Boonton School District

Course Title:	Algebra 1 CP and Honors	**Grade Level(s):**	**8, 9**		
Curriculum Area / Level:	Mathematics	**Credits:**	**5**		
Course prerequisites and/or co-requisites:	8th Grade Math, Pre-Algebra				
Course Description:	In Algebra 1, students build on the descriptive statistics, expressions and equations, and functions work first encountered in the middle grades while using more formal reasoning and precise language as they think deeper about the mathematics. Students add to the statistical work from the middle grades by working with standard deviation, describing statistical distributions more precisely, and measuring goodness-of-fit with residuals and the correlation coefficient. Students further their work with linear equations and inequalities as they transition from representations tied to tangible objects to working with abstract expressions. Students develop their abilities to see structure in expressions to show that expressions involving several operations are equivalent (for example, grasping that "substitution" works at various levels of complexity), and they solve linear and quadratic equations by writing a series of equivalent statements, justifying each step. Students formalize their concept of function and encounter exponential and quadratic functions as well as other examples of non-linear functions. A function that arises from a real context requires students to attend to an appropriate domain and to the meaning of various features of the function in the context. As they explore various functions, students should also leverage the power of making connections between graphical, tabular, symbolic, and contextual representations.				
Created by:	Natalie Perez	**Date:**	09/5/16	**BOE Approval:**	09/26/16
District Equity Statement:	As required by state law, it is the policy of Boonton School District not to discriminate on the basis of race, color, creed, religion, sex, ancestry, national origin, social or economic status, pregnancy, or physical handicap in its educational programs or activities and to maintain a learning environment that is free from sexual harassment. Courses of study and instructional materials shall be designed and selected in order to eliminate discrimination and promote understanding, sex equity, and mutual respect among people. No course offering, including but not limited to physical education, health, technology education, vocational, home economics, music and adult education, shall be limited on the basis of race, color, creed, religion, sex, ancestry, national origin, social or economic status, pregnancy, or physical handicap. Furthermore, there shall be no discrimination against students as to any educational activity or program because of pregnancy, childbirth, pregnancy-related disabilities, actual or potential parenthood, or family or marital status. If a student requests to be excluded or a physician certifies that such is necessary for her physical, mental, or emotional well-being, she must be				

	provided with adequate and timely opportunity for instruction to continue or make up her schoolwork without prejudice or penalty.

Content for 8th grade Algebra 1 only
Honors content

Division of Umbrella & Mini Units	
Umbrella Unit 1 Topic / Name: **Modeling with Linear Equations and Inequalities**	**Mini Unit(s)** **1A. Reason quantitatively and use units to solve problems, solve [linear] equations and inequalities in one variable and understand solving equations, including literal equations.** **1B. Create equations that describe numbers or relationships (between two variables); interpret the structure of expressions** **1C. Represent and solve equations and inequalities graphically, interpreting the slope and intercept within the context of the problem** **1D. Summarize, represent and interpret data and linear models**
Umbrella Unit 2 Topic / Name: **Modeling with Linear Functions, Linear Systems, & tExponential Functions**	**Mini Unit(s)** **2A. Solve linear systems of equations and inequalities exactly and approximate graphically** **2B. Understand the concept of a function and use function**

	notation; interpret functions that arise in applications in terms of the context; analyze functions using different representations **2C. Graph and compare linear, exponential, piecewise, square root, cube root and absolute value functions**
Umbrella Unit 3 Topic / Name: **Quadratic Equations, Functions & Polynomials**	**Mini Unit(s)** **3A. Add, subtract and multiply polynomials; solve quadratic equations in one variable, including completing the square** **3B. Interpret quadratic functions from graphs and tables; use factoring and completing the square to produce equivalent forms of quadratic expressions in one variable** **3C. Write explicit expressions for quadratic relationships (two variables); graph quadratic functions by hand and with technology showing intercepts, extreme values and symmetry; compare two quadratic functions** **3D. Calculate and interpret the average rate of change of non-linear functions. Identify effects of transformations on a function; approximate solutions to a system which includes a linear function and a quadratic function**
Umbrella Unit 4 Topic / Name: **Modeling with statistics** **Geometry**	**Mini Unit(s)** **4A. Represent data with plots on the real number line** **4B. Summarize, represent, and interpret data in two-way frequency tables; identify trends in data** **4C. Interpret functions that arise in applications in terms of**

	the context **4D. Geometry**

UMBRELLA UNIT 1	
Title:	**Modeling with Linear Equations and Inequalities**
Duration:	5 weeks
Essential Questions:	How and why are units used to understand problems and their solutions? How and why are scales used on graphs to create accurate visual representations? What are the properties of equality and how are they used to solve equations and inequalities? How are real world and mathematical problems represented by equations and inequalities? How and why is data represented with a scatter plot? How are scatter plots used in describing how the variables are related? What is the difference between correlation and causation?
Summative Assessments: **(Assessment at the end the learning period)**	https://www.bigideasmath.com Chapter 1, Chapter 2, and 4.4, 4,5 Standards will be assessed in conjunction with other standards Chapter tests and quizzes Chapter performance tasks
Formative Assessments: **(Ongoing assessments during the learning period)**	https://www.bigideasmath.com Chapter 1, Chapter 2, and 4.4, 4,5 See Laurie's Notes for formative assessment ideas
Differentiation:	Manipulatives, graphic organizers and note taking support Open questions Parallel tasks
TECHNOLOGY STANDARD (STANDARD 8)	
CPI #	**CUMULATIVE PROGRESS INDICATOR (CPI)**
8.1.12.A.1	**Create a personal digital portfolio which reflects personal and academic interests, achievements, and**

	career aspirations by using a variety of digital tools and resources.
8.1.12.A.3	**Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.**
8.1.12.A.4	**Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.**
21ST CENTURY LIFE AND CAREER (STANDARD 9)	
CPI #	**CUMULATIVE PROGRESS INDICATOR (CPI)**
CRP4	**Communicate clearly and effectively and with reason.**
CRP8	**Utilize critical thinking to make sense of problems and persevere in solving them.**
CRP11	**Use technology to enhance productivity.**

