Shepard Preparatory High School

Algebra 2

Curriculum

Algebra 2 is a high school mathematics course designed to extend the concepts of Algebra 1 and Geometry. It focuses on in-depth exploration of various function families (linear, quadratic, exponential, logarithmic, polynomial, radical, and rational), along with complex numbers, matrices, sequences, and trigonometry. The curriculum emphasizes advanced modeling, graphing calculator proficiency, and real-world problem-solving to prepare students for pre-calculus and college-level math.

Algebra 2

Unit 1	
Quadratic Function and Factoring	
Timeframe	Week 1-7
Unit Overview	1. Change does not always occur at a constant (linear) rate. 2. Real life situations can be modeled using quadratic functions in order to optimize situations, predict behavior, and design systems. 3. As in other human endeavors, mathematics has grown as a result of imaginative thinking. An example of this fact is the number i, defined as the square root of -1. This imaginary number gave mathematicians the power to solve certain equations that have no real solutions and students need to realize the importance of this power.
Essential Questions	1. Is one method of solving a quadratic equation better than another? 2. How do the characteristics of a quadratic equation affect its graph? 3. When would it be appropriate to use a quadratic function to model a real-life situation? 4. How does one find constant of variation and the value for a variable in direct, inverse, and joint variation? 5. When and why do we use imaginary numbers? 6. How do you use operations to simplify complex number? 7. What does discriminant tell us? 8. How do you graph and solve the quadratic inequaliites? 9. How are directrix and focus point related to parabola?
Unit Focus	• the characteristics, elements and forms of quadratic equations • the graph of the quadratic equation is a parabola with a vertex, an axis of symmetry and a direction • quadratic equations sometimes have 2, 1, or zero real roots • quadratic equations may have non-real roots • quadratic formula • the nature of the roots based upon the value of the discriminant • numerical, algebraic, graphic, and tabular representations of quadratic functions • relationship between algebraic solutions and x-intercepts • the leading coefficient determines whether the quadratic function has a minimum or a maximum • the imaginary unit i • the complex numbers
Interdisciplinary Connections	• NJSLS-9.4 Life Literacies and Key Skills

Common Assessments	• Assessment Suite chapter quizzes and tests

Materials	
Common Materials	**Supplemental Materials**
Prentice Hall Algebra 2 Textbook Kuta Software Worksheets Khan Academy	Discovering Algebra "An Investigative Approach" by Key Curriculum Press Teacher created materials

New Jersey Student Learning Standards (NJSLS)			
Subject Area **Mathematics**	**Technology** *8.1: Educational Technology* *8.2: Technology Education, Engineering, Design and Computational Thinking - Programming*	**21st Century Life and Careers** NJSLS-9.4 Life Literacies and Key Skills	**ELA Companion** *Secondary Science and Social Studies Only* N/A
MP Mathematical Practice Standards for Mathematical Practice MP.1 Make sense of problems and persevere in solving them MP.2 Reason abstractly and quantitatively MP.3 Construct viable arguments and critique the reasoning of others MP.4 Model with mathematics MP.5 Use appropriate tools strategically MP.6 Attend to precision MP.7 Look for and make use of structure MP.8 Look for and express regularity in repeated reasoning Number and Quantity	NJ: 2020 SLS: Science NJ: Grades 9-12 • HS-ETS1 Engineering Design • Students who demonstrate understanding can: HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	• 9.4.2.CI.1: Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2). • 9.4.2.CI.2: Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a). • 9.4.2.CT.3: Use a variety of types of thinking to solve problems (e.g., inductive, deductive). 9.4.2.IML.1: Identify a simple search term to find information in a search engine or digital resource. 9.4.5.CI.1: Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible	NJ: 2023 SLS: English Language Arts NJ: Grades 11-12 • Speaking and Listening Domain • Speaking and Listening

N.CN.A. The Complex Number System Perform arithmetic operations with complex numbers N.CN.A.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.A.2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. N.CN.A.3. (+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers. N.CN.C. The Complex Number System Use complex numbers in polynomial identities and equations N.CN.C.7. Solve quadratic equations with real coefficients that have complex solutions. 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.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		solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).	

