Fairview Public School

Grade	8
Unit	**UNIT ONE:** Seeing Structure in Expressions & Modeling with Linear Equations and Inequalities
Unit Duration	6-8 Weeks
Course	Mathematics: Algebra
Overview/Rationale	Students will reason quantitatively and use units to solve problems, solve linear equations and inequalities in one variable, understand solving equations as a process of reasoning and explain the reasoning, and create equations that describe numbers or relationships. They will also interpret the structure of expressions, represent and solve equations graphically, and summarize, represent, and interpret data on quantitative variables. These skills will be mastered through differentiated activities, cross-curricular lessons, multiple means of assessment and the enhancement of prior skills and knowledge.

DESIRED OUTCOMES

NJSL Standards Addressed

New Jersey Student Learning Standards
21st Century Life and Career Skills
(Additional standards should be applied, as needed, to enrich instruction and foster student achievement.

9.2.12.C.1	Review career goals and determine steps necessary for attainment.
9.2.12.C.3	Identify transferable career skills and design alternate career plans.
9.2.12.C.4	Analyze how economic conditions and societal changes influence employment trends and future education.
9.2.12.C.5	Research career opportunities in the United States and abroad that require knowledge of world languages and diverse cultures.
9.2.12.C.6	Investigate entrepreneurship opportunities as options for career planning and identify the knowledge, skills, abilities, and resources required for owning and managing a business.
9.2.12.C.7	Examine the professional, legal, and ethical responsibilities for both employers and employees in the global workplace.
9.2.12.C.9	Analyze the correlation between personal and financial behavior and

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	employability.
Indicator	***Career Ready Practices***
CRP 1	Act as a responsible and contributing citizen and employee.
CRP 2	Apply appropriate academic and technical skills.
CRP 3	Attend to personal health and financial well-being.
CRP 4	Communicate clearly and effectively and with reason.
CRP 5	Consider the environmental, social and economic impacts of decisions.
CRP 6	Demonstrate creativity and innovation.
CRP 7	Employ valid and reliable research strategies.
CRP 8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP 9	Model integrity, ethical leadership and effective management.
CRP 10	Plan education and career paths aligned to personal goals.
CRP 11	Use technology to enhance productivity.
CRP 12	Work productively in teams while using cultural global competence.

Mathematical Practices:
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Technology Standards Addressed

8.1.8.A.3-Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
8.1.12.C.1-Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.
8.1.12.D.1-Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.
8.1.12.D.2-Evaluate consequences of unauthorized electronic access (e.g., hacking) and disclosure, and on dissemination of personal information.

8.1.12.F.1-Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

8.2.12.B.4-Investigate a technology used in a given period of history, e.g., stone age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants.

8.2.12.D.6-Synthesize data, analyze trends and draw conclusions regarding the effect of a technology on the individual, society, or the environment and publish conclusions.

8.2.12.E.1-Demonstrate an understanding of the problem-solving capacity of computers in our world.

In this unit, the following 21st Century Themes & Skills are addressed:

	Check all Themes that apply		Indicate whether these skills are: E- Encouraged, T- Taught, or A-assessed In this unit by marking E, T, or A on the line before the appropriate skill.
T, E	*Global Awareness*	T,E, A	*Creativity and Innovation*
N/A	*Environmental Literacy*	T,E, A	*Critical Thinking*
N/A	*Health Literacy*	T,E, A	*Problem Solving*
N/A	*Civic Literacy*	T,E, A	*Communication*
T, E	*Financial, Economic, Business, and Entrepreneurial Literacy*	T,E, A	*Collaboration*

Interdisciplinary Connections

- Teacher made projects based learning activities connected to other subjects
- September 15th- October 15th: Research Hispanic/Latino/Latina Mathematicians of Today or Yesterday and write a One page summary of how they helped enhance the field of Mathematics

Key Terms	- Equations, Variable, Properties, Factors, Term, Coefficient - Linear equations, additive inverse, algebraic expression - Equivalent expressions, evaluate, integers, like terms - Order of operations, real numbers, simplify - Conversion factor, cross products, equivalent equations - Formula, inverse operations, literal equations, percent change - Proportion, rate, ratio, scale, unit analysis - Complement of a set, compound inequality, disjoint sets - Empty set, equivalent inequalities, intersection, interval notation - Roster form, set-builder notation, solution of an inequality - Union, universal set, absolute value, intersections of sets

Student Learning Objectives (SLO)

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	Student Learning Objectives ==Major Content== ==Supporting Content== ==Additional Content== (Identified by PARCC Model Content Frameworks)	
N.Q.A.1-3	Solve multi-step problems, using units to guide the solution, interpreting units consistently in formulas and choosing an appropriate level of accuracy on measurement quantities. Develop descriptive models by defining appropriate quantities.	
A.REI.B.3 A.REI.A.1 A.CED.A.4.	Solve linear equations and inequalities in one variable (including literal equations); justify each step in the process.	
A.SSE.A.1a	Interpret terms, factors, coefficients, and other parts of expressions in terms of a context.	
A.CED.A.1. A.REI.A.1.	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.CED.A.2. N.Q.A.1. A.REI.D.10.	Create linear equations in two variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	
S.ID.B.6	Represent data on a scatter plot, describe how the variables are related and use technology to fit function to data.	
S.ID.C.7-9	Interpret the slope, intercept, and correlation coefficient of a data set of a linear model; distinguish between correlation and causation.	
N.Q.A.1-3	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.	
A.REI.D.11	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.	
N.Q.A.1	Define appropriate quantities for the purpose of descriptive modeling.	

Adopted by The Fairview Board of Education on April 5, 2016

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N.Q.A.2	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities
N.Q.A.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
A.REI.B.3	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
A.REI.A.1	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*
A.CED.A.4	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.1	Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*
A.CED.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.
A.REI.A.1	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
A.CED.A.2	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
A.REI.D.10	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
S.ID.B.6	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

Instructional Strategies

Adopted by The Fairview Board of Education on April 5, 2016

- Differentiated Instructional Groups and Activities
- Small group/ large group discussion
- Exploration of key concepts
- Anchor Activities
- Students will learn to write and evaluate expressions with unknown values.
- Properties are used to simplify expressions.
- Students will find equivalent equations using inverse operations and simplification.
- Students will solve equations using addition, subtraction, multiplication, or division.
- Students will use distributive property to simplify expressions and solve equations.
- Students will use the multiplication property of equality and the cross products property to solve proportions.
- Students will calculate unit rates.
- Students will use proportions to solve problems involving percents, measurements and similar figures, and indirect measurement.
- Students will use scale drawing such as maps.
- Students will learn to write and graph inequalities.
- Students will use properties to generate equivalent inequalities.
- Equivalent inequalities are generated by using the properties of inequalities.
- Inequality symbols are reversed when multiplying or dividing both sides of an inequality by a negative number.