MINI UNIT 1A		
Title:	**Reason quantitatively and use units to solve problems**	
Duration:	**1 week**	
Overview:	**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.**	
Essential Outcomes - Upon completion of this course students will know (declarative):		**Alignment to Standards**
Units are associated with variables in expressions and equations in context.		**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.
Quantities may be used to model attributes of real world situations.	**N.Q.A.2. Define appropriate quantities for the purpose of descriptive modeling.**
Measurement tools have an inherent amount of uncertainty in measurement.	**N.Q.A.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.**
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
Use units to understand real world 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.**
Use units to guide the solution of multi-step real world problems (e.g. dimensional analysis).	**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.**
Convert within and between units of different measurement systems	**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.**
Choose and interpret units while using formulas 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.**
Identify and define appropriate quantities for descriptive modeling.	**N.Q.A.2. Define appropriate quantities for the purpose of descriptive modeling.**
Choose a level of accuracy when reporting measurement quantities.	**N.Q.A.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.**

Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
The units in a problem can be used to guide the solution.	**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.**
The choice of accuracy impacts the solution of a problem.	**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.**
Resources Mini Unit 1A:	N.Q.A.1 Runners' World N.Q.A.2 Giving Raises N.Q.A.3 Calories in a Sports Drink N.Q.1,N.Q.2 Broken Calculator N.Q.1, 2, 3 Mullets N.Q.A.1 How much is a penny worth? N.Q.A.1,2,3 Jack In The Box

MINI UNIT 1B	
Title:	**Solve [linear] equations and inequalities in one variable**
Duration:	**2 weeks**
Overview:	**Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.**

Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
Literal equations can be rearranged using the properties of equality.	**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.
Equations and inequalities can be solved using properties of equality.	**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.** **A.REI.B.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.**
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
Solve linear equations with coefficients represented by letters in one variable.	**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.**
Use the properties of equality to justify steps in solving linear equations.	**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 linear inequalities in one variable.	**A.REI.B.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.**
Rearrange linear formulas and literal equations, isolating a specific variable.	**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.**
Rearrange complex formulas and equations including exponents, isolating a specific variable.	**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.**
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**

Inverses and identities are necessary in solving linear 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.**
What factors, coefficients, and other part of an expression mean in the context of a problem.	**A.SSE.A.1.A Interpret parts of an expression, such as terms, factors, and coefficients. (Review of previous content.)**
Resources Mini Unit 1B:	A.REI.B.3, A.REI.A.1 Reasoning with linear inequalities A.SSE.A.1 Kitchen Floor Tiles A.CED.A.4 Broken Calculator A.CED.A.4 Mullets

MINI UNIT 1C	
Title:	**Understand solving equations as a process of reasoning and explain the reasoning**
Duration:	**1 week**
Overview:	**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.**
Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**
Equations and inequalities describe relationships.	**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.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.**
Equations can represent real-world and mathematical	**A.CED.A.1. Create equations and inequalities in one variable and use**

problems.	**them to solve problems. Include equations arising from linear functions 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.**
Equations represent quantitative 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.** **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 the coordinate plane, often forming a curve (which could be a line).**
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
Identify and describe relationships between quantities in word problems.	**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.**
Create linear equations in one variable.	**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.**
Create linear inequalities in one variable	**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.
Use equations and inequalities to solve real world problems.	**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.**
Explain each step in the solution process.	**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.**
Create linear equations in two variables, including those from a context.	**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.**
Create equations in more than two variables, including those from a context.	**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.**
Select appropriate scales for constructing a graph.	**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.**
Interpret the origin in graphs.	**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.**
Graph equations on coordinate axes, including labels and scales.	**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).**
Identify and describe the solutions in the graph of an equation.	**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).**

Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
Linear equations and inequalities in one variable can be used to solve problems contextual situations.	**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.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.**
The graph of linear equations in two variables can be used to visualize the relationship between the variables.	**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 the coordinate plane, often forming a curve (which could be a line).**
Resources Mini Unit 1C:	A.CED.A.1 Planes and wheat A-CED.A.1 Paying the rent A-CED.A.1 Circle-Square A-CED.A.1 Falling glowstick A-CED.A.1 Falling rocks A.CED.A.2 Clea on an Escalator A.REI.A.1 Zero Product Property 1 A-REI.1,3, A-CED.1 Balancing scales A-REI.1,3, A-CED.1 Gas Pump A-REI.1,3, A-CED.1 Bottomless Mug of Coffee A-REI.1,3, A-CED.1 Pepsi points A-REI 1,3, A-CED.1 Central Park

	A.REI.B.3, A.REI.A.1 Reasoning with linear inequalities N.Q.A.1 Runners' World

MINI UNIT 1D		
Title:	**Summarize, represent and interpret data and linear models**	
Duration:	**1 week**	
Overview:	**Represent data on a scatter plot, describe how the variables are related and use technology to fit a function to data. Interpret the slope, intercept, and correlation coefficient of a data set of a linear model; distinguish between correlation and causation**	
Essential Outcomes - Upon completion of this course students will know (declarative):		**Alignment to Standards**
Scatter plots represent the relationship between two variables.		**S.ID.B.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.**
Scatter plots can be used to determine the nature of the association between the variables.		**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.**
Linear models may be developed by fitting a linear function to approximately linear data.		**S.ID.B.6c. Fit a linear function for a scatter plot that suggests a linear association.**
The correlation coefficient represents the strength of a linear association.		**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.**

Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Distinguish linear models representing approximately linear data from linear equations representing “perfectly” linear relationships.	S.ID.B.6c. Fit a linear function for a scatter plot that suggests a linear association.
Create a scatter plot and sketch a line of best fit.	S.ID.B.6c. Fit a linear function for a scatter plot that suggests a linear association.
Fit a linear function to data using technology.	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.
Solve problems using prediction equations.	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.
Interpret the slope and the intercepts of the linear model in context.	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.
Determine the correlation coefficient for the linear model using technology.	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.
Determine the direction and strength of the linear association between two variables.	S.ID.C.9. Distinguish between correlation and causation.
Calculate the correlation coefficient using the formula.	S.ID.C.8. Compute (using technology) and interpret the correlation coefficient of a linear fit.
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
The variables of a scatter plot are related and can be summarized by fitting a function to 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.6c. Fit a linear function for a scatter plot that suggests a linear association.**
How the slope, intercept, and correlation coefficient of a data set of a linear model relate to the context of the data.	**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.**
Distinguish between correlation and causation	**S.ID.C.9. Distinguish between correlation and causation.**
Resources Mini Unit 1D:	S.ID.B.6,S.ID.C.7-9 Coffee and Crime S.ID.B.6, 7 Bird's Eggs S.ID.B.6, 8 Devising a measure: Correlation

UMBRELLA UNIT 2	
Title:	**Modeling with Linear Functions, Linear Systems, & Exponential Functions**
Duration:	**13 Weeks**
Essential Questions:	What is the difference between solving a system of linear equations approximately (graphically) and exactly (algebraically). What is a solution to a system of linear equations? What is a solution to a system of linear inequalities? How are systems of equations and inequalities used to model real world problems? What is a function?

	What are the domain and range? What is the difference between linear and exponential functions algebraically, graphically and in context? How are linear and exponential relationships expressed explicitly and recursively? What are key graphical features of linear and exponential functions and how do they relate to the context of the problem? How can functions given in different representations be compared? How is the average rate of change of a function calculated and what does it mean in the context of the problem? What are the key features of the graphs of linear, square root, cube root and piecewise defined functions?
Summative Assessments: **(Assessment at the end the learning period)**	https://www.bigideasmath.com Chapter 3, Chapter 4, Chapter 5, Chapter 10 Standards will be assessed in conjunction with other standards Chapter tests and quizzes Chapter performance tasks
Formative Assessments: **(Ongoing assessments during the learning period)**	https://www.bigideasmath.com Chapter 3, Chapter 4, Chapter 5, Chapter 10 See Laurie's Notes for formative assessment ideas
Differentiation:	Manipulatives, graphic organizers and note taking support Open questions Parallel tasks
TECHNOLOGY STANDARD (STANDARD 8)	
CPI #	**CUMULATIVE PROGRESS INDICATOR (CPI)**
8.1.12.A.1	**Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.**
8.1.12.A.3	**Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.**
CPI #	**CUMULATIVE PROGRESS INDICATOR (CPI)**

CRP4	**Communicate clearly and effectively and with reason.**
CRP8	**Utilize critical thinking to make sense of problems and persevere in solving them.**
CRP11	**Use technology to enhance productivity.**

MINI UNIT 2A		
Title:	**Solve linear systems of equations and inequalities exactly and approximate graphically**	
Duration:	**5 weeks**	
Overview:	**Solve multistep contextual problems by identifying variables, writing equations, and solving systems of linear equations in two variables algebraically and graphically. Graph linear inequalities and systems of linear inequalities in two variables and explain the solution to the system.**	
Essential Outcomes - Upon completion of this course students will know (declarative):		**Alignment to Standards**
Systems of equations can be solved exactly (algebraically) and approximately (graphically).		**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.** **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.**
Real world situations can be modeled by creating a system of linear inequalities.		**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. **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.**
The context of the problem will may exclude certain solutions derived algebraically.	**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.** **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.**
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
Identify and define variables representing essential features for the model.	**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.**
Model real world situations by creating a system of linear equations.	**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.**
Solve systems of linear equations using the elimination or substitution method.	**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.**
Solve systems of linear equations by graphing.	**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.**
Interpret the solution(s) in context.	**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.
Prove elimination and substitution methods.	**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.**
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
Multistep contextual problems can be solved by identifying variables, writing equations, and solving systems of linear equations in two variables algebraically and graphically.	**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.**
The solutions to linear inequalities and systems of linear inequalities in two variables are regions on the coordinate plane.	**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.** **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.**
Resources Mini Unit 2A:	A.REI.C.6 Cash Box A.REI.C.6 Selling Boomerangs A.REI.5,6 NFL Passer Ratings A.CED.A.3 Dimes and Quarters A.CED.A.3 Evaluating Energy Efficiency Claims A.REI.D.12 Road Trippin' A.REI.D.12 Fishing Adventures 3 A.REI.C.5 Solving Two Equations in Two Unknowns A.REI.C.5 Solving Linear Equations in Two Variables