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.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.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.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.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.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.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.			
Differentiation			
Differentiation for Support and General Curriculum (504, ELL, Special Education, Struggling Learners)	**Differentiation for Enrichment**		

Modifications for Classroom: Pair visual prompts with verbal presentations Ask students to restate information, directions, and assignments Model skills / techniques to be mastered Extended time to complete class work Student-directed learning/ independent studies when appropriate **Modifications for Homework and Assignments**: Extended time to complete assignments Provide the student with clearly stated (written) expectations and grading criteria for assignments **Modifications for Assessments:** Extended time on classroom assessments	Use of higher level questioning techniques Provide assessments that require higher level thinking Increased production Substituting written texts with project-based learning Student-directed learning/ independent studies Extension activities **Further Modifications for Honors Students** Students in Honors courses, in addition to regular class assignments, will complete enrichment/extension activities outside of the regular class period. These assignments may be projects, labs, research papers, independent novel study, or other activities assigned by the teacher

Activities

Engaging mathematics learning activities include hands-on games, movement-based challenges, and creative projects that make abstract concepts tangible

Hands-on & Interactive Game Examples

- **Math War (Cards):** Students play with cards to practice multiplication or addition, trying to get the highest result.
- **Math Bingo:** A fun way for students to practice multiplication, division, or addition in a group setting.
- **Dice Rolling Games:** Roll dice to create and solve numbers, or use them to build shapes and towers.

Movement-Based Math

- **Math Scavenger Hunt:** Hide numbers or equations around the room or outside for children to find
- **Math Relay Races:** Students run to solve problems in teams, combining physical activity with mental calculation.
- **Human Number Line:** Use body movement to represent positions on a number line, Walking number lines to demonstrate concepts like adding and subtracting negative numbers.

Creative & Visual Projects

- **Nature Sorting:** Collecting leaves or sticks during a walk to practice sorting, sequencing, and measurement and probability.
- **Marshmallow Geometry:** Using marshmallows and toothpicks to build 3D shapes.

Digital & Cognitive Activities

- **Virtual Manipulatives:** Using online tools like geoboards or fraction bars.
- **Brain Teasers/Riddles:** Daily puzzles that encourage logical thinking and problem-solving skills.
- **Virtual Escape Rooms:** Engaging, technology-based puzzles for older students.

Algebra 2

Unit 2	
Polynomials	
Timeframe	Week 8-14
Unit Overview	1. Because polynomials are such a big component of algebra, students need to be able to manipulate them in a variety of ways. Multiplying, dividing, adding, subtracting, and factoring are the major operations involved with polynomials. Being able to find solutions of polynomial equations can help students gain further insight into the given polynomial. Solutions help with graphing and with interpreting real-world applications, like word problems.
Essential Questions	1. What are the rules and laws of exponents used when simplifying expressions? 2. What special properties exist when multiplying two polynomials? 3. What factoring methods exist to help factor expressions? 4. How can we use factoring to solve polynomial equations and how can it be applied to real world problems? 5. When and why do you use long division and synthetic division? 6. How is the process of diving polynomials related to the division of whole numbers? 7. When goes a graph have a local maximum or local minimum? 8. How can you determine the possible number of positive, negative, and imaginary zeros of a polynomial function?
Unit Focus	• simplified polynomials • operations of polynomials • laws of exponents • factoring methods for polynomials • polynomial equations • long and synthetic division • remainder theorem • factor theorem • descartes rule of signs • fundamental theorem of algebra

Interdisciplinary Connections	• NJSLS-9.4 Life Literacies and Key Skills
Common Assessments	• Assessment Suite chapter quizzes and tests

Materials

Common Materials	Supplemental Materials
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New Jersey Student Learning Standards (NJSLS)

