, and other parts of quadratic expressions in terms of a context .
● A.APR.A.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.SSE.A.2. Use the structure of an , expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.* ● N.RN.B.3. 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. *Connect standards here to physical situations, e.g., finding the perimeter of a square of area 2.*	MP.2 Reason abstractly and quantitatively. MP.7 Look for and make use of structure.	Concept(s): Factoring Students are able to: ● use the distributive property to multiply a monomial by a polynomial and understand that factoring reverses the multiplication process. ● use polynomial expressions as side lengths of polygons and find area by multiplying. ● recognize patterns and formulate shortcuts for writing the expanded form of binomials whose expanded form is a perfect square or the difference of perfect squares. ● explore squaring a binomial, factoring the difference of squares, and finding the product of a sum and difference of the same two terms. **Learning Goal 2:** Add, subtract, and multiply polynomials, relating these to arithmetic operations with integers. Factor to produce equivalent forms of quadratic expressions in one variable.

Green Township School District Algebra 1 Curriculum - Revised 2017

● A.REI.B.4. Solve quadratic equations in one variable. A.REI.B.4a. 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. A.REI.B.4b. 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 and write them as $a \pm bi$ for real numbers a and b.	MP.1 Make sense of problems and persevere in solving them. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.7 Look for and make use of structure.	Concept(s): Factoring ● *Multiple methods for solving quadratic equations.* ● *Transforming a quadratic equation into the form $(x - p)^2 = q$ yields an equation having the same solutions.* Students are able to: ● use the method of completing the square to transform a quadratic equation in x into an equation of the form $(x - p)^2 = q$. ● derive the quadratic formula from $(x - p)^2 = q$. ● solve a quadratic equations in one variable by inspection. ● solve quadratic equations in one variable by taking square roots. ● solve a quadratic equations in one variable by completing the square. ● solve a quadratic equations in one variable using the quadratic formula. ● solve a quadratic equations in one variable by factoring. ● strategically select, as appropriate to the initial form of the equation, a method for solving a quadratic equation in one variable. ● write complex solutions of the quadratic formula in $a \pm bi$ form. ● analyze the quadratic formula, recognizing the conditions leading to complex solutions (discriminant). **Learning Goal 3:** Derive the quadratic formula by completing the square and recognize when there are no real solutions. **Learning Goal 4:** Solve quadratic equations in one variable using a variety of methods (including inspection, taking square roots, factoring, completing the square, and the quadratic formula) and write complex solutions in $a \pm bi$ form.
● A.SSE.B.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. A.SSE.B.3a. Factor a quadratic expression to reveal the zeros of the function it defines. A.SSE.B.3b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.7 Look for and make use of structure.	Concept(s): Rearrange expressions to highlight parts properties ● *Alternate, equivalent forms of a quadratic expression may reveal specific attributes of the function that it defines.* Students are able to: ● factor a quadratic expression for the purpose of revealing the zeros of a function. ● complete the square for the purpose of revealing the maximum or minimum of a function.

function it defines. ● A.CED.A.4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R.		**Learning Goal 5:** Use factoring and completing the square to produce equivalent forms of quadratic expressions in one variable that highlight particular properties such as the zeros or the maximum or minimum value of the function.
● F.IF.C.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. F.IF.C.8a. 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. ● N.RN.B.3. 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.		Concept(s): Factoring and completing the square Students are able to: ● rewrite quadratic expressions given in the standard form, $ax^2 + bx + c$, in the equivalent completed-square form, $a(x-h)^2 + k$, and recognize cases for which factored or completed-square form is most efficient to use. ● build quadratic expressions in basic business application contexts and rewrite them in equivalent forms. ● solve complex quadratic equations, including those with a leading coefficient other than 1, by completing the square. *(Some solutions may be irrational.)* ● draw conclusions about the properties of irrational numbers, including closure for the irrational number system under various operations. ● derive the quadratic formula by completing the square for a general quadratic equation in standard form and use it to verify the solutions for equations. ● use the quadratic formula to solve quadratic equations that cannot be easily factored. ● understand the discriminant, b^2-4ac, can be used to determine whether a quadratic equation has one, two or no real solutions. **Learning Goal:** ***Reinforces learning goals 3, 4, & 5.***
● F.IF.B.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior;*	MP.4 Model with mathematics. MP.6 Attend to precision.	Concept(s): Analyzing and interpreting features of quadratic graphs and functions. Students are able to: ● examine quadratic equations in two variables represented graphically on a coordinate plane and recognize the symmetry of the graph. ● explore key features of graphs of quadratic functions: y-intercepts, x-intercepts, the vertex, the axis of symmetry, increasing and decreasing intervals, negative and positive intervals, and end behavior. ● sketch graphs of quadratic functions as a symmetric curve with a highest or lowest point