MINI UNIT 2B	
Title:	**Understand the concept of a function and use function notation; interpret functions that arise in applications in terms of the context; analyze functions using different representations**
Duration:	**3 weeks**
Overview:	**Explain the definition of a function, including the relationship between the domain and range. Use function notation, evaluate functions and interpret statements in context.**

Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
F(x) is an element in the range and x is an element in the domain.	**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).**
Linear functions grow by equal differences over equal intervals.	**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.**
Exponential functions grow by equal factors over equal intervals	**F.LE.A.1. Distinguish between situations that can be modeled with linear functions and with exponential functions.** **F.LE.A.1c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.**

Sequences are functions, sometimes defined and represented recursively.	**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).** **F.IF.A.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.**
Sequences are functions whose domain is a subset of integers.	**F.IF.A.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.**
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
Use the definition of a function to determine whether a relationship is a function.	**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**
Use function notation once a relation is determined to be a function.	**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.**
Evaluate functions for given inputs in the domain.	**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.**
Explain statements involving function notation in the context of the problem.	**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.**
Identify and describe situations in which one quantity changes at a constant rate.	**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.**
Identify and describe situations in which a quantity grows or decays by a constant percent.	**F.LE.A.1. Distinguish between situations that can be modeled with linear functions and with exponential functions.** **F.LE.A.1c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.**
Show that linear functions grow by equal differences over equal intervals.	**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.**
Show that exponential functions grow by equal factors over equal intervals	**F.LE.A.1. Distinguish between situations that can be modeled with linear functions and with exponential functions.** **F.LE.A.1c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.**
Create arithmetic and geometric sequences from verbal descriptions.	**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).**
Create arithmetic sequences from linear functions.	**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).
Use sequence notation	**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).**
Create geometric sequences from exponential functions.	**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).**
Identify recursively defined sequences as functions.	**F.IF.A.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers**
Create linear and exponential functions given **- a graph;** **- a description of a relationship;** **- a table of values.**	**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).**
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
The definition of a function, including the relationship between the domain and range.	**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).**
Use function notation, evaluate functions and interpret statements in context.	**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.**
Key situations modeled with linear functions and with exponential functions.	**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.**
Arithmetic and geometric sequences.	**F.IF.A.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers**
The concept of "function" and how the vertical line test ties graphs to this definition	**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.** **A.SSE.A.1b: Interpret complicated expressions by viewing one or more of their parts as a single entity.**
Resources Mini Unit 2B:	F.IF.A.1 The Parking Lot F.IF.A.1 Points on a graph F.IF.A.1 Domain and Range F.IF.A.1,2,4 Sorting Functions F.IF.A.2 Yam in the Oven F.LE.A.1 Finding Linear and Exponential Models F.LE.A.1 Double Sunglasses F.LE.A.1 Fry's Bank F.LE.A.2 Interesting Interest Rates A.SSE.A.1 Mixing Candies **********start**********

MINI UNIT 2C	
Title:	**Graph and compare linear, exponential, piecewise, square root, cube root and absolute value functions**
Duration:	**5 weeks**
Overview:	**Distinguish between and explain situations modeled with linear functions and with exponential functions. Write linear and exponential functions given a graph, table of values, or written description; construct arithmetic and geometric sequences. Write explicit expressions, recursive processes and steps for calculation from a context that describes a linear or exponential relationship between two quantities. Graph piecewise, square root and absolute functions. 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.**

Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**
Rate of change of non-linear functions varies.	**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.**
Piecewise-defined functions may contain discontinuities.	**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.7b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**
Absolute value functions are piecewise functions.	**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.7b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**

Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Given a verbal description of a relationship, sketch linear 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**
Identify intercepts and intervals where the function is positive/negative.	**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**
Interpret parameters in context.	**F.LE.B.5. Interpret the parameters in a linear or exponential function in terms of a context.**
Determine the *practical* domain of a function.	**F.IF.B.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes**
Compare key features of two linear functions represented in different ways.	**F.IF.C.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).**
Compare key features of two exponential functions represented in different ways.	**F.IF.C.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).**
Calculate the rate of change from a table of values or from a function presented symbolically.	**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.**
Estimate the rate of change from a graph.	**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.**

Graph linear, square root, cube root, and piecewise-defined functions.	**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.** **F.IF.C.7b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**
Graph more complicated cases of functions using technology.	**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.** **F.IF.C.7b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**
Identify and describe key features of the graphs of square root, cube root, and piecewise-defined functions.	**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.** **F.IF.C.7b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
Linear and exponential functions expressed	**F.IF.B.4. For a function that models a relationship between two**

symbolically or from a verbal description. Show key features and interpret parameters in context.	**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** **F.IF.B.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes**
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) over a specified interval. Estimate the rate of change from a graph.**
The average rate of change of a function can be determined using a table or graph.	**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.**
Key features of a graph can be used to identify square root, cube root, piecewise, quadratic and linear functions.	**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.** **F.IF.C.7b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.**
Resources Mini Unit 2C:	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

UMBRELLA UNIT 3	
Title:	**Quadratic Equations, Functions & Polynomials**
Duration:	**13 weeks**
Essential Questions:	How are arithmetic operations with integers related to adding, subtracting and multiplying polynomials? How are quadratic expressions factored? What does it mean to “complete the square”? What is the quadratic formula and how is it derived? When will an equation have no real solutions and what does this mean in the context of the problem? What are the key features of quadratic functions? How and why are equivalent forms of quadratic functions helpful? What are the zeros, maximum and minimum of a quadratic function and what do they mean in the context of the problem? How are quadratic functions graphed? How is the average rate of change calculated for quadratic functions? How do transformations effect the graph of quadratic functions? What is the approximate solution to a system of equations comprised of a linear and a quadratic function? How are cubic functions factored? How are sums and products of rational and irrational numbers justified using logical arguments?
Summative Assessments: **(Assessment at the end the learning period)**	https://www.bigideasmath.com Chapter 7, Chapter 8, Chapter 9 Standards will be assessed in conjunction with other standards Chapter tests and quizzes Chapter performance tasks
Formative Assessments: **(Ongoing assessments during the learning period)**	https://www.bigideasmath.com Chapter 7, Chapter 8, Chapter 9 See Laurie’s Notes for formative assessment ideas
Differentiation:	Manipulatives, graphic organizers and note taking support Open questions Parallel tasks

