



Township of Ocean Schools

Assistant Superintendent
Office of Teaching and Learning

SPARTAN MISSION:

Meeting the needs of all students with a proud tradition of academic excellence.

DEPARTMENT: Mathematics

COURSE: Algebra II

Curriculum Development Timeline

School: Ocean Township High School

Course: Algebra II

Department: Mathematics

Board Approval	Supervisor	Notes
July 2008	Janet Bluefield	Born Date
July 2012	Janet Bluefield	Revisions
August 2017	Nichole Kerney	Revisions
March 2019	Nichole Kerney	Review
August 2022	Gerard Marrone	Alignment to Standards
August 2025	Greg Colon	Alignment to Standards

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Township of Ocean Pacing Guide			
Cycle	Marking Period 1	Cycle	Marking Period 3
1	Linear Equations & Functions		
2	Transformations on parent functions	22	Rational Functions & Relations
3	Quadratic Functions & Relations	23	Rational Functions & Relations
4	Quadratic Functions & Relations	24	Rational Functions & Relations
5	Quadratic Functions & Relations	25	Inverse & Radical Functions & Relations
6	Quadratic Functions & Relations	26	Inverse & Radical Functions & Relations
7	Quadratic Functions & Relations	27	Inverse & Radical Functions & Relations
8	Quadratic Functions & Relations	28	Exponential & Logarithmic Functions & Relations
9	Quadratic Functions & Relations	29	Exponential & Logarithmic Functions & Relations
10	Polynomials & Polynomial Functions	30	Exponential & Logarithmic Functions & Relations
		31	Exponential & Logarithmic Functions & Relations
Cycle	Marking Period 2	Cycle	Marking Period 4
11	Polynomials & Polynomial Functions	32	Exponential & Logarithmic Functions & Relations
12	Polynomials & Polynomial Functions	33	Exponential & Logarithmic Functions & Relations
13	Polynomials & Polynomial Functions	34	Exponential & Logarithmic Functions & Relations
14	Polynomials & Polynomial Functions	35	Exponential & Logarithmic Functions & Relations

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15	Polynomials & Polynomial Functions	36	Exponential & Logarithmic Functions & Relations
16	Polynomials & Polynomial Functions	37	Exponential & Logarithmic Functions & Relations
17	Polynomials & Polynomial Functions	38	Trigonometry
18	Polynomials & Polynomial Functions	39	Trigonometry
19	Polynomials & Polynomial Functions	40	Trigonometry
20	Quadratic Functions & Relations/Polynomials (Midterm Review)	41	Trigonometry
		42	Rational/Radical/Exponential/Logarithm/ Trig (Final exam review)

Core Instructional & Supplemental Materials including various levels of Texts

Core Instruction: Big Ideas Algebra II Textbook and Ebook (Cengage) ©2022

Supplemental: IXL, NJGPA Released Questions, and Desmos

Special Education and ELL Supplemental: bigideasmath.com

Time Frame	1 cycle (3 ~ 56 minute blocks)
Topic	
Linear Equations and Functions	
Alignment to Standards	
N.Q.2 – Reason Quantitatively and Use Units to Solve Problems Define appropriate quantities for the purpose of descriptive modeling.	
F.IF.4 – Interpret Functions That Arise in Applications in Terms of the Context For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities.	
F.IF.5 – Interpret Functions That Arise in Applications in Terms of the Context	

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Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

F.IF.6 – Interpret Functions That Arise in Applications in Terms of the Context

Calculate and interpret the average rate of change of a function over a specified interval

F.IF.7a – Analyze Functions Using Different Representations

Graph linear and quadratic functions and show intercepts, maxima, and minima.

F.IF.9 – Compare Properties of Two Functions Each Represented in a Different Way

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

F.LE.2 – Construct Linear and Exponential Functions

Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs.

F.LE.5 – Interpret Parameters in Linear and Exponential Functions

Interpret the parameters in a linear or exponential function in terms of a context.

A.REI.1 – Understand Solving Equations as a Process of Reasoning

Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step.

A.REI.6 – Solve Systems of Linear Equations

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

A.REI.C.5 (+) Solve Systems of Linear Equations

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.11 – Represent and Solve Equations and Inequalities Graphically

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 $f(x) = g(x)$.

A.REI.12 – Represent and Solve Equations and Inequalities Graphically

Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

A.SSE.1b – Interpret the Structure of Expressions

Interpret complicated expressions by viewing one or more of their parts as a single entity.

A.CED.2 – Create Equations That Describe Numbers or Relationships

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

A.CED.3 – Create Equations That Describe Numbers or Relationships

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.





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Learning Objectives and Activities

SWBAT answer the following questions:

- How are equations, inequalities, and their graphs used to solve real-world problems?
- Why are relations and functions represented in multiple ways?
- How does the graph of a given function or relation reflect its characteristics?
- How many solutions does a system have?
- Which method of solving a system works best in a given situation?
- Why do some systems have one solution, no solution, or an infinite number of solutions?