Subject Area **Mathematics**	Technology	21st Century Life and Careers	ELA Companion
Number and Quantity N.CN.A. The Complex Number System Perform arithmetic operations with complex numbers N.CN.A.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. 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,	NJ: 2020 SLS: Science NJ: Grades 9-12 • HS-ETS1 Engineering Design • Students who demonstrate understanding can: HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that	• 9.4.2.CI.1: Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2). • 9.4.2.CI.2: Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a). • 9.4.2.CT.3: Use a variety of types of thinking to solve problems (e.g., inductive, deductive).	NJ: 2023 SLS: English Language Arts NJ: Grades 11-12 • Speaking and Listening Domain • Speaking and Listening

and multiplication; add, subtract, and multiply polynomials. A.APR.B. Arithmetic with Polynomials and Rational Expressions Understand the relationship between zeros and factors of polynomials A.APR.B.2. Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x-a is p(a), so p(a) = 0 if and only if x-a is a factor of p(x). A.APR.B.3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. A.APR.C. Arithmetic with Polynomials and Rational Expressions Use polynomial identities to solve problems A.APR.C.4. (+) Prove polynomial identities and use them to describe numerical relationships. A.APR.D. Rewrite rational expressions A.APR.D.6. Rewrite simple rational expressions in different forms; write $\frac{a(x)}{b(x)}$ in the form $q(x)+\frac{r(x)}{b(x)}$, 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.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.	can be solved through engineering.	9.4.2.IML.1: Identify a simple search term to find information in a search engine or digital resource. 9.4.5.CI.1: Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).	

Algebra 2

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.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.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.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			

Differentiation

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Unit 3	
Rational Exponents and Radical Functions	
Timeframe	Week 15-19
Unit Overview	1. Many careers, like physics and chemistry, involve working with very large and very small numbers. The topics that are discussed in this unit will yield a better understanding of working with these values. This unit also helps students understand functions and prepares them for graphing functions in the future.

Essential Questions	1. What is the relationship nth roots and rational exponents? 2. How are the properties of rational exponents related to the properties of integer exponents? 3. What operations can be performed on a pair of functions to obtain a third function? 4. How do you find an inverse relation of a given function? 5. What do the graphs of square root and cube functions look like? 6. Why is it necessary to check every apparent solution of a radical equation in the original equation?
Unit Focus	• nth roots • properties of rational exponents • operations of functions • power functions • composition of functions • inverse relations and functions • parent functions for square and cube roots • radical equations • extraneous solutions
Interdisciplinary Connections	• NJSLS-9.4 Life Literacies and Key Skills
Common Assessments	• Assessment Suite chapter quizzes and tests

Materials

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New Jersey Student Learning Standards (NJSLS)

Subject Area	Technology	21st Century Life and	ELA Companion

Algebra 2

		Careers	
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.RN.A.3. Simplify radicals, including algebraic radicals (e.g. $\sqrt[3]{54} = 3\sqrt[3]{2}$, simplify $\sqrt{32x^2}$). Algebra A.REI.A. Reasoning with Equations and Inequalities Understand solving equations as a process of reasoning and explain the reasoning A.REI.A.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. 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	NJ: 2020 SLS: Science NJ: Grades 9-12 • HS-ETS1 Engineering Design • Students who demonstrate understanding can: HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	• 9.4.2.CI.1: Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2). • 9.4.2.CI.2: Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a). • 9.4.2.CT.3: Use a variety of types of thinking to solve problems (e.g., inductive, deductive). 9.4.2.IML.1: Identify a simple search term to find information in a search engine or digital resource. 9.4.5.CI.1: Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).	NJ: 2023 SLS: English Language Arts NJ: Grades 11-12 • Speaking and Listening Domain • Speaking and Listening

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.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.			

Differentiation

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Digital & Cognitive Activities

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Unit 4	
Exponential and Logarithmic Functions	
Timeframe	Week 20-23
Unit Overview	1. Exponents and logarithms are closely related. 2. Exponential functions and logarithms can be used to solve growth and decay problems. 3. We use exponential and logarithmic functions to model real life situations. Applying the properties of logarithms and exponential functions, students can solve applications such as population growth, compound interest, and half-life word problems.
Essential Questions	1. How are exponential functions and logarithmic functions related? 2. How can logarithmic and exponential functions be used to solve growth and decay problems? 3. When is the natural base 'e' useful?
Unit Focus	• what a logarithmic function is • what the basic laws of logarithms are and how to apply them • logarithms and exponents can be used to solve growth and decay problems • graphing exponential and logarithmic functions • solving exponential and logarithmic equations • writing and applying exponential and power functions
Interdisciplinary Connections	• NJSLS-9.4 Life Literacies and Key Skills
Common Assessments	• Assessment Suite chapter quizzes and tests