Essential Questions

- How can you represent quantities, patterns, and relationships?
  - Students will learn to write and evaluate expressions with unknown values.
- How are properties related to algebra?
  - Properties are used to simplify expressions.
- Can equations that appear to be different be equivalent?
  - Students will find equivalent equations using inverse operations and simplification.
- How can you solve equations?
  - Students will solve equations using addition, subtraction, multiplication, or division.
  - Students will use distributive property to simplify expressions and solve equations.
  - Students will use the multiplication property of equality and the cross products property to solve proportions.
- What kinds of relationships can proportions represent?
  - Students will calculate unit rates.
  - Students will use proportions to solve problems involving percents, measurements and similar figures, and indirect measurement.
  - Students will use scale drawing such as maps.
- How do you represent relationships between quantities that are not equal?
  - Students will learn to write and graph inequalities.
- Can inequalities that appear to be different be equivalent?
  - Students will use properties to generate equivalent inequalities.
- How can you solve inequalities?
  - Equivalent inequalities are generated by using the properties of inequalities.

○ Inequality symbols are reversed when multiplying or dividing both sides of an inequality by a negative number.

Enduring Understandings

- Algebra uses symbols to represent quantities that are unknown or that vary. You can represent mathematical phrases and real - world relationships using symbols and operations.
- Powers can be used to show in the representation of repeated multiplication such as 2 * 2 * 2 * 2 * 2 * 2. When simplifying an expression operations must be performed in the correct order.
- The definition of a square root can be used to find the exact square roots of some non negative numbers with square roots of other non- numbers can be approximated.
- Relationships that are always true for real numbers are called properties which are rules used to rewrite and compare expressions.
- Any real numbers can be added or subtracted using a number line model or using rules involving absolute value.
- The rules for multiplying real numbers are related to the properties of real numbers and the definitions of operations.
- The distributive property can be used to simplify the product of a number and a sum or difference. An algebraic expression can be simplified by combining the parts of the expression that are alike.
- Equations are used to represent the relationship between two quantities that have the same value.
- Sometimes the value of one quantity can be found in the value of another is known. The relationship between the quantities can be represented in different ways including tables, equations, and graphs.
- Equations and describe, explain, and reject various aspects of the real world. And these lessons, students solve One Step, two-step and multi-step linear equations, as well as Equations with variables on both sides.
- Ratios and rates can be used to compare quantities and make conversions.
- If two ratios are equal and a quantity and one of the ratios is unknown, the unknown quantity can be found by writing and solving a proportion.
- Proportional reasoning can be used to find missing side lengths in similar figures.
- Percents represent another application of proportions. The percent proportion can be used to solve for any one of the Missing components and to solve percent increase and percent decrease problems.
- An inequality is a mathematical sentence that uses an inequality symbol to compare the values of two expressions. Inequalities can be represented with symbols. Their Solutions can be represented on a number line.
- Just as properties of equality can be used to solve equations, properties of equality can be used to solve inequalities (including multi-step and compound inequalities).
- An equivalent pair of linear equations or inequalities can be used to solve absolute value equations and inequalities.

Assessments

- Benchmark Assessment

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- Presentations
- Class discussions
- Homework
- Tests/quizzes
- Discussions
- Peer evaluations
- Daily oral language
- Chapter Reading
- Outline/Notes
- Vocabulary Assessments/ Application of Vocabulary
- Exams
- Projects
- Teacher Observations

	Differentiated Activities:
	Modifications & Accommodations:
	*Please note that the following modifications and accommodations vary from unit to unit, and may be implemented for any student who would benefit
Enrichment	*(content, process, product, and learning environment)* **Extension Activities:** ● Conduct research and provide presentation of cultural 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 (role, audience, format, topic) activities as they pertain to the types/modes of communication ● Anchor activities ● Use of higher-level questioning techniques ● Provide assessments at a higher-level of thinking
ELL	**Modifications:** ● 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
Special Education	*(appropriate accommodations, instructional adaptation, 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 class notes ● 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 (role, audience, format, topic) activities as they pertain to the types/modes of communication **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
At-Risk (Intervention)	**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 a copy of class notes ● 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 (role, audience, format, topic) activities as they pertain to the types/modes of communication
	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

Resources	
Student Resources	• Teacher created materials • Conquer Math Binders • Illustrativemathematics.org ○ N.Q.A.1 Runners' World ○ N.Q.A.2 Giving Raises ○ N.Q.A.3 Calories in a Sports Drink ○ A.REI.B.3, A.REI.A.1 Reasoning with linear inequalities ○ A.CED.A.4 Equations and Formulas ○ A.SSE.A.1 Kitchen Floor Tiles

	○ [A.CED.A.1 Planes and wheat](#)
	○ [A-CED.A.1 Paying the rent](#)
	○ [A.REI.A.1 Zero Product Property 1](#)
	○ [A.CED.A.2 Clear on an Escalator](#)
	○ [S.ID.B.6,S.ID.C.7-9 Coffee and Crime](#)

Teacher Resources	● Teacher created materials
	● Pearson Realize: Algebra 1 Common Core Textbook Series
	● Conquer Math Binders
	● Illustrativemathematics.org
	  ○ [N.Q.A.1 Runners' World](#)
	
	  ○ [N.Q.A.2 Giving Raises](#)
	
	  ○ [N.Q.A.3 Calories in a Sports Drink](#)
	
	  ○ [A.REI.B.3, A.REI.A.1 Reasoning with linear inequalities](#)
	
	  ○ [A.CED.A.4 Equations and Formulas](#)
	
	  ○ [A.SSE.A.1 Kitchen Floor Tiles](#)
	
	  ○ [A.CED.A.1 Planes and wheat](#)
	
