Course: Algebra I (BMS)

Unit # 1: Linear Equations, Inequalities, and Functions

Grade Level(s): 7-8	**Length of Unit: 10 Weeks (Complete chapters 1, 2, 3, and 4 in textbook)**

Unit Rationale: This unit sets the stage for students to work with expressions, equations, and inequalities through understanding quantities and the relationships between them. Specifically students will be given an opportunity to learn how to reason quantitatively using appropriate units and scales, to create linear equations or inequalities in one variable describing relationships among quantities, and to interpret the structure of an expression in its context. Students will also learn how to graph and write linear functions.

Stage 1 - Desired Results

Enduring Understandings:	**Essential Questions:**
Students will understand that… • Write, solve, and graph one-step linear equations. • Solve problems using a formula. • Find the absolute value of a number. • Formulate and use different strategies to solve one-step and multi-step linear equations. • Use properties of equality to rewrite an equation and to show two equations are equivalent. • Use absolute value to add and subtract rational numbers. • Create models to represent, analyze, and solve problems related to linear equations. • Solve absolute value equations. • Solve literal equations for a variable. • Write, solve, and graph one-step linear equations. • Construct and analyze tables, graphs, and equations to describe linear relationships and other simple relations. • Write, solve, and graph multi-step equations. • Graph proportional relationships and identify the unit rate as slope of linear functions. • Use properties of equality to rewrite an equation and to show two equations are equivalent. • Construct and analyze tables, graphs, and models to describe linear equations. • Interpret slope and x- and y-intercepts when graphing a linear equation for a real world problem. • Use tables, graphs, and models to represent, analyze, and solve real-life problems related to linear equations. • Write, solve, and graph one-step linear inequalities.	• What skills are needed to solve linear equations and inequalities? • What makes an equation or inequality linear? • How are linear equations and inequalities similar? How are they different? • How does a graphical model of a linear equation differ from an algebraic model? • What tools are necessary to construct an accurate graph of a linear equation? • What real-life situations can be modeled by linear equations and graphs of linear equations? • What are some ways to represent, describe, and analyze patterns that occur in our world? • How can we use algebraic representation to analyze patterns? • Why is it useful to represent real-life situations algebraically? • How can you find the domain and range of a function? • How can you decide whether the domain of a function is discrete or continuous? • How can you use a linear function to describe a linear pattern? • How can you recognize when a pattern in real life is linear or nonlinear? • How can patterns, relations, and functions be used as tools to best describe and help explain real-life situations? • How are functions and their graphs related?

• Formulate and use different strategies to solve one-step and multi-step linear inequalities, including inequalities with rational coefficients. • Write, solve, and graph one-step and multi-step inequalities in one and two variables.	• How can technology be used to investigate properties of linear functions and their graphs?
Content: Students will know… • Solve simple and multi-step equations and inequalities. • Describe how to solve equations and inequalities. • Analyze measurements used to solve a problem to judge the level of accuracy. • Apply equation solving techniques to solve real-life problems. • Compare and contrast solving inequalities with solving equations. • Apply techniques for solving inequalities to solve real-life applications. • Identify the graph of a linear function. • Graph linear functions written in different forms. • Describe the characteristics of a function. • Explain how a transformation affects the graph of a linear function.	**Skills:** Students will be able to… **Solving Linear Equations and Linear Inequalities:** • Write and solve simple equations • Solve real-life problems • Write and solve multi-step equations • Write and solve equations with variables on both sides • Write and solve absolute value equations • Rewrite equations to solve for one variable in terms of the other variable(s) • Write and graph inequalities • Write and solve inequalities using addition or subtraction • Solve inequalities using multiplication or division • Write and solve multi-step inequalities • Write, solve, and graph compound inequalities • Write, solve, and graph absolute value inequalities **Graphing and Writing Linear Equations:** • Understand that lines represent solutions of linear equations • Graph linear equations • Find slopes of lines using two points • Find slopes of lines from tables • Find slopes and y-intercepts of graphs of linear equations • Graph linear equations written in slope-intercept form • Graph linear equations written in standard form • Write equations of lines in slope-intercept form • Write equations of lines using a slope and a point • Write equations of lines using two points

- Solve real-life problems involving linear equations
- Write equations of lines in standard form
- Identify direct and inverse variation
- Write and graph direct and inverse variation equations
- Graph linear inequalities in two variables

Linear Functions

- Find the domain and range of functions from graphs or tables
- Graph discrete and continuous data
- Determine whether functions have a discrete or continuous domain
- Write linear functions from graphs or tables
- Solve linear functions and real life problems
- Evaluate, solve, and graph functions written in function notation
- Compare graphs of linear functions
- Graph piecewise, step, and absolute value functions
- Identify linear and nonlinear functions from tables or graphs

NJ Student Learning Standards - Mathematics
Content Standards: 2023 NJSLS-Mathematics (K-12)

NJ: Grade 8
Expressions and Equations

8.EE.C. Analyze and solve linear equations and pairs of simultaneous linear equations

8.EE.C.8.a Analyze and solve pairs of simultaneous linear equations.

a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. For example: by inspection, conclude that $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6. Solve $3x + y = 30$ and $y = 2x$ using the substitution method; Solve $y = 3x + 1$ and $y = -2x + 7$ using the substitution method. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

Functions

8.F.A. Define, evaluate and compare functions

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

8.F.A.3 Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

8.F.B. Use functions to model relationships between quantities

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

NJ: Grades 9-12

Number and Quantity

N.Q.A. Quantities
Reason quantitatively and use units to solve problems

N.Q.A.1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

N.Q.A.2. Define appropriate quantities for the purpose of descriptive modeling.