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New Jersey Student Learning Standards (NJSLS)			
Subject Area	**Technology**	**21st Century Life and Careers**	**ELA Companion**
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express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	terms, employment, and qualifying for loans. 9.1.12.CP.2: Identify the advantages of maintaining a positive credit history. Building and maintaining a good credit history is a process. 9.1.12.CP.3: Summarize factors that affect a positive credit rating, including on-time payments, debt versus available credit, length of open credit, and how often you apply for credit. 9.1.12.CP.4: Identify the skill sets needed to build and maintain a positive credit profile. 9.2 Career Awareness, Exploration, Preparation, and Training Career planning requires purposeful planning based on research, self-knowledge, and informed choices. 9.2.12.CAP.10: Identify strategies for reducing overall costs of postsecondary education (e.g., tuition assistance, loans, grants, scholarships, and student loans). NJ: 2020 SLS: Computer Science & Design Thinking NJ: End of Grade 12 8.1 Computer Science: Data & Analysis Individuals select digital tools and design automated processes to collect, transform, generalize, simplify, and present large data sets in different ways to influence how other people interpret and understand the underlying information. 8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change		

Differentiation	
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Engaging mathematics learning activities include hands-on games, movement-based challenges, and creative projects that make abstract concepts tangible **Hands-on & Interactive Game Examples** • **Math War (Cards):** Students play with cards to practice multiplication or addition, trying to get the highest result. • **Math Bingo:** A fun way for students to practice multiplication, division, or addition in a group setting. • **Dice Rolling Games:** Roll dice to create and solve numbers, or use them to build shapes and towers. **Movement-Based Math** • **Math Scavenger Hunt:** Hide numbers or equations around the room or outside for children to find • **Math Relay Races:** Students run to solve problems in teams, combining physical activity with mental calculation. • **Human Number Line:** Use body movement to represent positions on a number line, Walking number lines to demonstrate concepts like adding and subtracting negative numbers. **Creative & Visual Projects**	

• **Nature Sorting:** Collecting leaves or sticks during a walk to practice sorting, sequencing, and measurement and probability. • **Marshmallow Geometry:** Using marshmallows and toothpicks to build 3D shapes. **Digital & Cognitive Activities** • **Virtual Manipulatives:** Using online tools like geoboards or fraction bars. • **Brain Teasers/Riddles:** Daily puzzles that encourage logical thinking and problem-solving skills. • **Virtual Escape Rooms:** Engaging, technology-based puzzles for older students.	

Unit 5	
Rational Functions	
Timeframe	Week 24-27
Unit Overview	1. Direct, inverse, and joint variation can be used to solve real life applications for problems where variables depend on each other. 2. Students can apply their knowledge to interpret equations with rational expressions. Students will be able to solve rational equations both algebraically and understand the relationship graphically. Being able to rewrite a rational expression, students can reveal properties of the related function and its graph.
Essential Questions	1. What is the difference between direct, inverse, and joint variation? 2. How do you graph a rational function? 3. What are the steps for multiplying and dividing rational expressions? 4. What are the steps for adding or subtracting rational expressions with different denominators? 5. How do you solve rational equations? 6. What is simplest form for a rational expression? 7. How do you compare functions represented in different ways?
Unit Focus	• How to solve problems involving direct variation. • How to solve problems involving inverse variation and joint variation. • How to graph rational functions.

	• Perform operations with rational expressions. • How to solve rational equations.
Interdisciplinary Connections	• NJSLS-9.4 Life Literacies and Key Skills
Common Assessments	• Assessment Suite chapter quizzes and tests

Materials

Common Materials	Supplemental Materials
Prentice Hall Algebra 2 Textbook Kuta Software Worksheets Khan Academy	Discovering Algebra "An Investigative Approach" by Key Curriculum Press Teacher created materials

New Jersey Student Learning Standards (NJSLS)

