Wall Township Public Schools	Board Approval Date: 8/19/2025

Course Title: Integrated Modern Algebra

Course Description: The curriculum for Integrated Modern Algebra is based on the belief that mastery in learning takes place over an extended period. When a skill or concept is introduced and practiced, students develop familiarity with it. This course intends to enable students to move toward independent learning within the context of review and extension of these skills with an introduction to topics essential for further study of mathematics. Emphasis is placed on the reinforcement of fundamental skills and concepts. The course focuses on essential geometric concepts, a study of right triangle trigonometry, families of functions, including linear, quadratic, exponential, and rational functions. Students are introduced to the complex number system. As this course follows Algebra 1 and Geometry, students who complete this course will meet the NJDOE three-year mathematics graduation requirement. Students who complete and wish to continue to pursue mathematics at Wall High School can enroll in Algebra 2 CP. As this is a non-required precursor for Algebra 2 CP, students who have completed Algebra 2 CP are not eligible to take this course.

New Jersey Student Learning Standards - Math

Vision for Mathematics Education in New Jersey

A New Jersey education in Mathematics builds quantitatively and analytically literate citizens prepared to meet the demands of college and career, and to engage productively in an information-driven society. All students will have access to a high-quality mathematics education that fosters a population that:

- leverages data in decision-making and as a lens for discussing, analyzing, and responding to practical questions.
- persists to make sense of and model problems arising in everyday life, society, and the workplace.
- thinks critically and strategically to assess quantitative relationships and to solutions to complex problems.
- employs precise reasoning and constructs viable arguments to deduce conclusions, recognize false statements and assess peers' reasoning.
- interprets, evaluates and critiques the mathematics embedded in social, scientific and commercial systems, as well as the claims made in the private and public sectors.
- communicates precisely when conveying, representing, and justifying both qualitative and quantitative perspectives.

Standards for Mathematical Practice*

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report Adding It Up: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

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

Inclusion of Climate Change Opportunities

( ) notes opportunities to integrate specific examples of climate change education provided by additional age-appropriate resources

The goal of inclusion of climate change education implementation is to foster generations of New Jersey students that can analyze, question, interpret, to think independently, and bring critical deduction to fulfill, and to lead in jobs created by burgeoning industries of the future green economy.

Course Sequence & Pacing	
Unit Title	**Estimated Number of Instructional Periods**
Unit 1: Basics of Geometry: Angles, Segments, Area, and Volume	15
Unit 2: Advanced Geometry: Right Triangle Trigonometry and Circles	15
Unit 3: Reading Graphs and Functions	8
Unit 4: Linear Functions	13
Unit 5: Linear Systems and Inequalities	15
Unit 6: Solving Quadratic Functions and Systems	17
Unit 7: Graphing Quadratic Functions and Systems	13
Unit 8: Exponential Functions and Radical Functions	17
Unit 9: Rational Functions	12
Total Instructional Periods	125

Current instructional periods are 56 minutes and meet 3 times every 4 days.

Unit 1

Desired Results

Unit 1: Basics of Geometry: Angles, Segments, Area, and Volume

Unit Summary: Geometric figures help us to describe and understand the world around us. Students can model real-world situations by exploring geometric relationships and improving their inductive and deductive reasoning skills. Students will start this unit by reviewing algebra skills involving expressions, equations, and operations of expressions. Students then study the midpoint and distance formulas as they relate to geometric figures and then apply this to segment addition and bisectors. Students then explore relationships between angles which helps them draw and interpret angles in diagrams, figures, and different types of lines cut by a transversal.

Learning Standards

NJSLS Math:

- A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
- A.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression
  - a. Factor a quadratic expression to reveal the zeros of the function it defines.
  - b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
  - c. Use the properties of exponents to transform expressions for exponential functions.
- A.APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
- G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

- ➢ G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
- ➢ G.CO.9 Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment endpoints.

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Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

9.4.12.TL.3 Analyze the effectiveness of the process and quality of collaborative environments.

9.4.12.CI.1 Demonstrate the ability to reflect, analyze, and use creative skills and ideas

Computer Science & Design Thinking (*CS & DT***):**

8.2.12.NT.1 Explain how different groups can contribute to the overall design of a product.

Learning Targets

Unit Essential Questions:	**Unit Enduring Understandings:**
• How can we use the properties of plane figures to make logical arguments about geometric relationships?	• Geometric properties can be used to distinguish and analyze geometric figures. • Algebraic skills can be used to prove facts about geometric figures in a plane.

• How do geometric relationships help to solve problems and/or make sense of phenomena? • How can we best represent geometric relationships?	• Coordinate geometry can be used to represent and verify geometric/algebraic relationships. • Angles in a diagram or figure contain helpful properties
Vocabulary: expression, equation, linear equation, distributive property, simplify, solve, polynomial, like term, angle, perpendicular lines, parallel lines, line segment, ray, line, point, sides of an angle, vertex, complement, supplement, adjacent, congruent, linear pair, vertical angles, angle addition postulate, segment addition postulate, bisect, midpoint, volume, area	
Students will be able to: • Simplify algebraic expressions • Add, subtract, and multiply polynomial expressions • Solve Linear Equations of all types (one step, two step, multi-step, variables on both sides) • Define and apply definitions of angle, perpendicular lines, parallel lines, and line segment. • Understand and apply angle relationships including complementary angles, supplementary angles, congruent angles, linear pairs, and vertical angles. • Understand and apply the angle addition postulate. • Understand and apply segment relationships including bisector, congruent segments, and midpoint. • Understand and apply the segment addition postulate. • Apply volume and area formulas for cylinders, pyramids, cones, and spheres. • Solve literal equations	
Learning Activities: Small Group Practice, Small Group Intervention, Small Group Activities, Differentiated Instruction, Enrichment Practice, Communicators, IXL, Scavenger Hunt, Color by Numbers Polynomial Operations	

Suggested activities: Desmos Unit 0.2 A Segment Addition and Bisector Activity by Meghan Arnold.