	  ○ [A-CED.A.1 Paying the rent](#)
	
	  ○ [A.REI.A.1 Zero Product Property 1](#)
	
	  ○ [A.CED.A.2 Clear on an Escalator](#)
	
	  ○ [S.ID.B.6,S.ID.C.7-9 Coffee and Crime](#)
	
	Primary:
	● Google Classroom
	● Khan Academy
	● Mathantics
	● Smartboards
	● Internet
	● Pearson Algebra 1 Common Core Textbook
	Secondary:
	● Supplemental Readings/ Articles based on student interest/discussion
	● [http://www.mathgiraffe.com/blog/relevant-math-articles-to-share-](#)

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	with-teens ● https://www.nytimes.com/topic/subject/mathematics **Core Instructional Materials/Resources/Digital Tools:** (I.e. classroom resources, digital tools, links to websites and videos Websites:) www.education.com www.khanacademy.com www.superteacherworksheets.com http://www.mathgiraffe.com/blog/relevant-math-articles-to-share-with-teens https://www.nytimes.com/topic/subject/mathematics https://www.illustrativemathematics.org/content https://www.pearsonrealize.com

Grade	8
Unit	**UNIT TWO:** Modeling with Linear Functions, Linear Systems & Exponential Functions
Unit Duration	6-8 Weeks
Course	Mathematics: Algebra
Overview/Rationale	Students will solve linear systems of equations, create equations that describe numbers or relationships, interpret the structure of expressions, and represent and solve equations and inequalities graphically. They will also construct & compare linear & exponential models, interpret expressions for functions in terms of the situation, build a function that models a relationship between two quantities, understand the concept of a function and use function notation, interpret functions that arise in applications in terms of the context, and analyze functions using different representations. These skills will be mastered through differentiated activities, cross-curricular lessons, multiple means of assessment and the enhancement of prior skills and knowledge.
DESIRED OUTCOMES
NJSL Standards Addressed***

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9.2.12.C.1	Review career goals and determine steps necessary for attainment.
9.2.12.C.3	Identify transferable career skills and design alternate career plans.
9.2.12.C.4	Analyze how economic conditions and societal changes influence employment trends and future education.
9.2.12.C.5	Research career opportunities in the United States and abroad that require knowledge of world languages and diverse cultures.
9.2.12.C.6	Investigate entrepreneurship opportunities as options for career planning and identify the knowledge, skills, abilities, and resources required for owning and managing a business.
9.2.12.C.7	Examine the professional, legal, and ethical responsibilities for both employers and employees in the global workplace.
9.2.12.C.9	Analyze the correlation between personal and financial behavior and employability.
Indicator	*Career Ready Practices*
CRP 1	Act as a responsible and contributing citizen and employee.
CRP 2	Apply appropriate academic and technical skills.
CRP 3	Attend to personal health and financial well-being.
CRP 4	Communicate clearly and effectively and with reason.
CRP 5	Consider the environmental, social and economic impacts of decisions.
CRP 6	Demonstrate creativity and innovation.
CRP 7	Employ valid and reliable research strategies.
CRP 8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP 9	Model integrity, ethical leadership and effective management.
CRP 10	Plan education and career paths aligned to personal goals.
CRP 11	Use technology to enhance productivity.

CRP 12	Work productively in teams while using cultural global competence.

Mathematical Practices:
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Technology Standards Addressed

8.1.8.A.3-Use and/or develop a simulation that provides an environment to solve a real world problem or theory.

8.1.12.C.1-Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.

8.1.12.D.1-Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.

8.1.12.D.2-Evaluate consequences of unauthorized electronic access (e.g., hacking) and disclosure, and on dissemination of personal information.

8.1.12.F.1-Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

8.2.2.B.2-Demonstrate how reusing a product affects the local and global environment.

8.2.2.B.3-Identify products or systems that are designed to meet human needs.

8.2.12.B.2-Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product.

In this unit, the following 21ˢᵗ Century Themes & Skills are addressed:

Check all Themes that apply		Indicate whether these skills are: E- Encouraged, T- Taught, or A-assessed In this unit by marking E, T, or A on the line before the appropriate skill.	
T, E	**Global Awareness**	T,E, A	**Creativity and Innovation**
N/A	**Environmental Literacy**	T,E, A	**Critical Thinking**
N/A	**Health Literacy**	T,E, A	**Problem Solving**
N/A	**Civic Literacy**	T,E, A	**Communication**
T, E	**Financial, Economic, Business, and Entrepreneurial Literacy**	T,E, A	**Collaboration**

Interdisciplinary Connections

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- Teacher made projects based learning activities connected to other subjects
- Research Native American Mathematicians of Today or Yesterday and write a One page summary of how they helped enhance the field of Mathematics

Key Terms	
	- Continuous graph, dependent variable, discrete graph, domain, function, and dependent variable, linear function, nonlinear function, range, recursive formula, relation, sequence
	- Direct variation, linear equation, piecewise function, point - slope form, rate of change, slope, slope - intercept form, standard form, step function, trendline, x - intercept, y - intercept
	- Consistent, dependent, elimination method, inconsistent, independent, linear inequalities, solution of an inequality, solution of a system of linear equations, solution of a system of linear inequalities, substitution method
	- Compound interest, Decay Factor, exponential decay, exponential function, exponential growth, geometric sequence, growth factor

Student Learning Objectives (SLO)

Student Learning Objectives
Major Content Supporting Content Additional Content
(Identified by PARCC Model Content Frameworks)

AREI.C.6 A.CED.A.3 A.REI.C.5	Solve multistep contextual problems by identifying variables, writing equations, and solving systems of linear equations in two variables algebraically and graphically
A.REI.D.12 A.CED.A.3	Graph linear inequalities and systems of linear inequalities in two variables and explain that the solution to the system.
F.IF.A.1 F.IF.A.2	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.LE.A.1a-b.	Distinguish between and explain situations modeled with linear functions and with exponential functions.
F.LE.A.2 F.IF.A.3	Write linear and exponential functions given a graph, table of values, or written description; construct arithmetic and geometric sequences.
F.BF.A.1 A.SSE.A.1a-b.	Write explicit expressions, recursive processes and steps for calculation from a context that describes a linear or exponential relationship between two quantities.
A.SSE.B.3.c	Use properties of exponents to produce equivalent forms of exponential expressions in one variable.
F.IF.B.4 F.LE.B.5 F.IF.B.5	Sketch graphs of linear and exponential functions expressed symbolically or from a verbal description. Show key features and interpret parameters in context.