Subject Area	Technology	21st Century Life and Careers	ELA Companion
Mathematics	*8.1: Educational Technology* *8.2: Technology Education, Engineering, Design and Computational Thinking - Programming*	*Career Ready Practices* *9.1: Personal Financial Literacy* *9.2: Career Awareness, Exploration, and Preparation*	*Secondary Science and Social Studies Only* N/A
A.APR.D. Rewrite rational expressions A.APR.D.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.	NJ: 2020 SLS: Science NJ: Grades 9-12 • HS-ETS1 Engineering Design • Students who demonstrate understanding can: HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more	• 9.4.2.CI.1: Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2). • 9.4.2.CI.2: Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a). • 9.4.2.CT.3: Use a variety of types of thinking to solve problems (e.g., inductive, deductive).	NJ: 2023 SLS: English Language Arts NJ: Grades 11-12 • Speaking and Listening Domain • Speaking and Listening

A.CED.A. Creating Equations ★ Create equations that describe numbers or relationships A.CED.A.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A.REI.A. Reasoning with Equations and Inequalities Understand solving equations as a process of reasoning and explain the reasoning A.REI.A.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. Functions 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.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	manageable problems that can be solved through engineering.	9.4.2.IML.1: Identify a simple search term to find information in a search engine or digital resource. 9.4.5.CI.1: Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).	
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Activities	

Unit 6	
Data Analysis and Statistics	
Timeframe	Weeks 28-32
Unit Overview	1. To be able to display and analyze data using different modes and to know what mode is most appropriate for the data. 2. To be able to use the fundamental counting principle, permutations and combinations to count large quantities. 3. To be able to compute probability for different types of events: mutually exclusive, independent, dependent or inclusive. 4. To be able to recognize and analyze both binomial and normal distributions 5. To be able to compare surveys, experiments, and observational studies and determine which is appropriate to use and what conclusions can be made from each.
Essential Questions	1. What is the fundamental counting principle? 2. When should you use permutations or combinations? 3. How is the binomial theorem applied? 4. What is probability? 5. What is a mutually exclusive event? 6. What is an independent event? 7. What is a binomial distribution? 8. What is a normal distribution? 9. What are special qualities of a normal distribution? 10. What conclusions can you draw from a sample? 11. How do surveys, experiments, and observational studies differ?
Unit Focus	• ways to display data • normal distributions • binomial distributions • binomial theorem • the fundamental counting principle • combinations, permutations and probabilities of the elements of a set • specified sample spaces and events for random experiments • mutually exclusive and independent events • surveys, experiments, and observational studies
Interdisciplinary Connections	• NJSLS-9.4 Life Literacies and Key Skills

Common Assessments	• Assessment Suite chapter quizzes and tests

Materials	
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New Jersey Student Learning Standards (NJSLS)			
Subject Area	**Technology**	**21st Century Life and Careers**	**ELA Companion**
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. 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	NJ: 2020 SLS: Science NJ: Grades 9-12 • HS-ETS1 Engineering Design • Students who demonstrate understanding can: HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. .	• 9.4.2.CI.1: Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2). • 9.4.2.CI.2: Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a). • 9.4.2.CT.3: Use a variety of types of thinking to solve problems (e.g., inductive, deductive). 9.4.2.IML.1: Identify a simple search term to find information in a search engine or digital resource. 9.4.5.CI.1: Use appropriate communication technologies to collaborate with individuals with	NJ: 2023 SLS: English Language Arts NJ: Grades 11-12 • Speaking and Listening Domain • Speaking and Listening .

Quantitative Data Summarize, represent, and interpret data on a single count or measurement variable 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.A.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. S.IC.A. Making Inferences and Justifying Conclusions Understand and evaluate random processes underlying statistical experiments S.IC.A.1. (+) Understand statistics as a process for making inferences about population parameters based on a random sample from that population. S.IC.B. Making Inferences and Justifying Conclusions Make inferences and justify conclusions from sample surveys, experiments, and observational studies S.IC.B.3. (+) Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. S.CP.A. Conditional Probability and the Rules of Probability		diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).	