Algebra

A.CED.A. Creating Equations
Create equations that describe numbers or relationships

A.CED.A.1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

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

A.CED.A.4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

A.REI.A. Reasoning with Equations and Inequalities
Understand solving equations as a process of reasoning and explain the reasoning

A.REI.A.1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A.REI.B. Reasoning with Equations and Inequalities
Solve equations and inequalities in one variable

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

A.REI.D. Reasoning with Equations and Inequalities
Represent and solve equations and inequalities graphically

A.REI.D.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

A.REI.D.11. Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = f(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★

A.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.

Functions

F.BF.A. Building Functions
Build a function that models a relationship between two quantities. ★

F.BF.A.1.a Write a function that describes a relationship between two quantities.
a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

F.BF.A.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. ★

F.BF.B. Building Functions
Build new functions from existing functions
F.BF.B.3. Identify the effect on the graph of replacing $f(x)$ by $f(x)+k$, $kf(x)$, $f(kx)$, and $f(x+k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

F.IF.A. Interpreting Functions
Understand the concept of a function and use function notation

F.IF.A.1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the

equation y = f(x).

F.IF.A.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F.IF.A.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

F.IF.B. Interpreting Functions
Interpret functions that arise in applications in terms of the context

F.IF.B.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. ★

F.IF.B.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. ★

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.IF.C. Interpreting Functions
Analyze functions using different representations

F.IF.C.7.a Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★
a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

F.LE.A. Linear, Quadratic and Exponential Models
Construct and compare linear and exponential models and solve problems

F.LE.A.1.a Distinguish between situations that can be modeled with linear functions and with exponential functions.
a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

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.LE.B. Linear, Quadratic and Exponential Models
Interpret expressions for functions in terms of the situation they model

F.LE.B.5. Interpret the parameters in a linear or exponential function in terms of a context.

The Standards for Mathematical Practice:
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.

4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Career Education (Career Readiness, Life Literacies, and Key Skills Practices and 9.2 Standards)

9.2.8.CAP.15: Present how the demand for certain skills, the job market, and credentials can determine an individual's earning power.
9.2.8.CAP.20: Identify the items to consider when estimating the cost of funding a business.

CLKS Practices:

1. Demonstrate creativity and innovation
2. Utilize critical thinking to make sense of problems and persevere in solving them
3. Use technology to enhance productivity increase collaboration and communicate effectively

Connected Careers:

accountant, economist

Explanation of how 9.2 standards connect to the unit:

Students should understand how the demand for certain skills in the real world dictates job opportunities and wages. The more in demand a particular skill is, the higher the wage and vice versa.

When developing a business plan, students need to account for all the various types of expenditures such as rent, wages, insurance, materials, and inventory.

Explanation of how CLKSs connect to the unit:

As with all the units it is important for students to attend to detail when working through problems. Students will continue developing both critical thinking and perseverance when solving problems. Students are encouraged to work with their classmates. Students will share their findings and methods when solving problems. Technology will be utilized from time to time as another vehicle for problem solving and as a way to check one's work.

Explanation of how Connected Careers connect to the unit:

Equations and inequalities can be utilized by an accountant when determining profits and losses for a company. An accountant uses systems of equations to solve financial problems and make business decisions. Examples include determining break-even points, finding optimal pricing strategies, and predicting sales volumes based on past data. An economist would use linear equations when comparing supply and demand. These two professions utilize many other concepts utilized not only in this unit, but the others as well.

Interdisciplinary Standards

Literacy Connections:

W.AW.8.1 - Write arguments to support claims with clear reasons and relevant evidence.

SL.PE.8.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.

SL.PI.8.4. Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

Science Connections:

MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

Explanation of how interdisciplinary standards connect to the unit:

Students should be able to clearly and logically explain their process to their peers/teachers when solving a problem. They should be able to do so in a respectful manner where eye contact is made and adequate volume is used. Students should be able to field questions about their solution method and provide reasons why that method was used. In some cases students may realize that a more efficient/effective method could have been utilized instead. All of these conversations are critical to the learning process.

Technology Integration (9.4 Standards):

- **9.4.8.CT.2:** Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option
- **9.4.8.DC.6:** Analyze online information to distinguish whether it is helpful or harmful to reputation.

Explanation of how 9.4 standards connect to the unit:

It is important for students to investigate multiple solution methods to the same problem to look for advantages and disadvantages of each method both in the short term and long term. Students should be able to recognize useful online tools and resources and weed out the ones that are not as beneficial or useful.

Stage 2- Assessment Evidence:

Assessment:

Formative	Warm-Up Problems, Entrance Tickets, Exit Tickets, Quick Mini Quiz
Summative	Each of the three chapters will have a final test

Alternative	Project, Q&A, Problem Set
Benchmark	None within this unit
Other (optional)	I-Ready My-Path Assignments, Graded Assignments

Stage 3 - Learning Plan

Learning Activities:
Structured learning activities can be found in the teacher's daily lesson plans.

- Lessons On:
  - Solving One-Step Equations
  - Solving Multi-Step Equations
  - Modeling Quantities
  - Solving Equations with Variables on Both Sides
  - Solving Absolute Value Equations
  - Rewriting Equations and Formulas
  - Solving Word Problems Using Equations
  - Writing and Graphing Inequalities
  - Solving One-Step Inequalities
  - Solving Multi-Step Inequalities
  - Solving Compound Inequalities
  - Solving Absolute Value Inequalities
  - Solving Word Problems Using Inequalities
  - Functions
  - Characteristics of Functions
  - Linear Functions
  - Function Notation
  - Graphing Linear Equations in Standard Form
  - Graphing Linear Equations in Slope-Intercept Form
  - Writing Equations in Slope-Intercept Form
  - Writing Equations in Point-Slope Form
  - Writing Equations of Parallel and Perpendicular Lines

Suggested activities include:
  - Use graphing calculators to identify

Differentiation:

English Language Learners:
The ELL Math Resources Folder is located here

- Point out key ideas and vocabulary
- Limit the number of items on tests or homework
- Give verbal as well as written directions / clarify directions