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F.IF.C.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	
F.IF.B.6	Calculate and interpret the average rate of change of a function presented symbolically or as a table; estimate the rate of change from a graph.	
F.IF.C.7a-b	Graph linear, square root, cube root, and piecewise-defined functions (including step and absolute value functions) expressed symbolically. Graph by hand in simple cases and using technology in more complex cases, showing key features of the graph.	
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 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.	
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.	
F.LE.A.1	Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	
F.LE.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	

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		(include reading these from a table).
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.*

Instructional Strategies

- Differentiated Instructional Groups and Activities
- Small group/ large group discussion
- Exploration of key concepts
- Anchor Activities
  - Graphs will be used to relate two quantities.
  - Students will model real -world situations that are continuous and real world situations that are discrete.
  - Students will represent functions using tables, equations, and graphs.
  - Students will use function notation.
  - Students will represent arithmetic sequences using function rules.
  - Students will find slope using a formula.
  - Students will find slope using a graph.
  - Students will analyze various types of describe their meaning.
  - The equation of a line gives it's slope.
  - The equation of a line gives it y-intercept.
  - Students will find the line of the best fit.
  - Students will analyze trend lines in scatter plots.
  - Students will learn to solve systems of equations or inequalities by graphing.
  - Students will learn to solve systems of equations by substitution.
  - Students will learn to solve systems of equations by elimination.
  - Students will write equations and inequalities to represent situations.
  - Students will examine constraints placed on real world situations.
  - Students will learn to represent numbers using negative exponents.
  - Students will Define and use zeros and negative exponents.
  - Students will learn the rules for multiplying powers.
  - Students will learn the rules for dividing powers.
  - Exponential functions may show growth or decay

Essential Questions

- Can functions describe a real-world situation?
  - Graphs will be used to relate two quantities.
  - Students will model real -world situations that are continuous and real world situations that are discrete.

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- How can you represent and describe functions?
  - Students will represent functions using tables, equations, and graphs.
  - Students will use function notation.
  - Students will represent arithmetic sequences using function rules.

- What does the slope of a line indicate about the line?
  - Students will find slope using a formula.
  - Students will find slope using a graph.
  - Students will analyze various types of describe their meaning.

- What information does the equation of a line give you?
  - The equation of a line gives it's slope.
  - The equation of a line gives it y-intercept.

- How can you make predictions based on a scatter plot?
  - Students will find the line of the best fit.
  - Students will analyze trend lines in scatter plots.

- How can you solve a system of equations or inequalities?
  - Students will learn to solve systems of equations or inequalities by graphing.
  - Students will learn to solve systems of equations by substitution.
  - Students will learn to solve systems of equations by elimination.

- Can systems of equations model real - World situations?
  - Students will write equations and inequalities to represent situations.
  - Students will examine constraints placed on real world situations.

- How can you represent numbers less than 1 using exponents?
  - Students will learn to represent numbers using negative exponents.

- How can you simplify expressions involving expressions?
  - Students will define and use zeros and negative exponents.
  - Students will learn the rules for multiplying powers.
  - Students will learn the rules for dividing powers.

- What are the characteristics of exponential functions?
  - Exponential functions may show growth or decay

Enduring Understandings

- Graphs can be used to visually represent the relationship between two variable quantities as they change.
- the set of all solutions of an equation forms its graph. A graph may include solutions that do not appear in a table. A real - world graph should show Only points that make sense in the given situation.
- The value of one valuable may be uniquely determined by the value of another variable. Such relationships may be represented using words, tables, equations, sets of ordered pairs, and graphs.

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- Many real - World functional relationships can be represented by equations. Equations can be used to find the solution of given real - world problems.
- Functions (linear and nonlinear) Are a special type of relation where each value of the domain is paired with exactly one value in the range. Some functions can be grabbed or represented by equations.
- Ratios can be used to show the relationship between changing quantities, such as vertical and horizontal change.
- If the ratio of two variables is consistent, then the variables have a special relationship, cold a direct variation.
- Arithmetic sequences have function rules that can be used to find any term of the sequence.
- A line on a graph can be represented by a linear equation. Forms of linear equations include the slope-intercept, point-slope, and standard forms.
- The relationship between two lines can be determined by comparing their slopes and y-intercepts.
- Absolute value equations can be graphed quickly by Shifting the graph of y equals absolute value of x.
- Two sets of numerical data can be graphed as ordered pairs. If the two sets of data are related, a lime on grass can be used estimate or predict values.
- Systems of linear equations can be used to model problems. Systems of equations can be solved by graphing, substitution, or eliminating a variable.
- A linear inequality in two variables has an infinite number of solutions. The solutions can be represented in the coordinate plane as a set of all points on one side of the boundary line. The solutions of a system of linear inequalities can be represented by the region where the graphs of individual inequalities overlap.
- Some problems can be modeled by systems of linear equations.
- Solutions to a linear inequality in two variables can be represented in the coordinate plane as a set of all points on one side of the boundary line. The solutions of a system of linear inequalities can be represented by the region where the graphs of the individual inequalities overlap.
- The idea of exponents can be extended to include zero and negative exponents.
- properties of exponents make it easier to simplify products or quotients of powers with the same base or Powers raised to a power or products raised to a power.
- You can use rational exponent to represent radicals.
- The parent of the family of exponential functions is $y=ab^x$. The independent variable is the exponent. This family of functions can model growth or decay of an initial amount.
- In a geometric sequence, the ratio of any term to its preceding term is a constant value.