Understand independence and conditional probability and use them to interpret data S.CP.A.2. (+) Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. S.CP.A.3. (+) Understand the conditional probability of A given B as $\frac{P(A \text{ and } B)}{P(B)}$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B. S.CP.A.5. (+) Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. S.CP.B. Conditional Probability and the Rules of Probability Use the rules of probability to compute probabilities of compound events in a uniform probability model S.CP.B.6. (+) Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. S.CP.B.9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems. S.MD.A. Using Probability to Make Decisions Calculate expected values and use them to solve problems S.MD.A.3. (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the			

expected value. Algebra A.APR.C. Arithmetic with Polynomials and Rational Expressions Use polynomial identities to solve problems A.APR.C.5. (+) Know and apply the Binomial Theorem for the expansion of $(x+y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle. (Clarification: The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.)			

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Unit 7	
Sequences and Series	
Timeframe	Week 33-38
Unit Overview	1. The problem-solving strategy of looking for a pattern is an important skill. Students should now be able to identify patterns and use them to find different terms and sums of a sequence without going in consecutive order.

Essential Questions	1. Is a sequence arithmetic, geometric or neither? 2. Given the general formula, what is the missing term, term place, or common difference/ratio? 3. What is the sum of finite geometric and arithmetic series? 4. When do infinite geometric series have a sum? 5. What is the sum of a infinite geometric series? 6. How do you write a recursive rule for an arithmetic sequence and for a geometric sequence?
Unit Focus	• arithmetic and geometric sequences • general formulas for sequences • sigma notation • recursive rules • geometric, arithmetic, finite, and infinite series
Interdisciplinary Connections	21st Century Life Skills and Careers • NJSLS-9.4 Life Literacies and Key Skills
Common Assessments	• Assessment Suite chapter quizzes and tests

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Algebra 2

Algebra 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. A.SSE.B.4. (+) Derive and/or explain the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. 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.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.LE.A. Linear, Qudratic and Exponential Models Construct and compare linear and exponential models and solve problems	NJ: 2020 SLS: Science NJ: Grades 9-12 • HS-ETS1 Engineering Design • Students who demonstrate understanding can: HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	• 9.4.2.CI.1: Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2). • 9.4.2.CI.2: Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a). • 9.4.2.CT.3: Use a variety of types of thinking to solve problems (e.g., inductive, deductive). 9.4.2.IML.1: Identify a simple search term to find information in a search engine or digital resource. 9.4.5.CI.1: Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).	NJ: 2023 SLS: English Language Arts NJ: Grades 11-12 • Speaking and Listening Domain • Speaking and Listening

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).			

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Unit 8	
Unit 8- Trigonometry	
Timeframe	Week 39-40
Unit Overview	1. It is important to know how to convert between degrees and radians 2. You can use trigonometric functions to model real world applications 3. knowing the fundamental trigonometric identities will help prove statements
Essential Questions	1. How do you convert from degrees to radians? 2. What is a radian measure? 3. What is a circular function? 4. What are the fundamental identities? 5. How do you evaluate trigonometric functions with Unit Circle?

Unit Focus	• what a radian is • How to convert degree to radian and radian to degree • how to evaluate a trigonometric function, given lengths. • How to sketch an angle on a plane. • How to evaluate a trigonometric function on an unit circle.
Interdisciplinary Connections	• NJSLS-9.4 Life Literacies and Key Skills
Common Assessments	• Assessment Suite chapter quizzes and tests

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G.SRT.C. Similarity, Right Triangles, and Trigonometry Define trigonometric ratios and solve problems involving right triangles G.SRT.C.6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to	NJ: 2020 SLS: Science NJ: Grades 9-12 • HS-ETS1 Engineering Design	• 9.4.2.CI.1: Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2). • 9.4.2.CI.2: Demonstrate	NJ: 2023 SLS: English Language Arts NJ: Grades 11-12 • Speaking and Listening Domain

definitions of trigonometric ratios for acute angles. G.SRT.C.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. ★ Functions F.TF.A. Trigonometric Functions Extend the domain of trigonometric functions using the unit circle F.TF.A.1. (+) Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. F.TF.A.2. (+) Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.	• Students who demonstrate understanding can: HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	originality and inventiveness in work (e.g., 1.3A.2CR1a). • 9.4.2.CT.3: Use a variety of types of thinking to solve problems (e.g., inductive, deductive). 9.4.2.IML.1: Identify a simple search term to find information in a search engine or digital resource. 9.4.5.CI.1: Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).	• Speaking and Listening
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Creative & Visual Projects

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Digital & Cognitive Activities

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