- This activity has students respond to prompts of slides to first identify prerequisite vocabulary such as a point being between two points and the segments created when a point is between two points. It then breaks down the segment addition postulate into parts where the student first identifies the measure of a segment and then a second segment and then comes up with conclusion that the parts add up to the whole segment. It extends into using algebraic equations to solve for segment parts and wholes. There is a video after the discovery for students to watch and take notes on definitions of bisect and midpoint. The activity includes a card sort with hints for struggling learners to assess if the students understood the segment addition postulate. This activity can be administered in small homogeneous groups where teacher is sitting with the struggling group.

Desmos Unit 0.2 B Angle Addition and Bisector Activity by Meghan Arnold.

- This activity has students respond to prompts of slides to first review angle vocabulary such as acute, obtuse, right, vertex, sides, linear pair and vertical angles. . It then breaks down the angle addition postulate into parts where the student first identifies the measure of a angle and then a second adjacent angle and then comes up with conclusion that the parts add up to the whole angle. It extends into using algebraic equations to solve for angle parts and wholes. There is a video after the discovery for students to watch and take notes on angle bisectors and congruent angles The activity includes some problems to solve to assess students understanding of the topic as well as marking of a diagram. This activity can be administered in small homogeneous groups where teacher is sitting with the struggling group.

NJGPA Practice:

- Volumes

Assessment Evidence
Formative Assessments: Quizzes, Warm-Ups, Exit Passes, Communicators, Classwork
Summative Assessments: Cumulative Assessments
Common Benchmark Assessments: Common Unit Assessments
Alternative Assessments: Modified Unit Assessments, Modified Projects, Other Modified Assessments

Core Instructional & Supplemental Materials
Math IXL
Delta Math
LinkIt!

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:

Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One to one - Additional time - Review of directions - Student restates information - Space for movement or breaks - Extra visual and verbal cues and prompts - Preferential seating - Follow a routine/schedule - Rest breaks - Verbal and visual cues regarding directions and staying on task - Checklists - Immediate feedback

Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Specific Strategies and Practices that Support English Language Learners

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts - Personal Glossary - Extended Time - Simplified/Verbal Instructions - Frequent Breaks - Visual learning, including graphic organizers - Use of cognates to increase comprehension - Teacher modeling - Pairing students with beginning English language skills with students who have more advanced English language skills - Scaffolding - Word walls - Think-pair-share - Cooperative learning groups

Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Students at Risk of Failure

- Home/School Connection - Alternative Assessments - Learning Contracts - Homogenous Grouping - Supplemental Instruction - Think-Pair-Share by Readiness - Homework Options - Differentiated Online Practice - Leveled Rubrics - Tiered Level of Supports - Tiered Activities - Small Group Instruction - Work Alone Choice - Group Work Choice

Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments - Opportunities for make-up work or reduce number of assignments - Provide access to extra help when possible

Students with 504 Plans

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504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way. Students' accommodations are outlined in their individual 504 plan. -

Specific Strategies and Practices that Support Gifted & Talented Students

It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

-Homogenous Grouping - Small Group In-Depth Instruction - Differentiated Online Practice - Alternative Assessments - Pre-Assess to provide Differentiated Instruction to Accelerate Learning

-Enrichment/Extension Activities within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Unit 2

Desired Results

Unit 2: Advanced Geometry: Right Triangle Trigonometry and Circles

Unit Summary: Students will discover relationships in special right triangles. Students will use their knowledge of the similarity of right triangles to establish an understanding of the trigonometric ratios of angles in these triangles. They will explore the interrelationships between the trigonometric functions and use these ratios, along with the Pythagorean Theorem to solve right triangles, given different initial information. Students will model problems involving unknown angles and distances. Students will build on their understanding of similarity to investigate relationships between circles. In addition, students will explore relationships between parts of circles, including radii, tangents, secants and chords. Students should understand how these parts relate to segment lengths and angle measures, and how this relates back to similarity. Students will justify the formulas for circumference and area, and use them to explore arc length, and use the formula for the area of a sector and apply this knowledge to find the area of a sector of a circle. Using their understanding of the Cartesian coordinate system, students will use the distance formula to write equations of circles given a radius and center.

Learning Standards

NJSLS Math:

- G-C.2 Identify and describe relationships among inscribed angles, radii, and chords and apply these concepts in problem solving situations.
- G-C.B Find arc lengths and areas of sectors of circles.
- G-CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

- ➢ G-GPE.1-2 Understand or complete a derivation of the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.
- ➢ G-GPE.1-1 Complete the square to find the center and radius of a circle given by an equation
- ➢ G-SRT.8G Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

9.4.12.TL.3 Analyze the effectiveness of the process and quality of collaborative environments.