Assessments

- Benchmark Assessment
- Presentations
- Class discussions
- Homework
- Tests/quizzes
- Discussions
- Peer evaluations

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- Daily oral language
- Chapter Reading
- Outline/Notes
- Vocabulary Assessments/ Application of Vocabulary
- Exams
- Projects
- Teacher Observations

	Differentiated Activities: **Modifications & Accommodations:** **Please note that the following modifications and accommodations vary from unit to unit, and may be implemented for any student who would benefit*
Enrichment	*(content, process, product, and learning environment)* **Extension Activities:** - Conduct research and provide presentation of cultural 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 (role, audience, format, topic) activities as they pertain to the types/modes of communication - Anchor activities - Use of higher-level questioning techniques - Provide assessments at a higher-level of thinking
ELL	**Modifications:** - 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
Special Education	*(appropriate accommodations, instructional adaptation, 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 class notes - 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 (role, audience, format, topic) activities as they pertain to the types/modes of communication **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
At-Risk (Intervention)	**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 a copy of class notes ● 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 (role, audience, format, topic) activities as they pertain to the types/modes of communication

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

Resources	
Student Resources	- Teacher created materials - Conquer Math Binders - Illustrativemathematics.org - A.REI.C.6 Cash Box - A.CED.A.3 Dimes and Quarters - A.REI.C.5 Solving Two Equations in Two Unknowns - A.REI.D.12 Fishing Adventures 3 - F.IF.A.1 The Parking Lot - F.IF.A.2 Yam in the Oven - F.LE.A.1 Finding Linear and Exponential Models - F.LE.A.2 Interesting Interest Rates - F.BF.A.1a Skeleton Tower - A.SSE.A.1 Mixing Candies

	○ [F.IF.B.4 Warming and Cooling](#)
	○ [F.IF.B.4, F.IF.B.5 Average Cost](#)
	○ [F.LE.B.5 US Population 1982-1988](#)
	○ [F.IF.B.6 Temperature Change](#)
	○ [F.IF.C.7b Bank Account Balance](#)

Teacher Resources	● Teacher created materials
	● Pearson Realize: Algebra 1 Common Core Textbook Series
	● Conquer Math Binders
	● Illustrativemathematics.org
	   ○ [A.REI.C.6 Cash Box](#)
	
	   ○ [A.CED.A.3 Dimes and Quarters](#)
	
	   ○ [A.REI.C.5 Solving Two Equations in Two Unknowns](#)
	
	   ○ [A.REI.D.12 Fishing Adventures 3](#)
	
	   ○ [F.IF.A.1 The Parking Lot](#)
	
	   ○ [F.IF.A.2 Yam in the Oven](#)
	
	   ○ [F.LE.A.1 Finding Linear and Exponential Models](#)
	
	   ○ [F.LE.A.2 Interesting Interest Rates](#)
	
	   ○ [F.BF.A.1a Skeleton Tower](#)
	
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	   ○ [F.LE.B.5 US Population 1982-1988](#)
	
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	   ○ [F.IF.C.7b Bank Account Balance](#)
	
	Primary:
	● Google Classroom
	● Khan Academy

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- Mathantics
- Smartboards
- Internet
- Pearson Algebra 1 Common Core Textbook

Secondary:

- Supplemental Readings/ Articles based on student interest/discussion
- http://www.mathgiraffe.com/blog/relevant-math-articles-to-share-with-teens
- https://www.nytimes.com/topic/subject/mathematics

Core Instructional Materials/Resources/Digital Tools:
 (I.e. classroom resources, digital tools, links to websites and videos Websites:)
www.education.com
www.khanacademy.com
www.superteacherworksheets.com
http://www.mathgiraffe.com/blog/relevant-math-articles-to-share-with-teens
https://www.nytimes.com/topic/subject/mathematics
https://www.illustrativemathematics.org/content
https://www.pearsonrealize.com

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Grade	8
Unit	**UNIT THREE:** Quadratic Equations, Functions, Polynomials, & Radical and Rational Expressions/Equations
Unit Duration	6-8 Weeks
Course	Mathematics: Algebra
Overview/Rationale	Students will perform arithmetic operations on polynomials, understand the relationship between zeros and factors, interpret the structure of expressions, solve equations and inequalities in one variable, create equations that describe numbers or relationships, and interpret functions that arise in applications in terms of the context. They will also represent and solve equations and inequalities graphically, build a function that models a

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<tr><td></td><td>relationship between two quantities, construct & compare linear, quadratic, & exponential models, build new functions from existing functions, analyze functions using different representations, and use properties of rational and irrational numbers. These skills will be mastered through differentiated activities, cross-curricular lessons, multiple means of assessment and the enhancement of prior skills and knowledge.</td></tr>
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DESIRED OUTCOMES

NJSL Standards Addressed

New Jersey Student Learning Standards
21st Century Life and Career Skills
(Additional standards should be applied, as needed, to enrich instruction and foster student achievement.

9.2.12.C.1	Review career goals and determine steps necessary for attainment.
9.2.12.C.3	Identify transferable career skills and design alternate career plans.
9.2.12.C.4	Analyze how economic conditions and societal changes influence employment trends and future education.
9.2.12.C.5	Research career opportunities in the United States and abroad that require knowledge of world languages and diverse cultures.
9.2.12.C.6	Investigate entrepreneurship opportunities as options for career planning and identify the knowledge, skills, abilities, and resources required for owning and managing a business.
9.2.12.C.7	Examine the professional, legal, and ethical responsibilities for both employers and employees in the global workplace.
9.2.12.C.9	Analyze the correlation between personal and financial behavior and employability.
Indicator	*Career Ready Practices*
CRP 1	Act as a responsible and contributing citizen and employee.
CRP 2	Apply appropriate academic and technical skills.
CRP 3	Attend to personal health and financial well-being.
CRP 4	Communicate clearly and effectively and with reason.
CRP 5	Consider the environmental, social and economic impacts of decisions.

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CRP 6	Demonstrate creativity and innovation.
CRP 7	Employ valid and reliable research strategies.
CRP 8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP 9	Model integrity, ethical leadership and effective management.
CRP 10	Plan education and career paths aligned to personal goals.
CRP 11	Use technology to enhance productivity.
CRP 12	Work productively in teams while using cultural global competence.

Mathematical Practices:
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Technology Standards Addressed

8.1.8.A.3-Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
8.1.12.C.1-Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.
8.1.12.D.1-Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.
8.1.12.D.2-Evaluate consequences of unauthorized electronic access (e.g., hacking) and disclosure, and on dissemination of personal information.
8.1.12.F.1-Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.
8.2.2.B.2-Demonstrate how reusing a product affects the local and global environment.
8.2.2.B.3-Identify products or systems that are designed to meet human needs.
8.2.12.B.2-Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product.