and periodicity. ● F.IF.B.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function*		corresponding to its vertex and an axis of symmetry passing through the vertex. **Learning Goal 6:** Interpret key features of quadratic functions from graphs and tables. Given a verbal description of the relationship, sketch the graph of a quadratic function, showing key features and relating the domain of the function to its graph.
● A.APR.B.3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. *[Algebra 1: limit to quadratic and cubic functions in which linear and quadratic factors are available]	MP.7 Look for and make use of structure.	Concept(s): Zero Product Property Students are able to: ● find the zeros of a polynomial (quadratic and cubic). ● test domain intervals to determine where f(x) is greater than or less than zero. ● use zeros of a function to sketch a graph. **Learning Goal 7:** Identify zeros of cubic functions when suitable factorizations are available and use the zeros to construct a rough graph of the function. (*cubic functions are presented as the product of a linear and a quadratic factor)
● F.IF.C.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. F.IF.C.7a. Graph linear and quadratic functions and show intercepts, maxima, and minima. *[emphasize quadratic functions] ● F.IF.B.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*	MP.1 Make sense of problems and persevere in solving them. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.8 Look for and express regularity in repeated reasoning.	Concept(s): Graphing quadratic functions Students are able to: ● identify, describe and interpret key features of quadratic functions. graphs and tables: zeros (x-intercepts), y-intercept, the minimum or maximum value (vertex), the graph's axis of symmetry, positive and negative values for the function, increasing and decreasing intervals, and the graph's end behavior. ● graph quadratic functions expressed symbolically. ● graph more complicated cases of quadratic functions using technology. ● given two quadratic functions, each represented in a different way, compare the properties of the functions. ● graph simple quadratic equations form completed-square form/vertex form, recognizing that (h,k) represents the vertex of the graph and use a graph to construct a quadratic equation in vertex form.

is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. *[Focus on exponential functions] ● F.IF.B.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function*		● understand the relationship between the leading coefficient of a quadratic function and its concavity and slope and recognize that an infinite number of quadratic functions share the same vertex. ● graph a variety of quadratic functions using standard form. **Learning Goal 8:** Graph quadratic functions by hand in simple cases and with technology in complex cases, showing intercepts, extreme values and symmetry of the graph.
● F.IF.A.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.A.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	MP 2 Reason abstractly and quantitatively. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): Function notation, domain and range. ● *F(x) is an element in the range and x is an element in the domain*. Students are able to: ● compare the basic quadratic (parent) function, $y = x^2$, to the square root function and do the same with cubic and cube root functions. ● sketch the graphs of square root and cube root functions, taking into consideration any constraints on the domain and range. **Learning Goal 9:** Compare parent functions and interpret the domain and range.
● F.BF.B.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	MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.7 Look for and make use of	Concept(s): Graphing transformations and understanding the structure of equations that create the translation. Students are able to: ● recognize and use parent functions for linear, absolute value, quadratic, square root, and cube root functions to perform vertical and horizontal translations. ● identify how the graph of y=f(x) relates to the graphs of y=f(x) + k and y = f(x+k) for any specific values of k, positive or negative, and find the constant value, k, given the graphs of the parent functions and the translated graphs.

them.	structure.	• recognize and use parent functions for absolute value, quadratic, square root, and cube root functions to perform transformations that stretch and shrink the graphs of the functions. • identify the effect on the graph of y=f(x) when f(x) is replaced with kf(x) and f(kx), for any specified value of k, positive or negative, and identifying the constant value, k, given the graphs of the parent functions and the transformed functions. • write formulas for the transformed functions given their graphs. **Learning Goal 10:** Identify the effects of transformations and combinations of transformations [$f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$] on a function; find the value of k given the graph.
• F.IF.C.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*		Concept: Comparing two functions Students are able to: • compare two different quadratic, square root, or cube root functions represented as graphs, tables or equations. • interpret, contextualize, and abstract various scenarios to complete the comparative analysis. **Learning Goal 11:** Compare properties of two functions, each represented in a different way.
• A.CED.A.1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear functions and quadratic functions, and simple rational and exponential functions. • A.CED.A.2. Create equations in two or more variables to represent relationships between quantities; Graph equations on coordinate axes with labels and scales.	MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.7 Look for and make use of structure.	Concept(s): Modeling with quadratics Students are able to: • create quadratic equations in one variable. • use quadratic equations to solve real world problems. **Learning Goal 12:** Create quadratic equations in one variable and use them to solve problems.
Interdisciplinary Connections: **NGSS Appendix for Alignment**	***Science:*** **MS-PS1 As part of this work, teachers should give students opportunities to work with ratios and proportional relationships, use signed numbers, write and solve equations, and use order of magnitude thinking and basic statistics:** *The Number System (6–8.NS). Science examples: Use positive and negative quantities to represent temperature changes in a chemical reaction (signs of energy released or absorbed).*	