SWBAT demonstrate understanding of the following:

- Linear functions can be used to model real-world situations.
- Algebraic properties govern the fluent manipulation of symbols in expressions, equations, and inequalities.
- Linear functions can be represented verbally, numerically, graphically, and analytically to understand patterns and relationships.
- Rates of change can be represented mathematically and graphically.
- Graphs and equations are alternative (and often equivalent) ways for depicting and analyzing families of linear functions. A variety of families of functions and methods can be used to model and solve real world situations.
- Creating a graph is not the same as interpreting the information displayed.

Learning Activities:

- Review Summer Packet
- CBL Activities- Matching the Graph
 - Time vs Distance
 - Piecewise Functions
- Using graphing calculator- solve systems
- Use communicators or dry erase board sets to graph linear equations

Assessments

Formative:

- Rich Thinking Tasks
- Classroom Observation
- Student Reflections and Math Talks
- Targeted Practice via IXL

Summative:

- Mid-unit Quizzes
- Topic Tests
- Performance Tasks/Projects

Alternative:

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- NJGPA Released Problems

Interdisciplinary Connections

Science:

HS-ETS1-3 – Evaluate a solution to a complex real-world problem.

Students apply linear models to evaluate engineering scenarios such as optimizing cost, energy efficiency, or material use.

ELA:

NJSLSA.W2 – Write informative/explanatory texts to examine and convey complex ideas clearly.

Students write about the significance of slope and intercepts in real-world contexts such as cost analysis, speed, and population changes.

SL.11-12.1 – Initiate and participate effectively in collaborative discussions.

Students discuss, critique, and defend strategies used to model and solve real-world problems with linear equations and systems.

Career Readiness, Life Literacies, and Key Skills

9.4.12.CI.2:

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

9.4.12.CT.2

Develop multiple solutions to a problem and evaluate short- and long-term impacts of each.

Technology Integration

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

- 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem.

Students will access the Big Ideas online ebook to further investigate lesson concepts and demonstrate understanding of standards.

- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
- 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.

Supplemental instruction and math games will be presented using IXL Math and Video Tutor bigideasmath.com.

- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and

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utility for accomplishing a specified task Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion utilizing pre-learned etiquette about blended learning platforms. 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem. Students will use graphing calculators to use math tools strategically and attend to precision and will use Desmos in order to discover new concepts involving graphing and functions. 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping
Career Education
9.4.12.CI.1: Demonstrate use of technical knowledge and skills. 9.4.12.CT.2: Explain the value of academic and technical skills in the workplace. 9.4.12.TL.3: Use digital tools to enhance productivity. 9.4.12.IML.5: Evaluate and select digital tools for effective communication and collaboration.

Time Frame	1 cycle ~ (3 - 56 minute blocks)
Topic	
Transformations on parent functions	
Alignment to Standards	
F.BF.3 – Build New Functions from Existing Functions 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.	
Learning Objectives and Activities	
Students will be able to: - Recognize and describe transformations of parent functions: vertical shifts, horizontal shifts, reflections, and stretches/compressions. - Analyze the impact of constants on the function rules: $f(x)+k$: vertical shift $f(x+k)$: horizontal shift	

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- $kf(x)$: vertical stretch/compression or reflection over the x-axis
- $f(kx)$: horizontal stretch/compression or reflection over the y-axis
- Match equations to transformed graphs and vice versa.
- Apply knowledge of transformations to model and interpret real-world situations.

Suggested Activities:

- Use Desmos or GeoGebra to dynamically explore transformations on graphs.
- Card sort matching equations to graphs and transformation descriptions.
- Collaborative group work with transformation stations (each station representing a type of transformation).

Assessments

Formative:

- Exit tickets identifying transformation types from graphs.
- Quick check-in quizzes using transformed and parent functions.
- Think-Pair-Share discussions interpreting transformations.

Summative:

- Unit test featuring graph identification, equation transformations, and real-world applications.
- Performance task: students design and explain a real-world scenario that involves multiple transformations.

Benchmark:

- Mid-year or end-of-year benchmark assessment evaluating growth in function transformation skills across multiple function types.

Alternative:

- Students create a digital presentation or infographic explaining each transformation type with examples.
- Oral assessment or recorded explanation of how changing a function's rule affects its graph.





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Interdisciplinary Connections

Science

HS-PS2-1: Analyze data to support the claim that the gravitational force exerted by Earth on objects is directed down.

HS-PS3-1: Create a computational model to calculate the change in the energy of one component in a system when the components of the system interact.

In physics, transformations of functions can represent energy changes, motion patterns, or wave behavior. For example, changing amplitude and frequency in sine functions can model sound waves.

Visual Arts

1.1.12prof.Cn10a: Synthesizing and relating knowledge and personal experiences to create products.

Students apply transformations creatively to design patterns and visual compositions, linking math to symmetry and design in visual media.