TECHNOLOGY STANDARD (STANDARD 8)	
CPI #	**CUMULATIVE PROGRESS INDICATOR (CPI)**
8.1.12.A.1	**Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.**
8.1.12.A.3	**Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.**
CPI #	**CUMULATIVE PROGRESS INDICATOR (CPI)**
CRP4	**Communicate clearly and effectively and with reason.**
CRP8	**Utilize critical thinking to make sense of problems and persevere in solving them.**
CRP11	**Use technology to enhance productivity.**

MINI UNIT 3A		
Title:	**Add, subtract and multiply polynomials; solve quadratic equations in one variable, including completing the square**	
Duration:	**4 weeks**	
Overview:	**Add, subtract, and multiply polynomials, relating these to arithmetic operations with integers. Factor to produce equivalent forms of quadratic expressions in one variable. Derive the quadratic formula by completing the square and recognize when there are no real solutions. 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. Create quadratic equations in one variable and use them to solve problems.**	
Essential Outcomes - Upon completion of this course		**Alignment to Standards**

students will know (declarative):	
Polynomials form a system analogous to the integers.	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.
Polynomials are closed under the operations of addition, subtraction, and multiplication	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.
Multiple methods for solving quadratic equations.	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.
Transforming a quadratic equation into the form $(x - p)^2 = q$ yields an equation having the same solutions.	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.
Recognize when a quadratic equation will have complex solutions.	A.REI.B.4. Solve quadratic equations in one variable. 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.
Solve problems using quadratic equations.	**A.REI.B.4. Solve quadratic equations in one variable.**
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
Add and subtract polynomials.	**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.**
Multiply polynomials.	**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.**
Recognize numerical expressions as a difference of squares and rewrite the expression as the product of sums/differences.	**A.SSE.A.2. Use the structure of an expression to identify ways to rewrite it.**
Recognize polynomial expressions in one variable as a difference of squares and rewrite the expression as the product of sums/differences.	**A.SSE.A.2. Use the structure of an expression to identify ways to rewrite it.**
Use the method of completing the square to transform a quadratic equation in x into an equation of the form $(x - p)^2 = q$.	**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.**
Derive the quadratic formula from $(x - p)^2 = q$.	**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.**

Solve a quadratic equations in one variable by inspection.	**A.REI.B.4. Solve quadratic equations in one variable.** **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.**
Solve quadratic equations in one variable by taking square roots.	**A.REI.B.4. Solve quadratic equations in one variable.** **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.**
Solve a quadratic equations in one variable by completing the square.	**A.REI.B.4. Solve quadratic equations in one variable.** **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.**
Solve a quadratic equations in one variable using the quadratic formula.	**A.REI.B.4. Solve quadratic equations in one variable.** **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.**
Solve a quadratic equations in one variable by factoring.	**A.REI.B.4. Solve quadratic equations in one variable.** **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* ± *bi* for real numbers *a* and *b*.
Strategically select, as appropriate to the initial form of the equation, a method for solving a quadratic equation in one variable.	**A.REI.B.4. Solve quadratic equations in one variable.**
Write complex solutions of the quadratic formula in *a* ± *bi* form.	**A.REI.B.4. Solve quadratic equations in one variable.** **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* ± *bi* for real numbers *a* and *b*.**
Analyze the quadratic formula, recognizing the conditions leading to complex solutions (discriminant).	**A.REI.B.4. Solve quadratic equations in one variable.** **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* ± *bi* for real numbers *a* and *b*.**
Create quadratic equations in one variable.	**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.**
Use quadratic equations to solve real world problems.	**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.**
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
Polynomials can be added, subtracted and multiplied.	**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.**
How to derive the quadratic formula by completing the square and recognize when there are no real solutions.	**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***
Which method will be most efficient to solve single-variable quadratic equations.	**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***
Quadratic equations in one variable can be used to solve problems.	**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.**
Resources Mini Unit 3A:	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

MINI UNIT 3B		
Title:	**Interpret quadratic functions from graphs and tables; use factoring and completing the square to produce equivalent forms of quadratic expressions in one variable**	
Duration:	**3 weeks**	
Overview:	**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. 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.**	
Essential Outcomes - Upon completion of this course students will know (declarative):		**Alignment to Standards**
Key features of 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.**
Alternate, equivalent forms of a quadratic expression may reveal specific attributes of the function that it defines.		**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 function it defines.**

Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Interpret maximum/minimum and intercepts of quadratic functions from graphs and tables in the context of the problem.	**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.**
Sketch graphs of quadratic functions given a verbal description of the relationship between the quantities.	**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.**
Identify intercepts and intervals where function is increasing/decreasing	**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.**
Determine the practical domain of a function.	**F.IF.B.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.**
Factor a quadratic expression for the purpose of revealing the zeros of a 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.** **A.SSE.B.3a. Factor a quadratic expression to reveal the zeros of the function it defines.**
Complete the square for the purpose of revealing the maximum or minimum of a 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.** **A.SSE.B.3b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.**

Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
Key features of quadratic functions from graphs and tables.	**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.** **F.IF.B.5. Relate the domain of a function to its graph and, where applicable, to the quantitative**
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.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.** **F.IF.B.5. Relate the domain of a function to its graph and, where applicable, to the quantitative**
Factoring and completing the square 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.	**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 function it defines.**
Resources Mini Unit 3B:	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

MINI UNIT 3C	
Title:	**Write explicit expressions for quadratic relationships (two variables); graph quadratic functions by hand and with technology showing intercepts, extreme values and symmetry; compare two quadratic functions**
Duration:	**3 weeks**
Overview:	**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. 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.**

Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**
An explicit expression can be written for quadratic relationships.	**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.**
A quadratic function can be graphed using key features.	**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.**
Compare functions given in different representations.	**F.IF.C.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).**

Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Given a context, write explicit expressions, a recursive process or steps for calculation for quadratic relationships.	**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.**
Graph quadratic functions expressed symbolically.	**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.**
Graph more complicated cases of quadratic functions using technology.	**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.**
Identify and describe key features of the graphs of quadratic functions.	**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.**
Given two quadratic functions, each represented in a different way, compare the properties of the 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).**

Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
Given a context, write an explicit expression, a recursive process or steps for calculation for quadratic relationships.	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.
Quadratic functions can be graphed by hand or with technology to identify the critical points.	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.
Properties of two quadratic functions, each represented in a different way.	F.IF.C.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
Resources Mini Unit 3C:	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

MINI UNIT 3D	
Title:	Calculate and interpret the average rate of change of non-linear functions. Identify effects of transformations on a function; approximate solutions to a system which includes a linear function and a quadratic function
Duration:	3 weeks
Overview:	Calculate and interpret the average rate of change of non-linear functions over a given interval. 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. 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. Identify zeros of cubic functions when suitable factorizations are available and use the zeros to construct a rough graph of the function. Explain and justify conclusions about sums and products of rational and irrational numbers.**

Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**
A quantity increasing exponentially eventually exceeds a quantity increasing quadratically.	**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.**
Characteristics of even and odd functions in graphs and algebraic expressions.	**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.**
Vertical and horizontal shifts.	**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.**
Solutions to non-linear systems.	**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.*
General shape(s) and end behavior of cubic 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.**
The sum or product of two rational numbers is rational.	**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.**
The sum of a rational number and an irrational number is irrational.	**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.**
The product of a nonzero rational number and an irrational number is irrational.	**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.**
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
Calculate the rate of change of a quadratic function from a table of values or from a function presented symbolically.	**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.**
Estimate the rate of change from a graph of a quadratic 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.**

Analyze graphs and tables to compare rates of change of exponential and quadratic functions.	**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.**
Perform transformations on graphs of linear and quadratic functions.	**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.**
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).**	**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.**
Identify the effect on the graph of combinations of transformations.	**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.**
Given the graph, find the value of k.	**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.**
Illustrate an explanation of the effects on linear and quadratic graphs using technology.	**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.
Recognize even and odd functions from their graphs and from algebraic expressions for them.	**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.**
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.	**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.**
Find the zeros of a polynomial (quadratic and cubic).	**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.**
Test domain intervals to determine where f(x) is greater than or less than zero.	**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.**
Use zeros of a function to sketch a 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.**
The sum or product of two rational numbers is rational.	**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.**
The sum of a rational number and an irrational number is irrational.	**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.
The product of a nonzero rational number and an irrational number is irrational.	**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.**
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
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.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.**
Systems of linear and nonlinear functions may have solutions that can be found by graphing or making tables of values.	**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.**
The zeros of cubic functions can be used in creating a graphical representation of the function.	**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**
How to explain and justify conclusions about sums and products of rational and irrational numbers.	**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.**
Resources Mini Unit 3D:	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

UMBRELLA UNIT 4	
Title:	**Modeling with statistics; geometry**
Duration:	**5 weeks**
Essential Questions:	How is data represented with plots? Why is data represented with plots? How are box plots used to compare data sets? What are outliers and how do they affect the data? How do the shape, center and spread help to interpret data? How are two-way frequency tables used to organize and interpret data? How are functions used in analyzing data? What do the residuals tell us about the functions used to represent bivariate data? How are volume formulas used in problem solving? What is the Pythagorean Theorem and its converse? How is the Pythagorean Theorem used in problem solving? How does the Pythagorean Theorem relate to the distance formula? What are rotations, reflections, translations and dilations?
Summative Assessments: **(Assessment at the end the learning period)**	https://www.bigideasmath.com Chapter 11 Standards will be assessed in conjunction with other standards Chapter tests and quizzes Chapter performance tasks
Formative Assessments: **(Ongoing assessments during the learning period)**	https://www.bigideasmath.com Chapter 11 See Laurie's Notes for formative assessment ideas
Differentiation:	Manipulatives, graphic organizers and note taking support Open questions Parallel tasks

TECHNOLOGY STANDARD (STANDARD 8)	
CPI #	**CUMULATIVE PROGRESS INDICATOR (CPI)**
8.1.12.A.1	**Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.**
8.1.12.A.3	**Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.**
8.1.12.A.4	**Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.**
CPI #	**CUMULATIVE PROGRESS INDICATOR (CPI)**
CRP4	**Communicate clearly and effectively and with reason.**
CRP8	**Utilize critical thinking to make sense of problems and persevere in solving them.**
CRP11	**Use technology to enhance productivity.**