	Statistics and Probability (6–8.SP). Science example: Compile all the boiling point measurements from the class into a line plot and discuss the distribution in terms of clustering and outliers. Why weren't all the measured values equal? How close is the average value to the nominal/textbook value? Show the average value and the nominal value on the line plot. **MS-PS2 As part of this work, teachers should give students opportunities to work with signed numbers and interpret expressions:** *The Number System (6–8.NS). Science examples: (1) Represent a third-law pair of forces as a 100 N force on one object and a −100N force on the other object. (2) Represent balanced forces on a single object as equal and opposite numbers 5 N. (3) Represent the net result of two or more forces as a sum of signed numbers. For example, given a large force and an oppositely directed small force, represent the net force as (100 N) + (−5 N) = 95 N. Relate the number sentence to the fact that the net effect on the motion is approximately what it would have been with only the large force* *Expressions and Equations (6–8.EE). Science example: Interpret an expression in terms of a physical context, e.g., interpret the expression F1 + F2 in a diagram as representing the net force on an object.* **MS-LS1 As part of this work, teachers should give students opportunities to use order of magnitude thinking, write and solve equations & analyze data:** *Expressions and Equations (6–8.EE). Science examples: (1) Quantify the sizes of cells and parts of cells, using convenient units such as microns.(2) Appreciate the orders of magnitude that span the difference in size between cells, molecules, and atoms. (3) Write a number sentence that expresses the conservation of mass as food moves through an organism. Assign values to the arrows in a diagram to show flows quantitatively. (4) Infer an unknown mass by using the concept of conservation to write and solve an equation with a variable.* **MS-LS2 As part of this work, teachers should give students opportunities to work with ratios and proportional relationships, write and solve equations, and use basic statistics:** *Expressions and Equations (6–8.EE). Science examples: (1) Write a number sentence that expresses the conservation of total matter or energy in a system as matter or energy flows into, out of, and within it. Assign values to the arrows in a diagram to show flows quantitatively. (2) Infer an unknown matter or energy flow in a system by using the concept of conservation to write and solve an equation with a variable.* **MS-ESS2 As part of this work, teachers should give students opportunities to work with positive and negative numbers, and use order of magnitude thinking:** *The Number System (6–8.NS). Science examples: (1) Use positive and negative quantities to quantify changes in physical quantities such as atmospheric pressure and temperature; for example, if the temperature dropped from 24oC to 11oC, then the temperature change was −13oC. (2) Solve word problems relating to changes in signed physical quantities. For example, a shift in the jet stream caused a 10oC temperature increase in a single day; if the temperature before was −32oC, what was the temperature after?* ***English-Language Arts:*** **RI.8.4**. Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts. **RI.8.5**. Analyze the structure an author uses to organize a specific paragraph in a text, including the role of particular sentences, to develop and to refine a key concept. **RI.8.6.** Determine an author's point of view or purpose in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints. **RI.8.7.** Evaluate the advantages and disadvantages of using different mediums (e.g., print or digital text, video, multimedia) to present a particular topic or idea. **W.8.2.** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection,

	organization, and analysis of relevant content. A. Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia). B. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples. C. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts. D. Use precise language and domain-specific vocabulary to inform about or explain the topic. E. Establish and maintain a formal style/academic style, approach, and form. F. Provide a concluding statement or section that follows from and supports the information or explanation presented. **W.8.4**. Produce clear and coherent writing in which the development, organization, voice and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.) **W.8.5.** With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed. **W.8.6.** Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others. **W.8.7**. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. **SL.8.1.** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. A. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion. B. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed. C. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas. D. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented. **SL.8.2**. Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate the motives (e.g., social, commercial, political) behind its presentation. **SL.8.3**. Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced. **SL.8.5**. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
21st Century Skills/ Career Ready Practices:	**CRP1. Act as a responsible and contributing citizen and employee.** **CRP2. Apply appropriate academic and technical skills.** **CRP3. Attend to personal health and financial well-being.** **CRP4. Communicate clearly and effectively and with reason.** **CRP5. Consider the environmental, social and economic impacts of decisions.** **CRP6. Demonstrate creativity and innovation.** **CRP7. Employ valid and reliable research strategies.** **CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.**

	CRP9. Model integrity, ethical leadership and effective management. **CRP10. Plan education and career paths aligned to personal goals.** **CRP11. Use technology to enhance productivity.** **CRP12. Work productively in teams while using cultural global competence.**
2014 NJ Technology Standards:	**8.1 Educational Technology** (Word | PDF) All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge. **8.2 Technology Education, Engineering, Design and Computational Thinking - Programming** (Word | PDF) All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment. Please see relevant projects for technology standards 8.1 and 8.2:

District/School Primary and Supplementary Resources	
Primary Resource: **Eureka Math (Unbound Ed - Module 4)**	**Supplementary Resources:** *Algebra I Common Core* (Pearson 2012) *Understanding Algebra I* (The Critical Thinking Company) **Khan Academy** eMath Instruction Supplemental Material for Transformations of Functions **Performance Tasks are available for use from the following sites:** Illustrative Mathematics Coherence Map Inside Mathematics Problems of the Month Algebra YouCubed Tasks PARCC Released test items
Tools & Materials	**Suggested Tasks for Use During Unit**
❑ *Coordinate Plane*	A.REI.A.1 Zero Product Property 1