In this unit, the following 21st Century Themes & Skills are addressed:

Check all Themes that apply		Indicate whether these skills are: E- Encouraged, T- Taught, or A-assessed In this unit by marking E, T, or A on the line before the appropriate skill.	
T, E	**Global Awareness**	T,E,	**Creativity and Innovation**

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		A	
N/A	*Environmental Literacy*	T,E, A	*Critical Thinking*
N/A	*Health Literacy*	T,E, A	*Problem Solving*
N/A	*Civic Literacy*	T,E, A	*Communication*
T, E	*Financial, Economic, Business, and Entrepreneurial Literacy*	T,E, A	*Collaboration*

Interdisciplinary Connections
● Teacher made projects based learning activities connected to other subjects ● Research Black and Women Mathematicians of Today or Yesterday and write a One page summary of how they helped enhance the field of Mathematics

Indicator	*Career Ready Practices*
CRP 1	Act as a responsible and contributing citizen and employee.
CRP 2	Apply appropriate academic and technical skills.
CRP 3	Attend to personal health and financial well-being.
CRP 4	Communicate clearly and effectively and with reason.
CRP 5	Consider the environmental, social and economic impacts of decisions.
CRP 6	Demonstrate creativity and innovation.
CRP 7	Employ valid and reliable research strategies.
CRP 8	Utilize critical thinking to make sense of problems and persevere in solving them.
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<td>Key Terms</td>
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Binomial, degree of a monomial, degree of a polynomial, difference of two squares, factoring by grouping, monomial, perfect - Square trinomial, polynomial, standard form of a polynomial, trinomial
Axis of symmetry, completing the square, discriminant, maximum, minimum, parabola, quadratic equation, quadratic function, root of an equation, vertex
Conditional, conjugates, extraneous solution, hypotenuse, like radicals, Pythagorean Theorem, radical expression, square root function, trigonometric ratios

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Student Learning Objectives (SLO)

Student Learning Objectives
<mark style="background-color:#00FF00">Major Content</mark> <mark style="background-color:#00FFFF">Supporting Content</mark> <mark style="background-color:#FFFF00">Additional Content</mark>
(Identified by PARCC Model Content Frameworks).

A.APR.A.1 A.SSE.A.2	Add, subtract, and multiply polynomials, relating these to arithmetic operations with integers. Factor to produce equivalent forms of quadratic expressions in one variable.
A.REI.B.4.a	Derive the quadratic formula by completing the square and recognize when there are no real solutions.
A.REI.B.4.b	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.CED.A.1	Create quadratic equations in one variable and use them to solve problems.
F.IF.B.4 F.IF.B.5	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.SSE.B.3a-b.	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.BF.A.1	Given a context, write an explicit expression, a recursive process or steps for calculation for quadratic relationships.
F.IF.C.7 F.IF.C.8 F.IF.C.9	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.
F.IF.B.6 F.LE.A.3	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.

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F.BF.B.3	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.REI.D.11	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 graph and finding successive approximations.	
A.APR.B.3	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)	
N.RN.B.3	Explain and justify conclusions about sums and products of rational and irrational numbers.	
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 $(x^2 - y^2)(x^2 + y^2)$.*	
A.REI.B.4	Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in *x* into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), 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*.	
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.	
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.*	
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*	
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.	

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	a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.	
F.BF.A.1	Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context.	
F.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. *[emphasize quadratic 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. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.	
F.IF.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.*	
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.	
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.	
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.*	
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]	
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	

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	rational number and an irrational number is irrational.	

- Differentiated Instructional Groups and Activities
- Small group/ large group discussion
- Exploration of key concepts
- Anchor Activities
- Students will add, subtract, multiply, and divide with radicals.
- Students will rationalize the denominators of radical expressions.
- Students will draw graphs to examine square root functions.
- Students will estimate values of square roots.
- Students will use inverse operations, such as squaring both sides of an equation that has a square root.

Essential Questions

- How are radical expressions represented?
  - Students will add, subtract, multiply, and divide with radicals.
- Students will rationalize the denominators of radical expressions.
- What are the characteristics of square root functions?
  - Students will draw graphs to examine square root functions.
  - Students will estimate values of square roots.
- How can you solve a radical equation?
  - Students will use inverse operations, such as squaring both sides of an equation that has a square root.

Enduring Understandings

- The idea of exponents can be extended to include zero and negative exponents.
- Mine and no one else can be used to form larger Expressions called polynomials. Polynomials can be added and subtracted.
- There Are several ways to find the product of two binomials, including models, algebra, and tables.
- Some trinomials of the form ax^2+bx+c And some polynomials of a degree greater than two can be factored to equivalent forms which are the product of two binomials.
- The properties of real numbers can be used to multiply a monomial buy a polynomial or simplified the product of binomials.
- The properties of real numbers can also be used to factor some trinomials of the form ax^2+bx+c And some polynomials of a degree greater than 2.
- The family of quadratic functions models certain situations where the rate of change is not constant. These functions are graphed by a symmetric curve with a highest or lowest point or responding to a maximum or minimum value.
- In the quadratic function $y=ax^2+bx+c$, The value of B translates the position of the axis of symmetry.

- Quadratic equations can be solved by a variety of methods, including graphing and finding the square root, using the Zero- Product Property, writing the equation in the form $m^2=n$, or using the quadratic formula.
- Systems of linear and quadratic equations can be solved graphically and algebraically. This type of system can have two solutions, one solution, or no solutions.
- Linear, Quadratic, or exponential functions can be used to model various sets of data.
- Operations can be performed with radical expressions and radical expressions can be simplified using the multiplication and division properties of square roots.
- Square root functions can be graphed by plotting points or using translations of the parent square root function.
- Sine, cosine, and tangent ratios can be used to find the measurements of sides or angles of right triangles.
- Some radical equations can be solved by sharing both sides and testing the solutions.