9.4.12.CI.1 Demonstrate the ability to reflect, analyze, and use creative skills and ideas

Computer Science & Design Thinking (*CS & DT***):**

8.2.12.NT.1 Explain how different groups can contribute to the overall design of a product.

Learning Targets

Unit Essential Questions:	**Unit Enduring Understandings:**
• How can we use geometric reasoning to prove statements about triangles? • How can trigonometry be applied to model real-world situations?	• There are special relationships between the sides and angles of right triangles. These relationships can be used to solve and model problems involving missing side lengths or angle measures.

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- How can abstract ratios be used to make sense of the world around
- Can we ever know the area or circumference of a circle exactly?
- What makes a circle perfect?
- How can we apply circles and their properties to model various applications?

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- Trigonometry is the study of triangles – more specifically, the study of the angles and dimensions of triangles. Although this might sound simple, trigonometry is a vital part of modern engineering, design, architecture and other fields.
- Because of its unique properties, a circle is considered by some to be a perfect figure.
- All circles are similar and there are relationships between circles, chords and radii that can be used to find measures of segments and angles.

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<td colspan="2">Vocabulary: triangle, right triangle, pythagorean theorem, distance formula, midpoint formula, trigonometry, sine, cosine, tangent, ratio, cofunction, circle, arc, arc length, measure of an arc, central angle, inscribed angle, diameter, radius, chord, circumference, area, center</td>
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<td colspan="2">Students will be able to:

- Understand and apply the Pythagorean Theorem
- Understand and apply the Distance Formula
- Understand and apply the Midpoint Formula
- Solve Right Triangles with Trigonometric Functions (only in degrees to find both angles and sides)
- Understand and apply the Cofunction Theorem. example: cos(30°)=sin(60°)
- Define and apply circles vocabulary: central angles, inscribed angle, diameter, semi-circle, center, radius, chord, measure of an arc.
- Write a standard-form circle equation given a graph or information such as center, radius, area, and circumference.

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Learning Activities: Small Group Practice, Small Group Intervention, Small Group Activities, Differentiated Instruction, Enrichment Practice, Communicators, IXL, Scavenger Hunt, Task Card Activity Circles, Midpoint Formula Math Lib

Suggested Activities: Desmos Activity: Right Triangle Trigonometry by Suzanne Bazak

- This activity has students explore the three trigonometric ratios of sine, cosine and tangent. The students are prompted through slides of first being given an indicated angle, correctly identifying an opposite or adjacent leg as well as the hypotenuse of th right triangle. The students then will calculate trigonometric ratios given a right triangle and a specified angle. The slides will then prompt students how to use trig ratios to solve for missing sides and eventually extend to real life application problems.

Arc Length and Area of a sector Partner Activity

- Students are partnered up and each student takes a role as either "Partner A" or "Partner B". Both students have a set of ten different problems but as they work through them, their answers should match. This activity has students calculating arc length and sector area while also needing to use vertical angles, diameters, and general knowledge of circles. It also slowly increasing in complexity throughout the assignment to grow confidence. This activity can be done in small homogeneous groups, with teacher assisting the struggling learners.

NJGPA Practice:

- Dilations

Assessment Evidence

Formative Assessments: Quizzes, Warm-Ups, Exit Passes, Communicators, Classwork
Summative Assessments: Cumulative Assessments
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-Enrichment/Extension Activities within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Unit 3

Desired Results

Unit 3: Reading Graphs and Functions

Unit Summary:

In this unit students will build upon the introduction of functions presented in Algebra 1. Students will work with a variety of function types at a basic level to prepare for a more in depth focus in future units on linear, exponential and quadratic functions. Students who are able to identify functions, evaluate with function notation, and are able to relate the domain of a function to the quantitative relationship it describes will be prepared for future study of functions.

Learning Standards

NJSLS Math:

- F.IF.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).
- F.IF.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.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity
- ➢ F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.
- ➢ F.IF.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.

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)***:**

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas

9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving

Computer Science & Design Thinking (*CS & DT***):**

8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).

8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).

Learning Targets

Unit Essential Questions:

- What is a function?
- What are the different methods for representing functions?
- How can functions be used to model real world situations?
- What are the key characteristics of graphs of functions?

Unit Enduring Understandings:

- Identify if a relation is a function by using the vertical line test.
- Identifying key characteristics of graphs of functions.
- Operations with Function Notation.
- Finding the average rate of change of different functions.

Vocabulary: Domain, Range, Increase, Decrease, Maximum, Minimum, Function, Relation, Function Notation, Vertical Line Test, Discontinuity, Average Rate of Change

Students will be able to:

- Use the definition of a function to determine whether a relationship is a function.
- Use function notation once a relation is determined to be a function.
- Evaluate functions for given inputs in the domain.
- Operations with function notation.
- Interpret Functions in real life problems
- Identify characteristics of graphs of functions including domain and range, increasing and decreasing, maximum and minimum, end behavior, positive and negative, and discontinuity.

- Calculate and interpret the average rate of change of a function over a specified interval.
- Estimate the rate of change from a graph.