❑ *Equations and Inequalities* ❑ *Graphing Calculator* ❑ *Graphing paper*	A.APR.A.1 Powers of 11 A.SSE.A.2 Equivalent Expressions A.REI.B.4 Visualizing Completing the Square A.REI.B.4 Braking Distance A.REI.B.4 Two Squares are Equal F.IF.B.4 Words – Tables - Graphs F.IF.B.5 The restaurant A.SSE.B.3 Profit of a company A.SSE.B.3 Rewriting a Quadratic Expression F.IF.C.7a Graphs of Quadratic Functions F.IF.C.8a Springboard Dive F.IF.C.8a Which Function? F.IF.B.9 Throwing Baseballs F.IF.B.6 Mathemafish Population F.LE.A.3 Population and Food Supply F.BF.B.3 Identifying Even and Odd Functions F.BF.B.3 Transforming the graph of a function A.REI.D.11 Introduction to Polynomials – College Fund A.APR.B.3 Graphing from Factors 1 N.RN.B.3 Operations with Rational and Irrational Numbers
District/School Formative Assessment Plan	**District/School Summative Assessment Plan**
• Teacher observation of students engaged in group and independent activities. • Individual and small group conferences/interviews to assess understanding with rubric • Self-assessment by students with guidance from teacher. • Eureka Math Sprints • Exit tickets	• Teacher created assessments and projects • ***Eureka Math*** Mid- and End- Module Assessments (Constructed response item with rubric) • Teacher/District created Quarterly Assessments
Instructional Best Practices and Exemplars	**Mathematical Terms/Vocabulary**
Facilitate partner and group collaborations *Inquiry based tasks introduced before direct teaching* *Small and large group discussions* *Have students use a variety of representations or methods to show and explain their understanding.*	• **Axis of symmetry of the graph of a quadratic function** (Given a quadratic function in standard form, $f(x) = ax\ 2 + bx + c$, the vertical line given by the graph of the equation, $x = -\ b\ 2a$, is called the axis of symmetry of the graph of the quadratic function.) • **Cube root function** (The parent function $f(x) = \sqrt{x}\ 3$.) Cubic function (A polynomial

Build fluency over time.	function of degree 3.) • **Degree of a monomial term** (The degree of a monomial term is the sum of the exponents of the variables that appear in a term of a polynomial.) • **Degree of a polynomial** (The degree of a polynomial in one variable in standard form is the highest degree of the terms in the polynomial.) • **Discriminant** (The discriminant of a quadratic function in the form $ax\,2 + bx + c = 0$ is $b^2 - 4ac$. The nature of the roots of a quadratic equation can be identified by determining if the discriminant is positive, negative, or equal to zero.) • **End behavior of a quadratic function** (Given a quadratic function in the form $f(x) = ax^2 + bx + c$ (or $f(x) = a(x - ħ)^2 + k$), the quadratic function is said to open up if $a > 0$ and open down if $a < 0$.) • **Factored form for a quadratic function** (A quadratic function written in the form $f(x) = a(x - n)(x - m)$.) • **Leading coefficient** (The leading coefficient of a polynomial is the coefficient of the term of highest degree.) • **Parent function** (A parent function is the simplest function in a "family" of functions that can each be formed by one or more transformations of another.) • **Quadratic formula** (The quadratic formula is the formula that emerges from solving the general form of a quadratic equation by completing the square, $y = (-b \pm \sqrt{b}\,2 - 4ac)/2a$. It can be used to solve any quadratic equation.) • **Quadratic function** (A polynomial function of degree 2.) • **Roots of a polynomial function** (The domain values for a polynomial function that make the value of the polynomial function equal zero when substituted for the variable.) $a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0$, where n is a non-negative integer, and a_0, a_1, a_2, …, an are constant coefficients with $a_n \neq 0$.) • **Square root function** (The parent function $f(x) = \sqrt{x}$.) • **Standard form for a quadratic function** (A quadratic function written in the form $f(x) = ax^2 + bx + c$.) • **Standard form of a polynomial in one variable** (A polynomial expression with one variable symbol x is in standard form if it is expressed as, Vertex form (Completed-square form for a quadratic function; in other words, written in the form $f(x) = a(x - ħ)^2 + k$.) • **Vertex of the graph of a quadratic function** (The point where the graph of a quadratic function and its axis of symmetry intersect is called the vertex. The vertex is either a maximum or a minimum of the quadratic function, depending on whether the

	leading coefficient of the function in standard form is negative or positive, respectively.)