Gifted and Talented:
- Provide enriching problem of the weeks for students to complete
- Engage students in higher level problem solving tasks
- Enable enrichment centers in each classroom which promote student's mathematical inquiry

Special Education Students:
- Break down complex problems into manageable / attainable tasks
- Provide copy of class notes
- Use of calculator

Students with 504 plans:

- Provide tools, manipulatives and graph papers
- Break down complex problems into smaller tasks
- Provide copy of class notes

Students at Risk of school failure:

key features ○ Demonstrating slope using a step	• Encourage "Mathematical Mindset" by pointing out successes • Provide one-on-one instruction when needed • Provide copy of class notes **Links to Math Differentiation Chart and Accommodations Chart**

Core and Supplementary Instructional Materials

Teacher Pedagogical Resources:

ISBN - Title - Publisher

978-1-64727-417-7 - Algebra I - Big Ideas with CalcChat and CalcView

Big Ideas Algebra I Textbook
https://www.illustrativemathematics.org/
http://map.mathshell.org/tasks.php
Kuta Infinite Algebra 1
www.desmos.com

Student Materials:

ISBN - Title - Publisher

978-1-64727-417-7 - Algebra I - Big Ideas with CalcChat and CalcView

Big Ideas Algebra I Textbook
Big Ideas Algebra I Workbook
Student Notebook
Chromebook
https://www.illustrativemathematics.org/
http://map.mathshell.org/tasks.php
Kuta Infinite Algebra 1
Graphing calculators and emulators
www.desmos.com

Notes:
Inclusion of Climate Change Opportunities

Students may create equations and/or inequalities to represent the economic impact of climate change.

Students may use the equation of a linear model to interpret the slope when comparing local and global precipitation rates for rainfall in different regions.

Course: Algebra I (BMS)

Unit # 2: Linear Systems and Exponential Functions

Grade Level(s): 7-8	**Length of Unit: 7 Weeks (Complete chapters 5 and 6 in the textbook)**

Unit Rationale: The primary focus of this unit is to understand systems of linear equations along with exponential functions and sequences. Students will learn different methods of solving a system of linear equations and be able to analyze systems and decide what solution method is the most efficient. Students will learn how to predict whether a system of linear equations has one solution, no solution, or infinitely many solutions. Students will learn how to identify and describe exponential functions, specifically exponential growth and decay. Model using an exponential function or a geometric sequence.

Stage 1 Desired Results

Enduring Understandings:	**Essential Questions:**
Students will understand that… • Reason about and solve simple one-variable equations and inequalities. • Write and solve one-step and two-step linear equations in one variable with one solution, no solution, or infinitely many solutions. • Solve systems of two linear equations in two variables algebraically and graphically. • Graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half planes. • Extend understanding of numbers to the system of rational numbers. • Evaluate expressions involving whole-number exponents. • Reason about and solve one variable equations. • Use rational numbers to approximate irrational numbers. • Work with radicals and integer exponents. • Solve real-life and mathematical problems using	• How can you solve a system of linear equations? • Can a system of linear equations have no solutions? Or many solutions? • How can systems of equations be used to solve real-life problems? • How can you sketch the graph of a system of linear inequalities? • What are the rules for multiplying and dividing square roots? • How can you use inductive reasoning to observe patterns and write general rules involving properties of exponents? • What are the characteristics of an exponential function? • How can we model situations using exponents? • What are the characteristics of exponential growth functions? Exponential decay functions? • How are linear and exponential functions similar? How are they different?

numerical and algebraic • expressions and equations. • Use properties of rational and irrational numbers. • Extend the properties of exponents to rational exponents. • Write and graph exponential equations and functions to model, analyze, and solve real-world problems.	
Content: Students will know… • Understand solving systems of linear equations and inequalities. • How to describe different methods of solving a system of linear equations. • Analyze systems of linear equations and decide what solution method is most efficient. • Predict how many solutions a system of linear equations will have. • Solve equations and inequalities in one variable. • Solve systems of equations. • Understand exponential functions and sequences. • Identify and use properties of exponents. • Describe exponential functions. • Analyze data, a graph, or a context to determine whether it represents exponential growth or decay. • Model using an exponential function or a geometric sequence.	**Skills:** Students will be able to… • Solve Systems of Equations and Inequalities • Write and solve systems of linear equations by graphing • Solve real-life problems • Write and solve systems of linear equations by substitution • Write and solve systems of linear equations by elimination • Solve systems of linear equations having no solution or infinitely many solutions • Solve linear equations by graphing a system of linear equations • Write and graph systems of linear inequalities in two variables Exponents and Exponential Functions • Simplify and evaluate square roots and radical expressions • Identify rational numbers vs irrational numbers • Use properties of exponents involving products • Use properties of exponents involving quotients • Use zero and negative exponents • Identify, evaluate, and graph exponential functions • Solve exponential equations algebraically and graphically • Identify, evaluate, and graph exponential growth functions • Identify, evaluate, and graph exponential decay functions • Identify exponential growth and decay functions
NJ Student Learning Standards - Mathematics **Content Standards:** 2023 NJSLS-Mathematics (K-12)	

NJ: 2023 SLS: Mathematics

NJ: Grade 8

Expressions and Equations

8.EE.C. Analyze and solve linear equations and pairs of simultaneous linear equations

8.EE.C.8.a Analyze and solve pairs of simultaneous linear equations.
a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.

Functions

8.F.A. Define, evaluate and compare functions

8.F.A.2 Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

8.F.B. Use functions to model relationships between quantities

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

NJ: Grades 9-12

Number and Quantity

N.RN.A. The Real Number System
Extend the properties of exponents to rational exponents

N.RN.A.1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.

N.RN.A.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.