Learning Activities:

Small Group Practice, Small Group Intervention, Small Group Activities, Differentiated Instruction, Enrichment Practice, Communicators, IXL, Scavenger Hunt,

Suggested Activities:

Kahoot Activity: Function Notation by davidfort

- This activity will help students to identify which function to use and if they are evaluating or solving for x. Students will also have to identify if the graph is a function or not.

Digital and Print: Increasing and Decreasing Functions Matching Activity by Scaffolded Math and Science

- This activity will help students identify when a function is increasing or decreasing. Students can work on this activity on the computer or on paper. Students will match the interval notation with the correct graphs.

Cars and Global Warming

- Students learn that CO_2 is emitted when gasoline is burned, that too much CO_2 is causing global warming, and that trees absorb CO_2 and produce oxygen. Using simple arithmetic to figure the amount of CO_2 emissions produced by their own travel, students discover why fuel-efficient cars are more environmentally friendly and consider alternative transportation. As a wrap-up activity, students design bumper stickers that express the information they have learned

NJGPA Practice:

- Average Rate of Change

Assessment Evidence
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Unit 4

Desired Results

Unit 4: Linear Functions

Unit Summary: In this unit students will focus on linear functions. An emphasis will be placed on slope and average rate of change. A main focus will be placed on the use of different forms of linear equations to identify key features both in and out of context.

Learning Standards

NJSLS Math:

- F.LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.
  - a. Prove that linear functions grow by equal differences over equal intervals
  - b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another
- F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity
- F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.
- F.IF.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.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

- a. Graph linear functions and show intercepts, maxima, and minima
- b. Graph piecewise-defined functions

➢ G.GPE.5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).

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

Standards for Mathematical Practice

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2. Reason abstractly and quantitatively
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

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas

9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving

Computer Science & Design Thinking (*CS & DT***):**

8.1 All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

8.2 All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

Learning Targets

Unit Essential Questions:

- What can a linear equation tell us about the function?
- How to graph a Linear Function and identify the key characteristics?
- What are the different but equivalent forms of Linear Functions that reveal and explain different properties of the function?

Unit Enduring Understandings:

- Graph and identify key characteristics from Linear Functions.
- Write a linear function in different but equivalent forms to reveal and explain different properties of the function.
- Rearrange the equation of a line into different forms.

Vocabulary: Linear, Slope, Average Rate of Change, Standard Form, Slope-Intercept Form, Point-Slope Form, Parallel, Perpendicular, Piecewise, Domain, Range, X-intercept, Y-intercept,

Students will be able to:

- Given tables of values determine which represent linear functions and explain reasoning.
- Write a linear function in different but equivalent forms to reveal and explain different properties of the function. These forms include slope-intercept form, standard form and point-slope form each revealing different properties.
- Rearrange the equation of a line into different forms.

- Graph linear functions from a table, an equation or a described relationship.
- Identify key characteristics from the graph and equations.
- Find slopes of parallel and perpendicular lines and write equations of parallel and perpendicular lines given information.

Learning Activities:

Small Group Practice, Small Group Intervention, Small Group Activities, Differentiated Instruction, Enrichment Practice, Communicators, IXL, Scavenger Hunt

Suggested Activities:

Desmos: Two Truths and a Lie: Lines

- Students will practice their understanding of the features and vocabulary of linear equations by creating a line, writing two true and one false statement about it, and inviting their peers to separate truth from lies.

Graphing Piecewise Functions Cut and Sort Activity by Mrs. Swisher Math

- This cut and sort (or cut and paste) activity is a great activity to help reinforce the basics of how piecewise functions and graphs are related! All piecewise functions are either linear or constant functions.

NJGPA Practice:

- Arc Length and Area of a Sector

Assessment Evidence
Formative Assessments: Quizzes, Warm-Ups, Exit Passes, Communicators, Classwork
Summative Assessments: Cumulative Assessments
Common Benchmark Assessments: Common Unit Assessments

Alternative Assessments: Modified Unit Assessments, Modified Projects, Other Modified Assessments

Core Instructional & Supplemental Materials
Math IXL
Delta Math
LinkIt!

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:

Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One to one - Additional time - Review of directions - Student restates information - Space for movement or breaks - Extra visual and verbal cues and prompts - Preferential seating - Follow a routine/schedule - Rest breaks - Verbal and visual cues regarding directions and staying on task - Checklists - Immediate feedback

Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Specific Strategies and Practices that Support English Language Learners

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts - Personal Glossary - Extended Time - Simplified/Verbal Instructions - Frequent Breaks - Visual learning, including graphic organizers - Use of cognates to increase comprehension - Teacher modeling - Pairing students with beginning English language skills with students who have more advanced English language skills - Scaffolding - Word walls - Think-pair-share - Cooperative learning groups

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Students at Risk of Failure

- Home/School Connection - Alternative Assessments - Learning Contracts - Homogenous Grouping - Supplemental Instruction - Think-Pair-Share by Readiness - Homework Options - Differentiated Online Practice - Leveled Rubrics - Tiered Level of Supports - Tiered Activities - Small Group Instruction - Work Alone Choice - Group Work Choice Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments - Opportunities for make-up work or reduce number of assignments - Provide access to extra help when possible

Students with 504 Plans

Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan.
504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way. Students' accommodations are outlined in their individual 504 plan. -

Specific Strategies and Practices that Support Gifted & Talented Students

It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

-Homogenous Grouping - Small Group In-Depth Instruction - Differentiated Online Practice - Alternative Assessments - Pre-Assess to provide Differentiated Instruction to Accelerate Learning

-Enrichment/Extension Activities within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

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Unit 5

Desired Results

Unit 5: Linear Systems and Inequalities

Unit Summary: In this unit you will focus on solving linear systems algebraically and graphically. Recognize when linear systems have one solution, no solutions or infinitely many solutions. Identifying the solution set of Linear Inequalities.