Assessments

- Benchmark Assessment
- Presentations
- Class discussions
- Homework
- Tests/quizzes
- Discussions
- Peer evaluations
- Daily oral language
- Chapter Reading
- Outline/Notes
- Vocabulary Assessments/ Application of Vocabulary
- Exams
- Projects
- Teacher Observations

Differentiated Activities:
Modifications & Accommodations:
Please note that the following modifications and accommodations vary from unit to unit, and may be implemented for any student who would benefit

Enrichment	*(content, process, product, and learning environment)*
	Extension Activities: - Conduct research and provide presentation of cultural 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 (role, audience, format, topic) activities as they pertain to the types/modes of communication - Anchor activities

	● Use of higher-level questioning techniques ● Provide assessments at a higher-level of thinking
ELL	**Modifications:** ● 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
Special Education	*(appropriate accommodations, instructional adaptation, 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 class notes ● 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 (role, audience, format, topic) activities as they pertain to the types/modes of communication **Modifications for Assessments:** ● Extended time on classroom tests and quizzes

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	● 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
At-Risk (Intervention)	**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 a copy of class notes ● 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 (role, audience, format, topic) activities as they pertain to the types/modes of communication **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

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	Resources
Student Resources	- Teacher created materials - Conquer Math Binders - Illustrativemathematics.org - 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
Teacher Resources	- Teacher created materials - Pearson Realize: Algebra 1 Common Core Textbook Series - Conquer Math Binders - Illustrativemathematics.org

- 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

Primary:
- Google Classroom
- Khan Academy
- Mathantics
- Smartboards
- Internet
- Pearson Algebra 1 Common Core Textbook
Secondary:

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| | ● Supplemental Readings/ Articles based on student interest/discussion
● http://www.mathgiraffe.com/blog/relevant-math-articles-to-share-with-teens
● https://www.nytimes.com/topic/subject/mathematics

Core Instructional Materials/Resources/Digital Tools:
 (I.e. classroom resources, digital tools, links to websites and videos Websites:)
www.education.com
www.khanacademy.com
www.superteacherworksheets.com
http://www.mathgiraffe.com/blog/relevant-math-articles-to-share-with-teens
https://www.nytimes.com/topic/subject/mathematics
https://www.illustrativemathematics.org/content
https://www.pearsonrealize.com |
| | |

Grade	8
Unit	**UNIT FOUR:** Modeling with Statistics
Unit Duration	6-8 Weeks
Course	Mathematics: Algebra
Overview/Rationale	Students will summarize, represent, and interpret data on a single count or measurement variable. They will also summarize, represent, and interpret data on two categorical and quantitative variables and interpret functions that arise in applications in terms of the context. These skills will be mastered through differentiated activities, cross-curricular lessons, multiple means of assessment and the enhancement of prior skills and knowledge.
DESIRED OUTCOMES
NJSL Standards Addressed
New Jersey Student Learning Standards**

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9.2.12.C.1	Review career goals and determine steps necessary for attainment.
9.2.12.C.3	Identify transferable career skills and design alternate career plans.
9.2.12.C.4	Analyze how economic conditions and societal changes influence employment trends and future education.
9.2.12.C.5	Research career opportunities in the United States and abroad that require knowledge of world languages and diverse cultures.
9.2.12.C.6	Investigate entrepreneurship opportunities as options for career planning and identify the knowledge, skills, abilities, and resources required for owning and managing a business.
9.2.12.C.7	Examine the professional, legal, and ethical responsibilities for both employers and employees in the global workplace.
9.2.12.C.9	Analyze the correlation between personal and financial behavior and employability.
Indicator	*Career Ready Practices*
CRP 1	Act as a responsible and contributing citizen and employee.
CRP 2	Apply appropriate academic and technical skills.
CRP 3	Attend to personal health and financial well-being.
CRP 4	Communicate clearly and effectively and with reason.
CRP 5	Consider the environmental, social and economic impacts of decisions.
CRP 6	Demonstrate creativity and innovation.
CRP 7	Employ valid and reliable research strategies.
CRP 8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP 9	Model integrity, ethical leadership and effective management.
CRP 10	Plan education and career paths aligned to personal goals.
CRP 11	Use technology to enhance productivity.

CRP 12	Work productively in teams while using cultural global competence.

Mathematical Practices:
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Technology Standards Addressed

8.1.8.A.3-Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
8.1.12.C.1-Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.
8.1.12.D.1-Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.
8.1.12.D.2-Evaluate consequences of unauthorized electronic access (e.g., hacking) and disclosure, and on dissemination of personal information.
8.1.12.F.1-Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.
8.2.2.B.2-Demonstrate how reusing a product affects the local and global environment.
8.2.2.B.3-Identify products or systems that are designed to meet human needs.
8.2.12.B.2-Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product.

In this unit, the following 21st Century Themes & Skills are addressed:

Check all Themes that apply		Indicate whether these skills are: *E- Encouraged, T- Taught, or A-assessed In this unit by marking E, T, or A on the line before the appropriate skill.*	
T, E	**Global Awareness**	*T,E, A*	**Creativity and Innovation**
N/A	**Environmental Literacy**	*T,E, A*	**Critical Thinking**
N/A	**Health Literacy**	*T,E, A*	**Problem Solving**
N/A	**Civic Literacy**	*T,E, A*	**Communication**
T, E	**Financial, Economic, Business, and Entrepreneurial Literacy**	*T,E, A*	**Collaboration**

Interdisciplinary Connections

● Teacher made projects based learning activities connected to other subjects

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	● Research Current Events or Topics that involve Mathematicians or the Field of Mathematics. Write a summary of the article and include how you could use this information to create a new business or evolve the way we live or learn today, tomorrow, or in the future.
Key Terms	● Asymptote, Constant of variation for an inverse variation, excluded value, inverse variation, rational equation, rational expression, rational function, combination, event, Matrix, measure of central tendency, outcome, outlier, permutation, probability, quartile, sample space

Student Learning Objectives (SLO)	

Student Learning Objectives
<mark>Major Content</mark> <mark>Supporting Content</mark> <mark>Additional Content</mark>
(Identified by PARCC Model Content Frameworks).