MINI UNIT 4A		
Title:	**Represent data with plots on the real number line**	
Duration:	**1 week**	
Overview:	**Represent data with plots (dot plots, histograms, and box plots) on the real number line.**	
Essential Outcomes - Upon completion of this course students will know (declarative):		**Alignment to Standards**
Data can be represented on number lines.		**S.ID.A.1. Represent data with plots on the real number line (dot plots, histograms, and box plots).**

Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
Represent data with dot plots on the real number line.	**S.ID.A.1. Represent data with plots on the real number line (dot plots, histograms, and box plots).**
Represent data with histograms on the real number line.	**S.ID.A.1. Represent data with plots on the real number line (dot plots, histograms, and box plots).**
Represent data with box plots on the real number line.	**S.ID.A.1. Represent data with plots on the real number line (dot plots, histograms, and box plots).**
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
When to use dot plots, histograms, or box plots for different data sets.	**S.ID.A.1. Represent data with plots on the real number line (dot plots, histograms, and box plots).**
Resources Mini Unit 4A:	S.ID.A.1-3 Haircut Costs S.ID.A.1-3 Speed Trap

MINI UNIT 4B	
Title:	**Summarize, represent, and interpret data in two-way frequency tables; identify trends in data**
Duration:	**1 week**
Overview:	**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. Summarize and interpret categorical data for two categories in two-way frequency tables; explain possible associations and trends in the data.**
Essential Outcomes - Upon completion of this course	**Alignment to Standards**

students will know (declarative):	
Appropriate use of a statistic depends on the shape of the data distribution.	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.
Standard deviation	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).
Categorical variables represent types of data which may be divided into groups.	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.
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
Represent two or more data sets with plots and use appropriate statistics to compare their center and spread.	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.
Interpret differences in shape, center, and spread in context.	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).
Explain possible effects of extreme data points (outliers) when summarizing data and interpreting shape, center and spread.	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).
Construct two-way frequency tables for categorical data.	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.
Interpret joint, marginal and conditional relative frequencies in context.	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.
Explain possible associations between categorical data in two-way tables.	**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.**
Identify and describe trends in the data.	**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.**
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
Data can be interpreted using the shape center and spread of the display.	**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).**
That statistical measures can offer likely conclusions about data sets, but have limits." or "trends in data do not always mean cause and effect	**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.**
Resources Mini Unit 4B:	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?

MINI UNIT 4C	
Title:	**Interpret functions that arise in applications in terms of the context**
Duration:	**2 weeks**
Overview:	**Fit functions to data using technology, plot residuals and informally assess the fit of linear and non-linear functions by analyzing residuals.**

Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**
Functions can model relationships in bivariate 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.**
Data can be interpreted using key features of the graph	**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.** **F.IF.B.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.**
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
Fit a function to data using technology.	**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.
Solve problems using functions fitted to data (prediction equations).	**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.**
Interpret the intercepts of models in context.	**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.**
Plot residuals of linear and non-linear functions.	**S.ID.B.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.** **S.ID.B.6b. Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.**
Aanalyze residuals in order to informally evaluate the fit of linear and non-linear functions.	**S.ID.B.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.** **S.ID.B.6b. Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.**
Interpret maximum/minimum and intercepts of	**F.IF.B.4. For a function that models a relationship between two**

functions from graphs and tables in the context of the problem.	**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.**
Sketch graphs of functions given a verbal description of the relationship between the quantities.	**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.**
Identify intercepts and intervals where function is increasing/decreasing.	**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.**
Determine the practical domain of a function,	**F.IF.B.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.**
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
The use of residuals when using technology to plot data and fit functions to data sets	**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.**
Understand 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.	**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.**

	F.IF.B.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
Resources Mini Unit 4C:	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

MINI UNIT 4D	
Title:	**Geometry: Volume, Pythagorean Theorem, Congruence and Similarity, Transformations**
Duration:	**3 weeks**
Overview:	**Apply the formula for the volume of a cone, a cylinder, or a sphere to find a single unknown dimension when solving real-world and mathematical problems. Apply the Pythagorean Theorem to determine unknown side lengths of right triangles in two and three dimensional cases when solving real-world and mathematical problems. Use the Pythagorean Theorem to determine the distance between two points in the coordinate plane. Apply an effective sequence of transformations to determine that figures are similar when corresponding angles are congruent and corresponding sides are proportional. Write similarity statements based on such transformations.**

Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**
Use volume formulas to find a single unknown dimension of cones, cylinders and spheres when solving real world problems.	**8.G.C.9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.**
Pythagorean Theorem	**8.G.B.6. Explain a proof of the Pythagorean Theorem and its converse.**
If the square of one side of a triangle is equal to	**8.G.B.6. Explain a proof of the Pythagorean Theorem and its**

the sum of the squares of the other two sides, then the triangle is a right triangle (Pythagorean theorem converse).	**converse.**
A property of rigid motion transformations (rotation, reflection, and translation) is that the measure of a two-dimensional object under the transformation remains unchanged.	**8.G.A.1. Verify experimentally the properties of rotations, reflections, and translations:** **8.G.A.1a. Lines are transformed to lines, and line segments to line segments of the same length.** **8.G.A.1b. Angles are transformed to angles of the same measure.** **8.G.A.1c. Parallel lines are transformed to parallel lines.**
A two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations.	**8.G.A.2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.**
A two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations.	**8.G.A.4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.**
Congruent figures are also similar.	**8.G.A.4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.**
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
Use volume formulas to find a single unknown	**8.G.C.9. Know the formulas for the volumes of cones, cylinders, and**