Learning Standards

NJSLS Math:

- A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
- A.REI.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
- A.REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

- ➢ A.REI.12 Graph the solutions to a linear inequality in two variables as a half plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.
- ➢ A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- ➢ A.CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
8. Look for and express regularity in repeated reasoning

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas

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9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving

Computer Science & Design Thinking ***(****CS & DT****)*:

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Learning Targets

Unit Essential Questions:

- When is an algebraic method more appropriate than a graphical method when solving a system of linear equations?
- What does the solution of a system of equations represent? System of Inequalities?
- How do I know when a result is reasonable?

Unit Enduring Understandings:

- Properties of numbers and equality can be used to transform an equation (or inequality) into equivalent, simpler equations (or inequalities) in order to find solutions.
- Useful information about equations and inequalities (including solutions) can be found by analyzing graphs.
- The numbers and types of solutions vary predictably, based on the type of equation.
- Many real-world mathematical problems can be represented algebraically.

Vocabulary: Systems, Elimination, Substitution, Intersection, Ordered Pair, Linear Inequalities, Feasible Region, Half-Plane

Students will be able to:

- Solve systems of linear equations through an algebraic method and check answers for correctness.
- Recognize when linear systems have one solution, no solutions or infinitely many solutions.
- Translate algebraic verbal equations to represent linear systems and solve those systems.
- Solve systems of linear equations through a graphical approach both by hand and with a graphing calculator.
- Find approximate solutions when appropriate. Explain why graphical approaches may only lead to approximate solutions while an algebraic approach produces precise solutions that can be represented graphically or numerically.

- Graph the solutions to a linear inequality.
- Graph the solution set to a system of linear inequalities.
- Solving basic linear inequalities.
- Solving compound inequalities.

Learning Activities:

Small Group Practice, Small Group Intervention, Small Group Activities, Differentiated Instruction, Enrichment Practice, Communicators, IXL, Scavenger Hunt

Suggested Activities:

Walk Around Activity with Nonlinear Systems of Equations by Caryn White

- This activity is designed to help students with solving nonlinear systems of equations by graphing (or with writing them). This activity also gets students up and about. Place the 12 cards on the wall around your room. Students pick any card to begin with. They should graph the functions on the bottom of the page. After graphing on their own paper, students look around the room for a graph that matches theirs. Then they graph the next problem. They should continue until they return to the card they started with.

Desmos: Card Sort Linear Systems

- In this activity, students practice what they've learned about solving systems of linear equations. The activity begins with a review of the graphical meaning of a solution to a system. Later, students consider which algebraic method is most efficient for solving a given system. Finally, students practice solving equations using substitution and elimination. Prior to beginning this activity, students should have experience solving systems of linear equations graphically and algebraically.

NJGPA Practice:

- Solving Linear Equations and Inequalities

Assessment Evidence
Formative Assessments: Quizzes, Warm-Ups, Exit Passes, Communicators, Classwork
Summative Assessments: Cumulative Assessments
Common Benchmark Assessments: Common Unit Assessments
Alternative Assessments: Modified Unit Assessments, Modified Projects, Other Modified Assessments

Core Instructional & Supplemental Materials
Math IXL
Delta Math
LinkIt!

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students
Specific Strategies and Practices that Support Students with Disabilities: Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner. - Small group/One to one - Additional time - Review of directions - Student restates information - Space for movement or breaks - Extra visual and verbal cues and prompts - Preferential seating - Follow a routine/schedule - Rest breaks - Verbal and visual cues regarding directions and staying on task - Checklists - Immediate feedback Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Specific Strategies and Practices that Support English Language Learners

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Students at Risk of Failure

- Home/School Connection - Alternative Assessments - Learning Contracts - Homogenous Grouping - Supplemental Instruction - Think-Pair-Share by Readiness - Homework Options - Differentiated Online Practice - Leveled Rubrics - Tiered Level of Supports - Tiered Activities - Small Group Instruction - Work Alone Choice - Group Work Choice

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Students with 504 Plans

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Unit 6

Desired Results

Unit 6: Solving Quadratic Functions and Systems

Unit Summary: Know where a complex number comes from. Solve quadratic equations with the best method. Solve quadratic systems algebraically.

Learning Standards

NJSLS Math:

- A.REI.4 Solve quadratic equations in one variable.
  - a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form (x - p) 2 = q that has the same solutions. Derive the quadratic formula from this form.
  - b. Solve quadratic equations in one variable. b. Solve quadratic equations by inspection (e.g., for x2 = 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.
- A.REI.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
- A.REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line y = -3x and the circle x2 + y2 = 3.

- ➢ N.CN.1 Know there is a complex number i such that i 2 = -1, and every complex number has the form a + bi with a and b real.
- ➢ N.CN.2 Use the relation i 2 = -1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
- ➢ A.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
    - ○ a. Factor a quadratic expression to reveal the zeros of the function it defines.
    - ○ b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines
- ➢ F.IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
    - ○ a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas

9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving

Computer Science & Design Thinking (*CS & DT***):**

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Learning Targets

Unit Essential Questions:

- How can you solve quadratic equations using concrete models, tables, graphs, and algebraic methods?
- How can you use functions to model real-world situations?