Focus Mathematical Concepts

Grade Level Fluency Requirement:

The PARCC Model Content Frameworks recommend the following fluencies for Algebra I students:

- ***A/G*** *Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).*
- ***A-APR.A.1*** *Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.*
- ***A-SSE.A.1b*** *Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations*

Prerequisite skills

Refer to Achieve the Core Coherence Map for full detail on vertical and horizontal alignment to prerequisite skills & future skills.

Coherence Map

Know that there are numbers that are not rational, and approximate them by rational numbers.

8.NS.A.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.

Work with radicals and integer exponents.

8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, 3 2 × 3 −5 = 3 −3 = 1/3 3 = 1/27.

Reason quantitatively and use units to solve problems.

N-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.★ *Note: This standard will be assessed in Algebra I by ensuring that some modeling tasks (involving Algebra I content or securely held content from Grades 6–8) require the student to create a quantity of interest in the situation being described.*

N-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.★ Create equations that describe numbers or relationships.

A-CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law $V = IR$ to highlight resistance R. ★

Understand solving equations as a process of reasoning and explain the reasoning.

A-REI.A.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. Solve equations and inequalities in one variable.

A-REI.B.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. Represent and solve equations and inequalities

graphically.
A-REI.D.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).
Understand the concept of a function and use function notation.
F-IF.A.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.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

Differentiation/Accommodations/Modifications

Gifted and Talented

(content, process, product and learning environment)

Extension Activities
- Conduct research and provide presentation of various topics.
- Design surveys to generate and analyze data to be used in discussion.
- Debate topics of interest / cultural importance.
- Authentic listening and reading sources that provide data and support for speaking and writing prompts.
- Exploration of art and/or artists to understand society and history.
- Implement RAFT Activities as they pertain to the types / modes of communication (role, audience, format, topic).

Anchor Activities
- Use of Higher Level Questioning Techniques
- Provide assessments at a higher level of thinking

English Language Learners

Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice.
- Model skills/techniques that need to be mastered.
- Extended time to complete class work
- Visual dictionaries to help build vocabulary
- Provide copy of classnotes

- Pair with a peer for assistance during class

Modifications for Homework/Assignments

- Modified Assignments
- Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary)
- Extended time for assignment completion as needed
- Highlight key vocabulary
- Use graphic organizers

Students with Disabilities

(**appropriate accommodations, instructional adaptations, and/or modifications as determined by the IEP or 504 team**)

Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice
- Model skills / techniques to be mastered.
- Extended time to complete class work
- Provide copy of classnotes
- Preferential seating to be mutually determined by the student and teacher
- Student may request to use a computer to complete assignments.
- Establish expectations for correct spelling on assignments.
- Extra textbooks for home.
- Student may request books on tape / CD / digital media, as available and appropriate.
- Assign a peer helper in the class setting
- Provide oral reminders and check student work during independent work time
- Assist student with long and short term planning of assignments
- Encourage student to proofread assignments and tests
- Provide regular parent/ school communication
- Teachers will check/sign student agenda daily
- Student requires use of other assistive technology device

Modifications for Homework and Assignments

- Extended time to complete assignments.
- Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases.
- Provide the student with clearly stated (written) expectations and grading criteria for assignments.

- Implement RAFT activities as they pertain to the types / modes of communication (role, audience, format, topic).

Modifications for Assessments
- Extended time on classroom tests and quizzes.
- Student may take/complete tests in an alternate setting as needed.
- Restate, reread, and clarify directions/questions
- Distribute study guide for classroom tests.
- Establish procedures for accommodations / modifications for assessments.

Students at Risk of School Failure

Modifications for Classroom
- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice
- Model skills / techniques to be mastered.
- Extended time to complete class work
- Provide copy of classnotes
- Preferential seating to be mutually determined by the student and teacher
- Student may request to use a computer to complete assignments.
- Establish expectations for correct spelling on assignments.
- Extra textbooks for home.
- Student may request books on tape / CD / digital media, as available and appropriate.
- Assign a peer helper in the class setting
- Provide oral reminders and check student work during independent work time
- Assist student with long and short term planning of assignments
- Encourage student to proofread assignments and tests
- Provide regular parent/ school communication
- Teachers will check/sign student agenda daily
- Student requires use of other assistive technology device

Modifications for Homework and Assignments
- Extended time to complete assignments.
- Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases.
- Provide the student with clearly stated (written) expectations and grading criteria for assignments.
- Implement RAFT activities as they pertain to the types / modes of communication (role, audience, format, topic).

Modifications for Assessments

- Extended time on classroom tests and quizzes.
- Student may take/complete tests in an alternate setting as needed.
- Restate, reread, and clarify directions/questions
- Distribute study guide for classroom tests.
- Establish procedures for accommodations / modifications for assessments.