dimension of cones, cylinders and spheres when solving real world problems	**spheres and use them to solve real-world and mathematical problems.**
Given a proof of the Pythagorean theorem, explain the proof.	**8.G.B.6. Explain a proof of the Pythagorean Theorem and its converse.**
Given a proof of the converse of the Pythagorean theorem, explain the proof.	**8.G.B.6. Explain a proof of the Pythagorean Theorem and its converse.**
Determine side lengths of right triangles by applying the Pythagorean Theorem to solve real world and mathematical problems involving two dimensional spaces.	**8.G.B.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.**
Determine side lengths of right triangles by applying the Pythagorean Theorem to solve real world and mathematical problems involving three dimensional spaces.	**8.G.B.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.**
Determine the distance between two points in a coordinate plane by drawing a right triangle and applying the Pythagorean Theorem.	**8.G.B.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system**
Show and explain that performing rotations, reflections, and translations on lines results in a line.	**8.G.A.1. Verify experimentally the properties of rotations, reflections, and translations:** **8.G.A.1a. Lines are transformed to lines, and line segments to line segments of the same length.**
Show and explain that performing rotations, reflections, and translations on line segments results in a line segment and does not alter the length of the line segment.	**8.G.A.1. Verify experimentally the properties of rotations, reflections, and translations:** **8.G.A.1a. Lines are transformed to lines, and line segments to line segments of the same length.**
Show and explain that performing rotations,	**8.G.A.1. Verify experimentally the properties of rotations, reflections,**

reflections, and translations on angles results in an angle and does not alter the measure of the angle.	**and translations:** **8.G.A.1b. Angles are transformed to angles of the same measure.**
Show and explain that performing rotations, reflections, and translations on parallel lines results in parallel lines.	**8.G.A.1. Verify experimentally the properties of rotations, reflections, and translations:** **8.G.A.1c. Parallel lines are transformed to parallel lines.**
Explain that a property of rigid motion transformations (rotation, reflection, and translation) is that the measure of a two-dimensional object under the transformation remains unchanged	**8.G.A.1. Verify experimentally the properties of rotations, reflections, and translations:** **8.G.A.1a. Lines are transformed to lines, and line segments to line segments of the same length.** **8.G.A.1b. Angles are transformed to angles of the same measure.** **8.G.A.1c. Parallel lines are transformed to parallel lines.**
Given two congruent figures, describe a transformation or sequence of transformations that shows the congruence between them.	**8.G.A.2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.**
Describe, using coordinates, the resulting two-dimensional figure after applying dilations with scale factor greater than, less than, and equal to 1.	**8.G.A.3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.**
Describe, using coordinates, the resulting two-dimensional figure after applying translation, rotation, and reflection.	**8.G.A.3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.**

Describe a transformation or sequence of transformations that show the similarity between them given two similar two-dimensional figures.	**8.G.A.4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.**
Give informal arguments to establish facts about the angle sum of triangles.	**8.G.A.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.**
Give informal arguments to establish facts about exterior angles of triangles.	**8.G.A.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.**
Give informal arguments to establish facts about the angles created when parallel lines are cut by a transversal.	**8.G.A.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.**
Give informal arguments to establish the angle-angle criterion for similarity of triangles.	**8.G.A.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.**
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
That the formula for the volume of a cone, a cylinder, or a sphere can be used to find a single unknown dimension when solving real-world and mathematical problems.	**8.G.C.9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.**
Explain a proof of the Pythagorean Theorem and its converse.	**8.G.B.6. Explain a proof of the Pythagorean Theorem and its converse.**

Apply the Pythagorean Theorem to determine unknown side lengths of right triangles in two and three dimensional cases when solving real-world and mathematical problems.	**8.G.B.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.**
Use the Pythagorean Theorem to determine the distance between two points in the coordinate plane.	**8.G.B.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system**
Explain and model the properties of rotations, reflections, and translations with physical representations and/or geometry software using pre-images and resultant images of lines, line segments, and angles.	**8.G.A.1. Verify experimentally the properties of rotations, reflections, and translations:** **8.G.A.1a. Lines are transformed to lines, and line segments to line segments of the same length.** **8.G.A.1b. Angles are transformed to angles of the same measure.** **8.G.A.1c. Parallel lines are transformed to parallel lines.**
Describe and perform a sequence of rotations, reflections, and/or translations on a two dimensional figure in order to prove that two figures are congruent.	**8.G.A.2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.**
Use the coordinate plane to locate images or pre-images of two-dimensional figures and determine the coordinates of a resultant image after applying dilations, rotations, reflections, and translations.	**8.G.A.3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.**
Apply an effective sequence of transformations to determine that figures are similar when corresponding angles are congruent and corresponding sides are proportional. Write similarity statements based on such	**8.G.A.4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.**

transformations.	
Give informal arguments to justify facts about the exterior angles of a triangle, the sum of the measures of the interior angles of a triangle, the angle-angle relationship used to determine similar triangles, and the angles created when parallel lines are cut by a transversal.	**8.G.A.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.**
Resources Mini Unit 4D:	8.G.B.6 Converse of the Pythagorean Theorem 8.G.B.7 Running on the Football Field 8.G.B.8 Finding isosceles triangles 8.G.A.1 Reflections, Rotations, and Translations 8.G.A.2 Congruent Triangles 8.G.A.3 Effects of Dilations on Length, Area, and Angles 8.G.A.4 Are They Similar 8.G.A.5 Street Intersections 8.G.A.5 Similar Triangles II 8.G.A.5 Triangle's Interior Angles

Board of Education Adoption Date: 09/26/2016