Unit Enduring Understandings:

- A variety of methods can be used to solve an equation and arrive at the same answer.
- Different quadratic forms reveal different characteristics of the function.
- Many real world situations can be modeled with a quadratic function.

Vocabulary: Zeros, Solutions, Roots, X-intercepts, Factor, Complete the Square, Square Roots, Quadratic Formula, Complex Numbers, Discriminant, Quadratic Equation, Quadratic Expression, Quadratic System, Quadratic-Linear System, Intersection, Substitution

Students will be able to:

- Simplify square roots.
- Operations with complex numbers.
- Solve quadratic equations by inspection: taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation.

- 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.
- Relate the value of the discriminant to the type of root to expect for the graph of a quadratic function.
- 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.
- Solve a simple System consisting of a linear equation and a quadratic equation in two variables algebraically.
- Solve a simple System consisting of quadratic equations in two variables algebraically.

Learning Activities:

Small Group Practice, Small Group Intervention, Small Group Activities, Differentiated Instruction, Enrichment Practice, Communicators, IXL, Scavenger Hunt

Suggested Activities:

Simplifying Square Root Bingo

- Students will get a bingo card. The teacher will post the problem on the board for students to simplify then mark off their bingo card.

Solving Quadratic Flip Book

- To review graphing quadratic equations and solving by factoring, square roots, completing the square, and the quadratic formula. A summary of steps along with practice problems is included with each topic. In total, there are 31 practice problems for students to complete in the book.

Color by Numbers Solving by Factoring

- Students will solve quadratic equations by factoring and color the correct space.

NJGPA Practice:

- Piecewise-Defined Functions

Assessment Evidence

Formative Assessments: Quizzes, Warm-Ups, Exit Passes, Communicators, Classwork
Summative Assessments: Cumulative Assessments
Common Benchmark Assessments: Common Unit Assessments
Alternative Assessments: Modified Unit Assessments, Modified Projects, Other Modified Assessments

Core Instructional & Supplemental Materials
Math IXL
Delta Math
LinkIt!

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

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Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

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Unit 7

Desired Results

Unit 7: Graphing Quadratic Functions and Systems

Unit Summary: Graph quadratic equations in vertex and standard form. Identify key characteristics from a quadratic equation and graph. Solve quadratic systems graphically.

Learning Standards

NJSLS Math:

- A.REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line y = -3x and the circle x2 + y2 = 3.
- A.REI.11 Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.
- F.BF.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.
- F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the

relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity

- ➢ F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
- ➢ F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
  - ○ a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

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

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas

9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving

Computer Science & Design Thinking (*CS & DT***):**

8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).

8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).

Learning Targets

Unit Essential Questions:	**Unit Enduring Understandings:**
• What are the characteristics of quadratic functions? • How can you use functions to model real-world situations?	• Different quadratic forms reveal different characteristics of the function. • Many real world situations can be modeled with a quadratic function.

Vocabulary: X-intercepts, Y-intercept, Maximum, Minimum, Domain, Range, Axis of Symmetry, Vertex, Vertex Form, Standard Form, Roots, Zeros, Solutions, Transformations

Students will be able to:

- Investigate the graph of quadratic functions through the use of the graphing calculator.
- Recognize transformations of the parent $f(x) = x^2$ as vertical $f(x) = x^2 + k$, horizontal $f(x + k)$, stretch or reflections.
- 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; find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
- Graph quadratic functions given in vertex form through the process of generating points in function notation and apply the meaning of symmetry to plot points.
- Recognize that different forms of quadratic functions reveal different key features of its graph.
- Relate the value of the discriminant to the type of root to expect for the graph of a quadratic function.
- Interpret models of quadratic functions given as equations or graphs. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
- Solve a simple System consisting of a linear equation and a quadratic equation in two variables graphically.

- Solve a simple System consisting of quadratic equations in two variables graphically.

Learning Activities:

Small Group Practice, Small Group Intervention, Small Group Activities, Differentiated Instruction, Enrichment Practice, Communicators, IXL, Scavenger Hunt

Suggested Activities:

Graphing Transformation Investigation

- Students will complete a graphing calculator investigation on transformations.

Graphing Project

- Students will work with a partner where they have to graph in vertex and standard form and identify the key characteristics. After all the groups are done students will walk around the room and see if they find any mistakes.

NJGPA Practice:

- Function Transformations

Unit 7 Stage 2 Assessment Evidence
Formative Assessments: Quizzes, Warm-Ups, Exit Passes, Communicators, Classwork
Summative Assessments: Cumulative Assessments
Common Benchmark Assessments: Common Unit Assessments
Alternative Assessments: Modified Unit Assessments, Modified Projects, Other Modified Assessments

Core Instructional & Supplemental Materials
Math IXL
Delta Math

LinkIt!