Green Township School District Algebra 1 Curriculum - Revised 2017

Unit 5: A Synthesis of Modeling with Equations and Functions **(Approximate Instructional Time: 4 weeks)**		
NJ Student Learning Standards	**Suggested Standards for Mathematical Practice**	**Critical Knowledge & Skills** ***(Learning goals are for the Unit but may not necessarily be in sequential order.)***
Unit 5 is a synthesis of the other four units. The NJSLS described are the major standards that are reinforced through the modeling tasks in this unit. Therefore, the Critical Knowledge and Skills section is comprised of the synthesized objectives for the unit, rather than broken down by standards. No new concepts are introduced in this unit. The objectives are designed to reinforce the learning from all four previous units and to focus on the mathematical practice of modeling with mathematics.		
● N.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. ● N.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ● A.CED.A.1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear functions and quadratic functions, and simple rational and exponential functions. ● A.CED.A.2. Create equations in two or more variables to represent relationships between quantities; Graph equations on coordinate axes with labels and scales. ● F.IF.B.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*	MP. 1 Make sense of problems and persevere in solving them MP. 2 Reason abstractly and quantitatively. MP. 4 Model with mathematics. MP. 5 Use appropriate tools strategically. MP. 6. Attend to precision	Students will be able to ● use a graphic representation to identify a function type, interpret key features of a graph and create an equation or table to use as a model of the context for functions addressed in previous units (i.e., linear, exponential, quadratic, cubic, square root, cube root, absolute value, and other piecewise functions. ● recognize linear, quadratic, and exponential functions when presented as a data set or sequence and formulate a model based on the data. ● make sense of a contextual situation that can be modeled with a linear, quadratic, or exponential function when presented as a word problem. ● analyze a verbal description and create a model using an equation, graph or table. ● create a two-variable equation that models a graph from a context, e.g. function types to include linear, quadratic, exponential, square root, cube root, and absolute value. ● interpret the graph, function, and answer questions related to the model, choosing an appropriate level of precision for reporting results and solutions. ● recognize when a table of values represents an arithmetic or geometric sequence ● choose and define the parameter values for a function that represents a sequence. ● write equations to model data from tables, which can be represented with linear, quadratic or exponential functions. ● interpret the function in terms of the context in which it is presented, make predictions based on the model, and use an appropriate level of precision for reporting results and solutions. ● use linear, quadratic and exponential functions to model data from tables and choose the

minimums; symmetries; end behavior; and periodicity. ● F.IF.B.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function* ● F.IF.B.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. ● F.BF.A.1. Write a function that describes a relationship between two quantities. F.BF.A.1a: Determine an explicit expression, a recursive process, or steps for calculation from a context. ● F.LE.A.1. Distinguish between situations that can be modeled with linear functions and with exponential functions. ● F.LE.A.1b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. ● F.LE.A.1c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. ● F.LE.A.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).		regression most appropriate to a given context. ● use the correlation coefficient to determine the accuracy of a regression model and then interpret the function in context. ● make predictions based on the regression model. ● model functions described verbally in a given context using graphs, tables or algebraic representations ● interpret a function and its graph and use them to answer questions related to the model, including calculating the rate of change over an interval, and always using an appropriate level of precision when reporting results. ● use graphs to interpret the function represented by an equation in terms of the context and answer questions.

*[Algebra 1 limitation: exponential expressions with integer exponents]		
Interdisciplinary Connections: **NGSS Appendix for Alignment**	***Science:*** **MS-PS1 As part of this work, teachers should give students opportunities to work with ratios and proportional relationships, use signed numbers, write and solve equations, and use order of magnitude thinking and basic statistics:** *The Number System (6–8.NS). Science examples: Use positive and negative quantities to represent temperature changes in a chemical reaction (signs of energy released or absorbed).* *Statistics and Probability (6–8.SP). Science example: Compile all the boiling point measurements from the class into a line plot and discuss the distribution in terms of clustering and outliers. Why weren't all the measured values equal? How close is the average value to the nominal/textbook value? Show the average value and the nominal value on the line plot.* **MS-PS2 As part of this work, teachers should give students opportunities to work with signed numbers and interpret expressions:** *The Number System (6–8.NS). Science examples: (1) Represent a third-law pair of forces as a 100 N force on one object and a −100N force on the other object. (2) Represent balanced forces on a single object as equal and opposite numbers 5 N. (3) Represent the net result of two or more forces as a sum of signed numbers. For example, given a large force and an oppositely directed small force, represent the net force as (100 N) + (−5 N) = 95 N. Relate the number sentence to the fact that the net effect on the motion is approximately what it would have been with only the large force* *Expressions and Equations (6–8.EE). Science example: Interpret an expression in terms of a physical context, e.g., interpret the expression F1 + F2 in a diagram as representing the net force on an object.* **MS-LS1 As part of this work, teachers should give students opportunities to use order of magnitude thinking, write and solve equations & analyze data:** *Expressions and Equations (6–8.EE). Science examples: (1) Quantify the sizes of cells and parts of cells, using convenient units such as microns.(2) Appreciate the orders of magnitude that span the difference in size between cells, molecules, and atoms. (3) Write a number sentence that expresses the conservation of mass as food moves through an organism. Assign values to the arrows in a diagram to show flows quantitatively. (4) Infer an unknown mass by using the concept of conservation to write and solve an equation with a variable.* **MS-LS2 As part of this work, teachers should give students opportunities to work with ratios and proportional relationships, write and solve equations, and use basic statistics:** *Expressions and Equations (6–8.EE). Science examples: (1) Write a number sentence that expresses the conservation of total matter or energy in a system as matter or energy flows into, out of, and within it. Assign values to the arrows in a diagram to show flows quantitatively. (2) Infer an unknown matter or energy flow in a system by using the concept of conservation to write and solve an equation with a variable.* **MS-ESS2 As part of this work, teachers should give students opportunities to work with positive and negative numbers, and use order of magnitude thinking:** *The Number System (6–8.NS). Science examples: (1) Use positive and negative quantities to quantify changes in physical quantities such as atmospheric pressure and temperature; for example, if the temperature dropped from 24oC to 11oC, then the temperature change was −13oC. (2) Solve word problems relating to changes in signed physical quantities. For example, a shift in the jet stream caused a 10oC temperature increase in a single day; if the temperature before was −32oC, what was the temperature after?* ***English-Language Arts:*** **RI.8.4**. Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts. **RI.8.5**. Analyze the structure an author uses to organize a specific paragraph in a text, including the role of particular sentences, to