N.Q.A. Quantities
Reason quantitatively and use units to solve problems

N.Q.A.1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
N.Q.A.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Algebra

A.CED.A. Creating Equations ★
Create equations that describe numbers or relationships

A.CED.A.1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. ★

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

A.CED.A.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. ★

A.REI.B. Reasoning with Equations and Inequalities
Solve equations and inequalities in one variable

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

A.REI.C. Reasoning with Equations and Inequalities
Solve systems of equations

A.REI.C.5. (+) Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

A.REI.C.6. Solve systems of linear equations algebraically (include using the elimination method) and graphically, focusing on pairs of linear equations in two variables.

A.REI.D. Reasoning with Equations and Inequalities
Represent and solve equations and inequalities graphically

A.REI.D.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

A.REI.D.11. Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = f(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★

A.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.SSE.A. Seeing Structure in Expressions
Interpret the structure of expressions

A.SSE.A.1.a Interpret expressions that represent a quantity in terms of its context. ★
a. Interpret parts of an expression, such as terms, factors, and coefficients.

Functions

F.BF.A. Building Functions
Build a function that models a relationship between two quantities. ★

F.BF.A.1.a Write a function that describes a relationship between two quantities.
a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

F.BF.A.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. ★

F.BF.B. Building Functions
Build new functions from existing functions

F.BF.B.3. Identify the effect on the graph of replacing f(x) by f(x)+k, kf(x), f(kx), and f(x+k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

F.IF.A. Interpreting Functions
Understand the concept of a function and use function notation

F.IF.A.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

F.IF.C. Interpreting Functions
Analyze functions using different representations

F.IF.C.7.a Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★
a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

F.IF.C.8.a Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

F.IF.C.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

F.LE.A. Linear, Quadratic and Exponential Models
Construct and compare linear and exponential models and solve problems

F.LE.A.1.a Distinguish between situations that can be modeled with linear functions and with exponential functions.
a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

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.LE.B. Linear, Quadratic and Exponential Models
Interpret expressions for functions in terms of the situation they model
F.LE.B.5. Interpret the parameters in a linear or exponential function in terms of a context.

NJ: HS: Num/Quantity

The Real Number System

HSN-RN.B. Use properties of rational and irrational numbers.

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

Career Education (Career Readiness, Life Literacies, and Key Skills Practices and 9.2 Standards)

CLKS Practices:

1. Consider the environmental, social and economic impacts of decisions
2. Utilize critical thinking to make sense of problems and persevere in solving them
3. Use technology to enhance productivity increase collaboration and communicate effectively

Connected Careers:

financial planner

Explanation of how CLKSs connect to the unit:
As with all the units it is important for students to attend to detail when working through problems. Students will continue developing both critical thinking and perseverance when solving problems. Students are encouraged to work with their classmates. Students will share their findings and methods when solving problems. Technology will be utilized from time to time as another vehicle for problem solving and as a way to check one's work. When students are learning about compound interest they should consider what might happen if they do not have enough money for retirement. Students will investigate and determine when investing in their retirement should start based upon how much they think they should have at retirement age.

Explanation of how Connected Careers connect to the unit:
A financial planner is going to use the compound interest formula when reviewing different strategies for a client's retirement. It is important for clients to see how starting early and increasing their retirement contributions over time has big impacts later on in life.

Interdisciplinary Standards

Literacy Connections:

W.AW.8.1 - Write arguments to support claims with clear reasons and relevant evidence.

SL.PI.8.4. Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

Science Connections:

MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems

Explanation of how interdisciplinary standards connect to the unit:
Students should be able to clearly and logically explain their process to their peers/teachers when solving a problem. They should be able to do so in a respectful manner where eye contact is made and adequate volume is used. Students should be able to field questions about their solution method and provide reasons why that method was used. In some cases students may realize that a more efficient/effective method could have been utilized instead. All of these conversations are critical to the learning process.

Technology Integration (9.4 Standards):

- **9.4.8.CT.2:** Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option
- **9.4.2.TL.3:** Enter information into a spreadsheet and sort the information.

Explanation of how 9.4 standards connect to the unit:

It is important for students to investigate multiple solution methods to the same problem to look for advantages and disadvantages of each method both in the short term and long term. Students will use a spreadsheet to organize and input data into a compound interest calculator to run retirement simulations.

Stage 2- Assessment Evidence:

Assessment:

Formative	Warm-Up Problems, Entrance Tickets, Exit Tickets, Quick Mini Quiz, Homework Checks
Summative	Each of the two chapters will have a final test.
Alternative	Project, Q&A, Problem Set
Benchmark	Students will take the I-Ready Diagnostic Assessment
Other (optional)	I-Ready My-Path Assignments, Graded Assignments

Stage 3 - Learning Plan

Learning Activities:

- Lessons On:
  - Solving systems of linear equations by graphing
  - Solving systems of linear equations by substitution
  - Solving systems of linear equations by elimination
  - Solving special systems of linear equations (includes no solution and infinitely many solutions)
  - Solving equations by graphing
  - Graphing linear inequalities in two variables
  - Graphing systems of inequalities
  - Zero and negative exponents
  - Multiplication properties of exponents (includes power to a power)
  - Solving exponential equations
  - Division properties of exponents
  - Exponential functions
  - Exponential growth and decay
- Suggested activities include
  - Discovery of properties by expansion of simple expressions with exponents
  - Use PEMDAS to as a pneumonic device to remember properties of exponents
  - Use graphing calculators to solve exponential equations using a graph or table

Differentiation:

English Language Learners:
The ELL Math Resources Folder is located here

- Point out key ideas and vocabulary
- Limit the number of items on tests or homework
- Give verbal as well as written directions / clarify directions

Gifted and Talented:

- Provide enriching problem of the weeks for students to complete
- Engage students in higher level problem solving tasks
- Enable enrichment centers in each classroom which promote student's mathematical inquiry

Special Education Students:

- Break down complex problems into manageable / attainable tasks
- Provide copy of class notes
- Use of calculator

Students with 504 plans:

- Provide tools, manipulatives and graph papers
- Break down complex problems into

○ Use graphing calculators to solve systems of equations using a graph or table	smaller tasks • Provide copy of class notes **Students at Risk of school failure:** • Encourage "Mathematical Mindset" by pointing out successes • Provide one-on-one instruction when needed • Provide copy of class notes **Links to Math Differentiation Chart and Accommodations Chart**

Core and Supplementary Instructional Materials

Teacher Pedagogical Resources:

ISBN - Title - Publisher

978-1-64727-417-7 - Algebra I - Big Ideas with CalcChat and CalcView

Big Ideas Algebra I Textbook
https://www.illustrativemathematics.org/
http://map.mathshell.org/tasks.php
Kuta Infinite Algebra 1
www.desmos.com

Student Materials:

ISBN - Title - Publisher

978-1-64727-417-7 - Algebra I - Big Ideas with CalcChat and CalcView

Big Ideas Algebra I Textbook
Big Ideas Algebra I Workbook
Student Notebook

Chromebook
https://www.illustrativemathematics.org/
http://map.mathshell.org/tasks.php
Kuta Infinite Algebra 1
Graphing calculators and emulators

Notes:
Inclusion of Climate Change Opportunities

Students may represent constraints describing the economic impact of climate change by equations, inequalities, and/or by systems of inequalities, and interpret solutions as viable or nonviable options.

Students may use the equation of a linear model to interpret the slope when comparing local and global precipitation rates for rainfall in different regions.

Course: Algebra I (BMS)

Unit # 3: Polynomials and Quadratic Functions

Grade Level(s): 7-8	**Length of Unit: 13 Weeks (Complete chapters 7, 8 and 9 in the textbook)**

Unit Rationale: Unit 3 consists of polynomial equations and factoring along with graphing and solving quadratic functions. Students will perform operations with polynomials and factoring polynomials to solve problems. Students will spend time graphing quadratics while identifying and describing the graphs. Students will solve quadratic functions using a variety of methods.

Stage 1 - Desired Results

Enduring Understandings:	**Essential Questions:**
Students will understand that….. • Evaluate algebraic expressions at specific values of their variables. • Solve one-step linear equations. • Evaluate algebraic expressions at specific values of their variables. • Solve one-step linear equations. • Perform arithmetic operations on polynomials. • Solve problems involving polynomial equations by factoring. • Solve unit rate problems. • Use equations, tables, and graphs to express and analyze linear relationships between independent variables and dependent variables.	• What are the different methods for solving quadratic equations? When is each appropriate? • How can the discriminant be used to explore the types of quadratic functions? • What are the similarities and differences between algebraic and graphical representations of quadratic functions? • How do the algebraic properties of a function relate to the graphical properties of a function, or vice versa? • What are the relationships between zeros, roots, and intercepts?

• Describe the effect of transformations on two-dimensional figures. • Analyze proportional relationships using tables, graphs, equations, and so on, interpreting the unit rate as the slope of the graph. • Describe the relationship between a line and its equation. • Graph quadratic functions and interpret key features of their graphs. • Describe how various changes in a quadratic equation affect its graph. • Compare the rates of change of linear, exponential, and quadratic functions using graphs and tables. • Write and solve one-step linear equations in one variable. • Evaluate expressions at specific values of their variables. • Write and solve multi-step linear equations in one variable with one solution, no solution, or infinitely many solutions. • Evaluate square roots of perfect squares. • Solve quadratic equations in one variable by graphing, using square roots, completing the square, and using the quadratic formula. • Derive the quadratic formula by completing the square. • Solve a system of equations consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.	• How is operating (adding, subtracting, and multiplying) with polynomial expressions the same or different than operating with numeric expressions? • How is factoring a polynomial like factoring a number? • Why does a quadratic equation have two possible solutions? • What is the significance of the zero product property?
Content: Students will know… • Classify polynomials by degree and number of terms. • Add, subtract, multiply, and divide polynomials. • Solve polynomial equations. • Factor polynomials and use factoring to solve real life problems. • Identify characteristics of quadratic functions. • Describe how to graph quadratic functions in different forms. • Find zeros of functions using intercept form. • Choose an appropriate function to model data. • Simplify expressions using properties of radicals • Describe different methods for solving quadratic	**Skills:** Students will be able to… **Polynomials and Factoring** • Add and subtract polynomials • Multiply polynomials • Use special product patterns to multiply polynomials • Solve polynomial equations in factored form • Factor trinomials of the form x^2+bx+c • Factor trinomials of the form ax^2+bx+c • Factor special products • Factor polynomials completely **Graphing Quadratic Equations and Functions**

equations. • Solve quadratic equations. • Solve nonlinear systems of equations	• Graph simple quadratic functions • Graph general quadratic functions • Graph quadratic functions in intercept form • Graph quadratic functions in vertex form • Write a quadratic equation given its roots or its graph • Conversions of Quadratic Functions **Solving Quadratic Equations** • Solve a quadratic equation by graphing • Solve a quadratic equation by using square roots • Solve a quadratic equation by completing the square • Use the quadratic formula to solve quadratic equations • Choose a solutions method • Solve systems of linear and quadratic equations

NJ Student Learning Standards - Mathematics

NJ: 2023 SLS: Mathematics

NJ: Grade 8

Functions

8.F.B. Use functions to model relationships between quantities

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

NJ: Grades 9-12

Algebra

A.APR.A. Arithmetic with Polynomials and Rational Expressions
Perform arithmetic operations on 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.

A.CED.A. Creating Equations ★
Create equations that describe numbers or relationships

A.CED.A.1. Create equations and inequalities in one variable and use them to solve problems. Include

equations arising from linear and quadratic functions, and simple rational and exponential functions.

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

A.REI.B. Reasoning with Equations and Inequalities
Solve equations and inequalities in one variable

A.REI.B.4.a Solve quadratic equations in one variable.
a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.