<mark>S.ID.A.1</mark>	Represent data with plots (dot plots, histograms, and box plots) on the real number line.
<mark>S.ID.A.2</mark> <mark>S.ID.A.3</mark>	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.
<mark>S.ID.B.5</mark>	Summarize and interpret categorical data for two categories in two-way frequency tables; explain possible associations and trends in the data.
<mark>S.ID.B.6.a.b.</mark>	Fit functions to data using technology, plot residuals and informally assess the fit of linear and non-linear functions by analyzing residuals.
<mark>F.IF.B.4*</mark> <mark>F.IF.B.5*</mark>	Interpret key features of functions from graphs and tables. Given a verbal description of the relationship, sketch the graph of a function, showing key features and relating the domain of the function to its graph.
Progress Indicator	**New Jersey Student Learning Standards** <mark>Major Content</mark> <mark>Supporting Content</mark> <mark>Additional Content</mark> (Identified by PARCC Model Content Frameworks).
<mark>S.ID.A.1</mark>	Represent data with plots on the real number line (dot plots, histograms, and box plots).
<mark>S.ID.A.2</mark>	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.
<mark>S.ID.A.3</mark>	Interpret differences in shape, center, and spread in the context of

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	the data sets, accounting for possible effects of extreme data points (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.	
S.ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. 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. b. Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.	
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.*	
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.*	
S.ID.A.1	Represent data with plots (dot plots, histograms, and box plots) on the real number line.	
S.ID.A.2 S.ID.A.3	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.	
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S.ID.B.6.a.b.	Fit functions to data using technology, plot residuals and informally assess the fit of linear and non-linear functions by analyzing residuals.	
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Instructional Strategies

- Differentiated Instructional Groups and Activities
- Small group/ large group discussion
- Exploration of key concepts
- Anchor Activities

- Students will graph rational expressions.
- Students will simplify rational expressions.
- Graphing will be used to show rational functions.
- Students will add, subtract, multiply, and divide rational expressions.
- The concept of inverse variation will be explored.
- Students will use inverse operations to solve a rational equation.
- Students will identify extraneous solutions.
- Students will find measures of central tendency.
- Students will examine samples and conduct surveys.
- Students will make predictions Based on data they collect and observe.
- Students were organized data and display such as matrices, frequency tables, histograms, and box - and - whisker plots.
- Students will Describe a data set by using measures of central tendency.
- Theoretical and experimental probabilities will be compared.
- Students will find probabilities of simple events and compound events.

Essential Questions

- How are rational expressions represented?
  - Students will graph rational expressions.
  - Students will simplify rational expressions.
- What are the characteristics of rational functions?
  - Graphing will be used to show rational functions.
  - Students will add, subtract, multiply, and divide rational expressions.
  - The concept of inverse variation will be explored.
- How can you solve a rational equation?
  - Students will use inverse operations to solve a rational equation.
  - Students will identify extraneous solutions.
- How can collecting and analyzing data help you make decisions or predictions?
  - students will find measures of central tendency.
  - Students will examine samples and conduct surveys.
  - Students will make predictions Based on data they collect and observe.
- How can you make an interpret different representations of data?
  - Students were organized data and display such as matrices, frequency tables, histograms, and box - and - whisker plots.
  - students will Describe a data set by using measures of central tendency.
- How is probability related to real world events?
  - Theoretical and experimental probabilities will be compared.
  - Students will find probabilities of simple events and compound events.

Enduring Understandings

- The simplest form of the rational expression is like the simplest form of the numerical fraction. The numerator and denominator have no common factor other than 1. to simplify a rational expression, divide out common factors from the numerator and denominator.
- Rational expressions and polynomials can be added, subtracted, multiplied and divided using the same properties used to multiply and divide numerical fractions.
- If the product of two variables is a nonzero constant, then the variables form an inverse

variation.
- To graph a rational function f(x), it is necessary to understand the graph's behavior near values of x where the function is undefined.
- A rational equation can be solved by first multiplying each side of the equation by the LCD. When each side of a rational equation is a single rational expression, the equation can be solved using the Cross Products Property.
- Different measures can be used to interpret and compare sets of data.
- When collecting data, it is important for the results to accurately represent the situation.
- Data can be organized in matrices or in intervals. Different measures can be used to interpret and compare sets of data. Separating data into subsets is a useful way to summarize and compare data sets.
- Counting methods can be used to find the number of possible ways to choose objects with and without regard to order.
- The probability of an event, or P(event), tells how likely it is that the event will occur. Probabilities can be found by reasoning mathematically or by using experimental data. The probability of a compound event can sometimes be found from expressions of the probabilities of simpler events.

Assessments

- Benchmark Assessment
- Presentations
- Class discussions
- Homework
- Tests/quizzes
- Discussions
- Peer evaluations
- Daily oral language
- Chapter Reading
- Outline/Notes
- Vocabulary Assessments/ Application of Vocabulary
- Exams
- Projects
- Teacher Observations

Differentiated Activities:
Modifications & Accommodations:
Please note that the following modifications and accommodations vary from unit to unit, and may be implemented for any student who would benefit

Enrichment	*(content, process, product, and learning environment)* **Extension Activities:** ● Conduct research and provide presentation of cultural 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 (role, audience, format, topic) activities as they pertain to the types/modes of communication ● Anchor activities ● Use of higher-level questioning techniques ● Provide assessments at a higher-level of thinking
ELL	**Modifications:** ● 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
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	● Establish procedures for accommodations/modifications for assessments
**Resources**	

Student Resources	● Teacher created materials
	● Conquer Math Binders
	● Illustrativemathematics.org
	   ○ [S.ID.A.1-3 Haircut Costs](#)
	   ○ [S.ID.A.1-3 Speed Trap](#)
	   ○ [S.ID.A.2-3 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](#)
	   ○ [F.IF.B.4 The Aquarium](#)
	   ○ [F.IF.B.4 Containers](#)
	   ○ [F.IF.B.4-5 The Canoe Trip, Variation 2](#)

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	Primary:
	● Google Classroom
	● Khan Academy
	● Mathantics
	● Smartboards
	● Internet
	● Pearson Algebra 1 Common Core Textbook
	Secondary:
	● Supplemental Readings/ Articles based on student interest/discussion

- http://www.mathgiraffe.com/blog/relevant-math-articles-to-share-with-teens
- https://www.nytimes.com/topic/subject/mathematics

Core Instructional Materials/Resources/Digital Tools:
 (I.e. classroom resources, digital tools, links to websites and videos Websites:)
www.education.com
www.khanacademy.com
www.superteacherworksheets.com
http://www.mathgiraffe.com/blog/relevant-math-articles-to-share-with-teens
https://www.nytimes.com/topic/subject/mathematics
https://www.illustrativemathematics.org/content
https://www.pearsonrealize.com