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Students at Risk of Failure

- Home/School Connection - Alternative Assessments - Learning Contracts - Homogenous Grouping - Supplemental Instruction - Think-Pair-Share by Readiness - Homework Options - Differentiated Online Practice - Leveled Rubrics - Tiered Level of Supports - Tiered Activities - Small Group Instruction - Work Alone Choice - Group Work Choice

Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments - Opportunities

for make-up work or reduce number of assignments - Provide access to extra help when possible

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Unit 8

Desired Results

Unit 8: Exponential Functions and Radical Functions

Unit Summary: This unit of study provides a review of function families learned throughout the year and introduces exponential functions. In this unit, students will study rational exponents and radical functions. The algebraic study of radical functions helps symbolize and generalize the rules of arithmetic. This builds a thorough understanding of our number system by applying the rules of arithmetic to the set of irrational numbers. Radical functions are used to describe relationships that have a variable rate of change, in terms of a dependent and independent variable. Students will study data, graphs, and equations to determine if it represents a linear, quadratic, or exponential relationship. Next, they will learn to graph exponential functions and write exponential functions from tables and real-world scenarios. Expressing non-linear quantities gives us the power to recognize and describe patterns, make

generalizations, and draw and justify conclusions. Non-linear representations enable us to model many real-life situations and represent them abstractly. Finally, students will review the function families and connect how changes to a parent function impact the behavior of its graph. Functions will be translated and reflected in this unit. This learning will connect to future families of functions and additional transformations that will be covered later in future courses.

Learning Standards

NJSLS Math:

- A-SSE.1-1 Interpret exponential expressions, including related numerical expressions that represent a quantity in terms of its context. a) Interpret parts of an expression, such as terms, factors, and coefficients. b) Interpret complicated expressions by viewing one or more of their parts as a single entity.
- A-SSE.3c-1 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression, where exponentials are limited to integer exponents.
    - c) Use the properties of exponents to transform expressions for exponential functions
- F-IF.5-1 Relate the domain of a function to a graph and, where applicable, to the quantitative relationship it describes, limiting to linear functions, square root functions, piecewise-defined functions, and exponential functions with domains in the integers.
- F-IF.7b Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases
    - b) Graph square root, cube root, and piecewise-defined functions.
- A-REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
- F-BF.3-2 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $f(k)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs, limiting the function types to polynomial, exponential functions.
- F-IF.7e-1 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
    - Graph exponential functions, showing intercepts and end behavior.

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

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
4. Model with mathematics
5. Use appropriate tools strategically
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

9.4.5.CI.3 Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity.

9.4.5.CT.3 Describe how digital tools and technology may be used to solve problems.

9.4.5.CT.4 Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global

Computer Science & Design Thinking (*CS & DT***):**

8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).

8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).

Learning Targets

Unit Essential Questions:	**Unit Enduring Understandings:**

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- How do we simplify expressions containing rational exponents?
- How do we write rational exponents as radicals?
- How do we write radicals using rational exponents?
- How do we solve equations containing radicals?
- How is the domain affected when performing operations with functions?
- How does an exponential function model growth or decay?
- How do we graph exponential functions?
- How can you transform the graphs of exponential functions?

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- Mathematicians use algebraic and graphical representations to generalize patterns and relationships
- Inverse operations allow us to state mathematical facts in a variety of ways.
- The relationships between functions and their inverses relate to their domain and range
- Patterns and relationships can be represented graphically, numerically, symbolically, and verbally. Each representation has its advantages and disadvantages.
- Mathematicians use radical equations and exponential equations to model, interpret and explain real-life phenomena.

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<tr>
<td colspan="2">Vocabulary: exponent, base, quotient, product, laws of exponents, radical, root, index, rational exponent, intercept, asymptote, square root function, rationalize, piecewise function, restricted domain, extraneous</td>
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<td colspan="2">Students will be able to:

- Understand and apply the Laws of Exponents
- Graph Exponential functions and discuss key features including intercepts, transformations, and horizontal asymptotes.
- Switch from radical form to rational exponents and vice versa
- Simplifying higher roots
- Simplify radicals with variables
- Graph square roots functions and discuss key features including intercepts and transformations.
- Perform addition, subtraction, multiplying and dividing with square root functions.
- Solve radical and exponential equations and discuss extraneous solutions.

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- *Graph and analyze piecewise functions containing linear, quadratic, exponentials and square root functions.*

Learning Activities: Small Group Practice, Small Group Intervention, Small Group Activities, Differentiated Instruction, Enrichment Practice, Communicators, IXL, Scavenger Hunt, Exponent Escape Room, Flip Book Radicals Operations

Suggested activities: Exponential Growth and Decay Lab with M&M's

- Students will use candy to model and interpret exponential growth and decay in a real world context. The purpose of this lab is to provide a simple model to illustrate exponential growth of cancerous cells. In our experiment, an M&M represents a cancerous cell. If the M&M lands "M" up, the cell divides into the "parent" cell and "daughter" cell. The cancerous cells divide like this uncontrollably-without end. We will conduct 15 trials and record the number of "cancerous cells" on the plate. The students will then plot there recordings on coordinate axes and discuss the graph as an exponential function. The students will then look at the percentages of m&m that were face up each time and connect to the exponential growth function. Students will alos be asked predictive questions as relates to the real world context of cancerous cells growing.