A.REI.C. Reasoning with Equations and Inequalities
Solve systems of equations

A.REI.C.7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.

A.REI.D. Reasoning with Equations and Inequalities
Represent and solve equations and inequalities graphically

A.REI.D.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

A.REI.D.11. Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = f(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★

A.SSE.A. Seeing Structure in Expressions
Interpret the structure of expressions

A.SSE.A.1.a Interpret expressions that represent a quantity in terms of its context. ★
a. Interpret parts of an expression, such as terms, factors, and coefficients.

A.SSE.A.2. Use the structure of an expression to identify ways to rewrite it.

A.SSE.B. Seeing Structure in Expressions
Write expressions in equivalent forms to solve problems

A.SSE.B.3.a Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★
a. Factor a quadratic expression to reveal the zeros of the function it defines.

Functions

F.BF.B. Building Functions

Build new functions from existing functions

F.BF.B.3. Identify the effect on the graph of replacing f(x) by f(x)+k, kf(x), f(kx), and f(x+k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

F.IF.B. Interpreting Functions
Interpret functions that arise in applications in terms of the context

F.IF.B.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. ★

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.IF.C. Interpreting Functions
Analyze functions using different representations

F.IF.C.7.a Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★
a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

F.IF.C.8.a Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

F.LE.A. Linear, Quadratic and Exponential Models
Construct and compare linear and exponential models and solve problems

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.

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

Career Education (Career Readiness, Life Literacies, and Key Skills Practices and 9.2 Standards)

9.2.8.CAP.15: Present how the demand for certain skills, the job market, and credentials can determine an individual's earning power.

CLKS Practices:

1. Demonstrate creativity and innovation
2. Utilize critical thinking to make sense of problems and persevere in solving them
3. Use technology to enhance productivity increase collaboration and communicate effectively

Connected Careers:

Engineer

Explanation of how 9.2 standards connect to the unit:

Students should understand how the demand for certain skills in the real world dictates job opportunities and wages. The more in demand a particular skill is, the higher the wage and vice versa. It is also important that as a particular industry changes over time that you adapt to those changes to keep yourself marketable.

Explanation of how CLKSs connect to the unit:

As with all the units it is important for students to attend to detail when working through problems. Students will continue developing both critical thinking and perseverance when solving problems. Students are encouraged to work with their classmates. Students will share their findings and methods when solving problems. Technology will be utilized from time to time as another vehicle for problem solving and as a way to check one's work. Students will use a graphing calculator when working with quadratic functions.

Explanation of how Connected Careers connect to the unit:
One common application is in the analysis of projectile motion. Engineers use the quadratic formula to determine the time of flight, range, and maximum height of a projectile by solving the equations of motion under the influence of gravity.

Interdisciplinary Standards

Literacy Connections:

W.AW.8.1 - Write arguments to support claims with clear reasons and relevant evidence.

SL.PI.8.4. Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

RI.CR.8.1. Cite a range of textual evidence and make clear and relevant connections (including informational text features such as charts, graphs, and diagrams) that strongly support an analysis of multiple aspects of what an informational text says explicitly, as well as inferences drawn from the text.

Science Connections:

MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems

Explanation of how interdisciplinary standards connect to the unit:
Students should be able to clearly and logically explain their process to their peers/teachers when solving a problem. They should be able to do so in a respectful manner where eye contact is made and adequate volume is used. Students should be able to field questions about their solution method and provide reasons why that method was used. In some cases students may realize that a more efficient/effective method could have been utilized instead. All of these conversations are critical to the learning process.

Technology Integration (9.4 Standards):

- **9.4.8.CT.2:** Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option
- **9.4.8.DC.6:** Analyze online information to distinguish whether it is helpful or harmful to reputation.

Explanation of how 9.4 standards connect to the unit:

It is important for students to investigate multiple solution methods to the same problem to look for advantages and disadvantages of each method both in the short term and long term. Students should be able to recognize useful online tools and resources and weed out the ones that are not as beneficial or useful.

Stage 2 - Assessment Evidence:

Assessment:

Formative	Warm-Up Problems, Entrance Tickets, Exit Tickets, Quick Mini Quiz, Homework Checks
Summative	Each chapter in the unit will have a final test
Alternative	Project, Q&A, Problem Set
Benchmark	No benchmark given within this unit. (see Unit 4)
Other (optional)	I-Ready, My-Path Assignments, Graded Assignments

Stage 3 - Learning Plan

Learning Activities:

- Lessons On:
  - Adding and subtracting polynomials
  - Multiplying polynomials

Differentiation:

English Language Learners:
The ELL Math Resources Folder is located here

- Factoring greatest common factor
- Factoring quadratic expressions
- Quadratic parent function and transformations
- Graphing quadratic functions given vertex form
- Graphing quadratic functions given standard form
- Find the zeros of a quadratic equation
- Solving quadratic equations by square roots
- Solving quadratic equations by factoring
- Solving quadratic equations by complete the square
- Solving quadratic equations by Quadratic Formula
- Solving a quadratic equation using multiple methods that produce the same solutions.
- Rational and irrational numbers
- Adding and subtracting square roots
- Multiplying and dividing square roots

- Suggested activities include
  - Showing different methods of multiplying polynomials
  - Showing different methods of factoring polynomials

- Point out key ideas and vocabulary
- Limit the number of items on tests or homework
- Give verbal as well as written directions / clarify directions

Gifted and Talented:

- Provide enriching problem of the weeks for students to complete
- Engage students in higher level problem solving tasks
- Enable enrichment centers in each classroom which promote student's mathematical inquiry

Special Education Students:

- Break down complex problems into manageable / attainable tasks
- Provide copy of class notes
- Use of calculator

Students with 504 plans:

- Provide tools, manipulatives and graph papers
- Break down complex problems into smaller tasks
- Provide copy of class notes