	develop and to refine a key concept. **RI.8.6.** Determine an author's point of view or purpose in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints. **RI.8.7.** Evaluate the advantages and disadvantages of using different mediums (e.g., print or digital text, video, multimedia) to present a particular topic or idea. **W.8.2.** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. A. Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia). B. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples. C. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts. D. Use precise language and domain-specific vocabulary to inform about or explain the topic. E. Establish and maintain a formal style/academic style, approach, and form. F. Provide a concluding statement or section that follows from and supports the information or explanation presented. **W.8.4**. Produce clear and coherent writing in which the development, organization, voice and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.) **W.8.5.** With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed. **W.8.6.** Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others. **W.8.7**. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. **SL.8.1.** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. A. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion. B. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed. C. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas. D. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented. **SL.8.2**. Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate the motives (e.g., social, commercial, political) behind its presentation. **SL.8.3**. Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced. **SL.8.5**. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

21st Century Skills/ Career Ready Practices:	**CRP1. Act as a responsible and contributing citizen and employee.** **CRP2. Apply appropriate academic and technical skills.** **CRP3. Attend to personal health and financial well-being.** **CRP4. Communicate clearly and effectively and with reason.** **CRP5. Consider the environmental, social and economic impacts of decisions.** **CRP6. Demonstrate creativity and innovation.** **CRP7. Employ valid and reliable research strategies.** **CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.** **CRP9. Model integrity, ethical leadership and effective management.** **CRP10. Plan education and career paths aligned to personal goals.** **CRP11. Use technology to enhance productivity.** **CRP12. Work productively in teams while using cultural global competence.**
2014 NJ Technology Standards:	**8.1 Educational Technology** (Word | PDF) All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge. **8.2 Technology Education, Engineering, Design and Computational Thinking - Programming** (Word | PDF) All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment. Please see relevant projects for technology standards 8.1 and 8.2:

District/School Primary and Supplementary Resources	
Primary Resource: **Eureka Math (Unbound Ed - Module 5)**	**Supplementary Resources:** *Algebra I Common Core* (Pearson 2012) *Understanding Algebra I* (The Critical Thinking Company) **Khan Academy** eMath Instruction Supplemental Material for Transformations of Functions **Performance Tasks are available for use from the following sites:** Illustrative Mathematics Coherence Map Inside Mathematics Problems of the Month

	Algebra YouCubed Tasks PARCC Released test items
Tools & Materials	**Suggested Tasks for Use During Unit**
❑ *Scientific Calculator* ❑ *Graphing Calculator* ❑ *Geometer's Sketch Pad* ❑ *GeoGebra*	Teachers should revisit suggested tasks from previous units and/or identify other tasks from sites like Illustrative Mathematics to identify modeling tasks and other tasks that synthesize two or more standards.
District/School Formative Assessment Plan	**District/School Summative Assessment Plan**
• Teacher observation of students engaged in group and independent activities. • Individual and small group conferences/interviews to assess understanding with rubric • Self-assessment by students with guidance from teacher. • Eureka Math Sprints • Exit tickets	• Teacher created assessments and projects • ***Eureka Math*** Mid- and End- Module Assessments (Constructed response item with rubric) • Teacher/District created Quarterly Assessments
Instructional Best Practices and Exemplars	**Mathematical Terms/Vocabulary**
Facilitate partner and group collaborations *Inquiry based tasks introduced before direct teaching* *Small and large group discussions* *Have students use a variety of representations or methods to show and explain their understanding.* *Build fluency over time.*	• **Analytic Model** (A model that seeks to explain data based on deeper theoretical ideas. For example, by using an algebraic equation. This is sometimes referred to as a symbolic model.) • **Descriptive Model** (A model that seeks to describe phenomena or summarize them in a compact form. For example, by using a graph.)
Focus Mathematical Concepts	
Grade Level Fluency Requirement: *The PARCC Model Content Frameworks recommend the following fluencies for Algebra I students:* ❖ ***A/G*** *Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).* ❖ ***A-APR.A.1*** *Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.*	

- ***A-SSE.A.1b*** *Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations*

Prerequisite skills

Refer to Achieve the Core Coherence Map for full detail on vertical and horizontal alignment to prerequisite skills & future skills.