Math Just got Real Piecewise functions Project

- Students create a graph of a roller coaster in regards to time and height using linear, absolute value, exponential,square root, and quadratic functions. They can pretend that their graph is what the roller coaster looks like as well, because it makes it a little more fun for them. However, we know that physics would not necessarily allow this to be true. (Downhill will not be as fast as uphill as you would see in an absolute value or quadratic function). Students write a function that represents their graph. Then the students use Desmos to check and see if their function and graph match. The next part is naming the roller coaster and answering questions about key features.

Assessment Evidence
Formative Assessments: Quizzes, Warm-Ups, Exit Passes, Communicators, Classwork
Summative Assessments: Cumulative Assessments
Common Benchmark Assessments: Common Unit Assessments
Alternative Assessments: Modified Unit Assessments, Modified Projects, Other Modified Assessments

Core Instructional & Supplemental Materials
Math IXL
Delta Math
LinkIt!

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:

Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One to one - Additional time - Review of directions - Student restates information - Space for movement or breaks - Extra visual and verbal cues and prompts - Preferential seating - Follow a routine/schedule - Rest breaks - Verbal and visual cues regarding directions and staying on task - Checklists - Immediate feedback

Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Specific Strategies and Practices that Support English Language Learners

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts - Personal Glossary - Extended Time - Simplified/Verbal Instructions - Frequent Breaks - Visual learning, including graphic organizers - Use of cognates to increase comprehension - Teacher modeling - Pairing students with beginning English language skills with students who have more advanced English language skills - Scaffolding - Word walls - Think-pair-share - Cooperative learning groups
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Students at Risk of Failure

- Home/School Connection - Alternative Assessments - Learning Contracts - Homogenous Grouping - Supplemental Instruction - Think-Pair-Share by Readiness - Homework Options - Differentiated Online Practice - Leveled Rubrics - Tiered Level of Supports - Tiered Activities - Small Group Instruction - Work Alone Choice - Group Work Choice
Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments - Opportunities for make-up work or reduce number of assignments - Provide access to extra help when possible

Students with 504 Plans

Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan.
504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way. Students' accommodations are outlined in their individual 504 plan. -

Specific Strategies and Practices that Support Gifted & Talented Students

It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

-Homogenous Grouping - Small Group In-Depth Instruction - Differentiated Online Practice - Alternative Assessments - Pre-Assess to provide Differentiated Instruction to Accelerate Learning
-Enrichment/Extension Activities within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Unit 9

Desired Results

Unit 9: Rational Functions

Unit Summary: In this unit, students will study rational functions. They will expand upon their knowledge of functions by exploring the ratio of two polynomials. The algebraic study of rational functions enables mathematicians to symbolize and generalize the rules of arithmetic. This builds a thorough understanding of our number system and the connectedness of the discipline of mathematics. Students will continue to analyze and connect a rational equation to its graph. Students will use patterns to generalize how one variable changes based on other variables.

Learning Standards

NJSLS Math:

- A-REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

- ➢ A-SSE.2-6 Use the structure of a polynomial, rational, or exponential expression to rewrite it, in a case where two or more rewriting steps are required.
- ➢ A-APR.6 Rewrite simple rational expressions in different forms; write $a(x)/\ b(x)$ in the form $q(x)$ + $r(x)/\ b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.
- ➢ A-APR.7 Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
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Learning Targets	
Unit Essential Questions: • What kinds of asymptotes are possible for a rational function? • What are the advantages and disadvantages of various, equivalent forms of rational expressions? • What does the factored form of an equation tell us about its graph? • How do rational equations model real world relationships between variables? • When two quantities vary, how do they relate to their constant of variation?	**Unit Enduring Understandings:** • Rational equations are used to model, understand and explain real-life situations • Non Vertical asymptotes model the end behavior of a graph and, therefore, can be crossed • Domain restrictions affect the solutions of an algebraic equation. • Restrictions in the domain of a rational function result in discontinuities
Vocabulary: ratio, rational function, excluded value, discontinuity, hole, asymptote, branch, factor, coefficient, reciprocal, common denominator, extraneous solution	
Students will be able to: • Simplify rational expressions • Identify excluded values and discuss as domain restrictions and discontinuities • Multiply rational expressions • Divide rational expressions • Solve rational equations and check for extraneous solutions. • Finding the key characteristics from a rational equation.	

- Graphing rational equations using the calculator.

Learning Activities: Small Group Practice, Small Group Intervention, Small Group Activities, Differentiated Instruction, Enrichment Practice, Communicators, IXL, Scavenger Hunt, Matching Cards (Simplifying, Multiply, and Divide)

Suggested activities: Rational expressions Battleship

- Students with their partners will play a version of the game battleship where the grid is rational expressions they must simplify in order to make guesses on where there opponents battleship is located.

Rational operations Bingo

- Students will play bingo with bingo cards that have multiplying and dividing rational expressions on them. They will first need to work out the problems on their card to then play bingo as a class.

Assessment Evidence
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Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a

problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

2. Reason abstractly and quantitatively

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

3. Construct viable arguments and critique the reasoning of others

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

4. Model with mathematics

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the

community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5. Use appropriate tools strategically

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6. Attend to precision

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

7. Look for and make use of structure

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well-remembered$7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$ older students can see the 14 as $2 \times 7$and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

8. Look for and express regularity in repeated reasoning

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $\frac{(y-2)}{(x-1)} = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)\left(x^2 + x + 1\right)$ and $(x - 1)\left(x^3 + x^2 + x + 1\right)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.