Students at Risk of school failure:

- Encourage "Mathematical Mindset" by pointing out successes
- Provide one-on-one instruction when needed
- Provide copy of class notes

Links to Math Differentiation Chart and Accommodations Chart

Core and Supplementary Instructional Materials

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978-1-64727-417-7 - Algebra I - Big Ideas with CalcChat and CalcView

Big Ideas Algebra I Textbook
https://www.illustrativemathematics.org/
http://map.mathshell.org/tasks.php
Kuta Infinite Algebra 1
www.desmos.com

Student Materials:

ISBN - Title - Publisher

978-1-64727-417-7 - Algebra I - Big Ideas with CalcChat and CalcView

Big Ideas Algebra I Textbook
Big Ideas Algebra I Workbook
Student Notebook
Chromebook
https://www.illustrativemathematics.org/
http://map.mathshell.org/tasks.php
Kuta Infinite Algebra 1
Graphing calculators and emulators

Notes:
Inclusion of Climate Change Opportunities

Students may calculate the average rate of change of a function c(m) presented symbolically or as a table, where c(m) represents the amount of carbon dioxide produced by burning a given number of molecules of ethane (gasoline).

Students may use function notation to determine the amount of carbon dioxide produced by burning a given number of molecules of ethane (gasoline), m, where c(m) is the number of molecules of carbon dioxide.

Revised: 2024

Course: Algebra I (BMS)

Unit # 4: Data Analysis, Scientific Notation and Geometry.

Grade Level(s): 7-8	**Length of Unit: 8 Weeks** (Complete chapter 11 and supplement from other resources)

Unit Rationale: Through the topics of data analysis and descriptive statistics this unit provides students with the opportunities to represent data with plots, to describe the shape of a data distribution, and to interpret the data they observe. Students may also distinguish situations that can be modeled differently by building on their previous work with linear, quadratic, and exponential equations along with their graphical models. Students will work with numbers in scientific notation. Certain geometry topics such as the Pythagorean Theorem will be covered.

Stage 1 - Desired Results

Enduring Understandings:

Students will understand that…..

- Mathematical models can be used to describe and quantify physical relationships.
- Physical models can be used to clarify mathematical relationships.
- Depending on data sets certain plots are better than others to represent the data.
- The statistical description and summary of data can be used to support or refute an argument.
- Scientific Notation is a way to write very large or small numbers in convenient form.
- The derivation and application of the Pythagorean Theorem.

Essential Questions:

- How can we use measures of central tendency?
- How can we measure the dispersion of a data set?
- How can we use a box-and-whisker plot to describe a data set?
- How can we use a histogram to characterize the basic shape of a distribution?
- How can we use data to predict an event?
- How can you find a line that best models a data set?
- How can you read and construct a two-way table?
- What are the similarities and differences between correlation and causation? What types of situations are appropriate for each?
- How are the lengths of the sides of a right triangle related?
- How can we use the Pythagorean Theorem?
- How can you read numbers that are written in scientific notation?
- How can you write a number in scientific notation?
- How can you perform operations with numbers written in scientific notation?

Content:	**Skills:**
Students will know…	Students will be able to…

- Summarize, represent, and interpret data on a single count or measurement variable.
- Summarize, represent, and interpret data on two categorical and quantitative variables.
- Interpret linear models.
- Build a function that models a relationship between two quantities.
- Construct and compare linear, quadratic, and exponential models and solve problems.
- Write numbers in Scientific Notation
- Convert numbers to and from Scientific Notation
- Add, Subtract, Multiply, and Divide numbers in Scientific Notation.
- Derive the Pythagorean Theorem.
- Apply the Pythagorean Theorem to solve real-life applications.

Data Analysis and Displays:

- Find the mean, median, and mode of a data set
- Identify and remove outliers
- Explain the effects of changing values in data sets.
- Find ranges of data sets
- Compare spreads of data sets
- Find standard deviations of data sets
- Make and interpret box-and-whisker plots
- Find interquartile ranges of data sets
- Compare box-and-whisker plots
- Describe shapes of distributions
- Choose appropriate measures of central tendency and dispersion to represent data sets
- Interpret scatter plots
- Identify relationships from scatter plots
- Find lines of fit
- Use residuals to determine whether models are a good fit
- Find lines of best fit using technology
- Identify correlations and causations
- Read two-way tables
- Make two-way tables
- Find relationships in two-way tables
- Solve real-life problems

Geometry:

- Discover the Pythagorean Theorem
- Find missing sides lengths of right triangles
- Identify right triangles
- Find distances between two points
- Solve real-life problems

Scientific Notation:

- Identify and compare numbers in scientific notation. Write numbers in standard form.
- Write large and small numbers in scientific notation, and perform operations with numbers written in scientific notation.

	• Multiply and divide numbers written in scientific notation

NJ Student Learning Standards - Mathematics

NJ: 2023 SLS: Mathematics

NJ: Grade 8

Geometry

8.G.B. Understand and apply the Pythagorean Theorem

8.G.B.6 Explain a proof of the Pythagorean Theorem and its converse.

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.

8.G.B.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
8.G.C Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres

Expressions and Equations

8.EE.A. Work with radicals and integer exponents

8.EE.A.3 Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.

8.EE.A.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

Statistics and Probability

8.SP.A. Investigate patterns of association in bivariate data

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

8.SP.A.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

NJ: Grades 9-12

Number and Quantity

N.Q.A. Quantities
Reason quantitatively and use units to solve problems
N.Q.A.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Statistics and Probability

S.ID.A. Interpreting Categorical and Quantitative Data
Summarize, represent, and interpret data on a single count or measurement variable
S.ID.A.1. Represent data with plots on the real number line (dot plots, histograms, and box plots).

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).