Coherence Map

Use functions to model relationships between quantities.

8.F.B.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. *Note: Tasks have a real-world context. In Algebra I, tasks are limited to linear, quadratic, square root, cube root, piecewise-defined (including step and absolute value functions), and exponential functions with domains in the integers.*

8.F.B.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Analyze functions using different representations.

F-IF.C.7 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 square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

F-IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

c. 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.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum. Interpret expressions for functions in terms of the situation they model. *Note: In Algebra I, tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.*

F-LE.B.5 Interpret the parameters in a linear or exponential function in terms of a context. *Note: Tasks have a real-world context. In Algebra I, exponential functions are limited to those with domains in the integers.*

Differentiation/Accommodations/Modifications
Gifted and Talented
(content, process, product and learning environment)

Extension Activities

- Conduct research and provide presentation of various topics.
- Design surveys to generate and analyze data to be used in discussion.
- Debate topics of interest / cultural importance.
- Authentic listening and reading sources that provide data and support for speaking and writing prompts.
- Exploration of art and/or artists to understand society and history.
- Implement RAFT Activities as they pertain to the types / modes of communication (role, audience, format, topic).

Anchor Activities

- Use of Higher Level Questioning Techniques
- Provide assessments at a higher level of thinking

English Language Learners

Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice.
- Model skills/techniques that need to be mastered.
- Extended time to complete class work
- Visual dictionaries to help build vocabulary
- Provide copy of classnotes
- Pair with a peer for assistance during class

Modifications for Homework/Assignments

- Modified Assignments
- Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary)
- Extended time for assignment completion as needed
- Highlight key vocabulary
- Use graphic organizers

Students with Disabilities

(**appropriate accommodations, instructional adaptations, and/or modifications as determined by the IEP or 504 team**)

Modifications for Classroom
- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice
- Model skills / techniques to be mastered.
- Extended time to complete class work
- Provide copy of classnotes
- Preferential seating to be mutually determined by the student and teacher
- Student may request to use a computer to complete assignments.
- Establish expectations for correct spelling on assignments.
- Extra textbooks for home.
- Student may request books on tape / CD / digital media, as available and appropriate.
- Assign a peer helper in the class setting
- Provide oral reminders and check student work during independent work time
- Assist student with long and short term planning of assignments
- Encourage student to proofread assignments and tests
- Provide regular parent/ school communication
- Teachers will check/sign student agenda daily
- Student requires use of other assistive technology device

Modifications for Homework and Assignments
- Extended time to complete assignments.
- Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases.
- Provide the student with clearly stated (written) expectations and grading criteria for assignments.
- Implement RAFT activities as they pertain to the types / modes of communication (role, audience, format, topic).

Modifications for Assessments
- Extended time on classroom tests and quizzes.
- Student may take/complete tests in an alternate setting as needed.
- Restate, reread, and clarify directions/questions
- Distribute study guide for classroom tests.
- Establish procedures for accommodations / modifications for assessments.

Students at Risk of School Failure

Modifications for Classroom
- Pair visual prompts with verbal presentations

- Ask students to restate information, directions, and assignments.
- Repetition and practice
- Model skills / techniques to be mastered.
- Extended time to complete class work
- Provide copy of classnotes
- Preferential seating to be mutually determined by the student and teacher
- Student may request to use a computer to complete assignments.
- Establish expectations for correct spelling on assignments.
- Extra textbooks for home.
- Student may request books on tape / CD / digital media, as available and appropriate.
- Assign a peer helper in the class setting
- Provide oral reminders and check student work during independent work time
- Assist student with long and short term planning of assignments
- Encourage student to proofread assignments and tests
- Provide regular parent/ school communication
- Teachers will check/sign student agenda daily
- Student requires use of other assistive technology device

Modifications for Homework and Assignments

- Extended time to complete assignments.
- Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases.
- Provide the student with clearly stated (written) expectations and grading criteria for assignments.
- Implement RAFT activities as they pertain to the types / modes of communication (role, audience, format, topic).

Modifications for Assessments

- Extended time on classroom tests and quizzes.
- Student may take/complete tests in an alternate setting as needed.
- Restate, reread, and clarify directions/questions
- Distribute study guide for classroom tests.
- Establish procedures for accommodations / modifications for assessments.