S.ID.B. Interpreting Categorical and Quantitative Data
Summarize, represent, and interpret data on two categorical and quantitative variables

S.ID.B.6.a Represent data on two quantitative variables on a scatter plot and describe how the variables are related.
a. Fit a function to the data (including with 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 and exponential models.

S.ID.B.5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

S.ID.C. Interpreting Categorical and Quantitative Data
Interpret linear models
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.

Content Standards: 2023 NJSLS-Mathematics (K-12)
Mathematics: New Jersey Student learning standards (NJSLS)

The Standards for Mathematical Practice:
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.

6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Career Education (Career Readiness, Life Literacies, and Key Skills Practices and 9.2 Standards)

CLKS Practices:

1. Consider the environmental, social and economic impacts of decisions
2. Utilize critical thinking to make sense of problems and persevere in solving them
3. Use technology to enhance productivity increase collaboration and communicate effectively

Connected Careers:

Statistician, architect

Explanation of how CLKSs connect to the unit:
As with all the units it is important for students to attend to detail when working through problems. Students will continue developing both critical thinking and perseverance when solving problems. Students are encouraged to work with their classmates. Students will share their findings and methods when solving problems. Technology will be utilized from time to time as another vehicle for problem solving and as a way to check one's work. Students will use geometry tools on their ChromeBooks to assist in the learning process.

Explanation of how Connected Careers connect to the unit:
A statistician is going to analyze a lot of data on a daily basis. They will use lines of best fit when making future projections based upon historical data and trends. An architect is going to be working with geometry on a day to day basis working with angles and triangles. Architects use the Pythagorean Theorem to calculate the heights of buildings and the lengths of walls.

Interdisciplinary Standards

Literacy Connections:

W.AW.8.1 - Write arguments to support claims with clear reasons and relevant evidence.

RI.CR.8.1. Cite a range of textual evidence and make clear and relevant connections (including informational text features such as charts, graphs, and diagrams) that strongly support an analysis of multiple aspects of what an informational text says explicitly, as well as inferences drawn from the text.

Science Connections:

MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems

Explanation of how interdisciplinary standards connect to the unit:
Students should be able to clearly and logically explain their process to their peers/teachers when solving a

problem. They should be able to do so in a respectful manner where eye contact is made and adequate volume is used. Students should be able to field questions about their solution method and provide reasons why that method was used. In some cases students may realize that a more efficient/effective method could have been utilized instead. All of these conversations are critical to the learning process.

Technology Integration (9.4 Standards):

- **9.4.8.CT.2:** Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option
- **9.4.2.IML.2:** Represent data in a visual format to tell a story about the data

Explanation of how 9.4 standards connect to the unit:

It is important for students to investigate multiple solution methods to the same problem to look for advantages and disadvantages of each method both in the short term and long term. Students will be able to organize data into multiple representations that tell a story about the data. (For example, on a scatter plot the more hours you spend practicing math, the higher your grades are. The more time you spend on your phone each night the lower your grades are.)

Stage 2- Assessment Evidence:	
Assessment:	
Formative	Warm-Up Problems, Entrance Tickets, Exit Tickets, Quick Mini Quiz, Homework Checks
Summative	Each chapter will have a final test.
Alternative	Project, Q & A, Problem Set
Benchmark	Students will take the I-Ready Diagnostic Assessment (June)
Other (optional)	I-Ready My-Path Assignments, Graded Assignments

Stage 3 - Learning Plan	
Learning Activities: Lessons On: ○ Measures of center and variation ○ Box-and-whisker plots	**Differentiation:** **English Language Learners:** The ELL Math Resources Folder is located here

- Shapes of distributions
- Two-Way Tables
- Discover the Pythagorean Theorem
- Find missing sides lengths of right triangles
- Identify right triangles
- Find distances between two points
- Solve real-life problems
- Use Scientific Notation
- Identify and compare numbers in scientific notation. Write numbers in standard form.
- Write large and small numbers in scientific notation, and perform operations with numbers written in scientific notation.
- Multiply and divide numbers written in scientific notation

- Point out key ideas and vocabulary
- Limit the number of items on tests or homework
- Give verbal as well as written directions / clarify directions

Gifted and Talented:

- Provide enriching problem of the weeks for students to complete
- Engage students in higher level problem solving tasks
- Enable enrichment centers in each classroom which promote student's mathematical inquiry

Special Education Students:

- Break down complex problems into manageable / attainable tasks
- Provide copy of class notes
- Use of calculator

Students with 504 plans:

- Provide tools, manipulatives and graph papers
- Break down complex problems into smaller tasks
- Provide copy of class notes

Students at Risk of school failure:

- Encourage "Mathematical Mindset" by pointing out successes
- Provide one-on-one instruction when needed
- Provide copy of class notes

Links to Math Differentiation Chart and Accommodations Chart

Core and Supplementary Instructional Materials

Teacher Pedagogical Resources:

ISBN - Title - Publisher

978-1-64727-417-7 - Algebra I - Big Ideas with CalcChat and CalcView

Big Ideas Algebra I Textbook
https://www.illustrativemathematics.org/
http://map.mathshell.org/tasks.php
Kuta Infinite Algebra 1
www.desmos.com

Student Materials:

ISBN - Title - Publisher

978-1-64727-417-7 - Algebra I - Big Ideas with CalcChat and CalcView

Big Ideas Algebra I Textbook
Big Ideas Algebra I Workbook
Student Notebook
Chromebook
https://www.illustrativemathematics.org/
http://map.mathshell.org/tasks.php
Kuta Infinite Algebra 1
Graphing calculators and emulators

Notes:
Inclusion of Climate Change Opportunities

Students may use circles, their measures, and their properties to describe the cross section of a tree and compare changes in radial diameter or circumference variations of tree trunks when considering changes in seasonal weather patterns over time.

Students may construct and interpret scatterplots of measurement data to investigate patterns of association in bivariate data involving the amount of a greenhouse gas in the atmosphere and its effect on temperature.