Career Readiness, Life Literacies, and Key Skills

9.4.12.CI.2:

Collaborate with individuals of diverse backgrounds to brainstorm and solve problems related to interpreting function transformations.

9.4.12.IML.7:

Evaluate the accuracy and reliability of visual data, such as graphs depicting economic or population growth trends using transformed functions.

9.4.12.CT.2:

Develop solutions to solve complex real-world problems using critical thinking, such as adjusting formulas in spreadsheets for business forecasts.

Technology Integration

Standard: 9.4.12.TL.3 – Use a variety of digital tools to design and develop a solution or product.

Desmos or GeoGebra Graphing Tools: Students use these platforms to experiment with and visualize function transformations dynamically.

Standard: 9.4.12.DC.1 – Evaluate the social and economic implications of digital decisions.

Learning Management System (e.g., Google Classroom): Students submit graph matching activities and performance tasks digitally.

Career Education

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9.4.12.CI.1: Demonstrate use of technical knowledge and skills.
9.4.12.CT.2: Explain the value of academic and technical skills in the workplace.
9.4.12.CI.3 – Collaborate with individuals of diverse backgrounds to produce quality work.
9.4.12.CI.4 – Demonstrate effective communication and collaboration in a digital environment.
9.4.12.IML.4 – Explain how a message and its delivery can impact how it is understood.

Time Frame	7 cycles (21 ~ 56 minute blocks)
Topic	
Quadratic Functions and Relations	
Alignment to Standards	
A.CED.3 – Create Equations That Describe Numbers or Relationships 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.1 – Understand Solving Equations as a Process of Reasoning Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, and construct a viable argument to justify a solution method. A.REI.4.a – Solve Quadratic Equations in One Variable 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.4.b – Solve Quadratic Equations in One Variable Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b. A.REI.11 – Represent and Solve Equations and Inequalities Graphically 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. A.SSE.2 – Use the Structure of an Expression to Identify Ways to Rewrite It Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$. A.SSE.3.a – Choose and Produce an Equivalent Form of an Expression Factor a quadratic expression to reveal the zeros of the function it defines. A.SSE.3.b – Choose and Produce an Equivalent Form of an Expression Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.	

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F.IF.7.a – Analyze Functions Using Different Representations

Graph linear and quadratic functions and show intercepts, maxima, and minima.

F.IF.8.a – Write a Function Defined by an Expression in Different but Equivalent Forms

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.

N.Q.2 – Reason Quantitatively and Use Units to Solve Problems

Define appropriate quantities for the purpose of descriptive modeling.

N.CN.1 – Perform Arithmetic Operations with Complex Numbers

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 – Perform Arithmetic Operations with Complex Numbers

Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

N.CN.3(+) – Perform Arithmetic Operations with Complex Numbers

Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

N.CN.4(+) – Represent Complex Numbers on the Complex Plane

Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number

N.CN.5(+) – Represent Complex Numbers on the Complex Plane

Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation.

N.CN.7 – Use Complex Numbers in Polynomial Identities and Equations

Solve quadratic equations with real coefficients that have complex solutions.

N.CN.8(+) – Use Complex Numbers in Polynomial Identities and Equations

Extend polynomial identities to the complex numbers. For example, rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$.

Learning Objectives and Activities

SWBAT answer the following questions:

- Why do we use different methods to solve math problems?
- Where in real life do we solve quadratic equations?
- How do you know if an equation is quadratic?
- How do you know which method to use when solving quadratic equations?
- When is it more efficient to use standard form over vertex form (and vice versa) when graphing a parabola?
- When do we use quadratic functions to solve everyday problems?
- What can we learn about the graph of a quadratic equation?

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SWBAT demonstrate understanding of the following:

- There are several strategies to solve quadratic equations.
- Simplifying expressions and solving equations allow us to take a complex situation and make it simple.
- Quadratic functions model real-world phenomena.
- Using previous knowledge to help you solve problems allows you to grow.
- Mathematical models can be used to describe physical relationships; these relationships are often non-linear.

Learning Activities:

- Use Algebra Tiles to review trinomial patterns
- Solve quadratic equations by finding the zeros on the graphing calculator
- Green Globes- Transformations
- Use graphing calculators- Quad reg & Stat Plot
- Use of communicators or dry erase board sets

Assessments

Formative:

- Daily Practice Problems
- IXL Practice
- Class Debate of Approaches/Mathematical Methods
- Graphic Organizer
- Math Scavenger Hunt/Trail

Summative:

- Mid-unit Quizzes
- Topic Tests
- Problem-based Quiz/Test on projectile motion

Alternative:

- Observation Assessment with Problem-solving finding max and min's in real world.
- Individual or group productive struggle assessment during introductory lessons

Interdisciplinary Connections

Science:

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.

In this quadratics unit students will design a solution to a complex real-world problem involving maximum/minimum/projectile motion by breaking it down into smaller, more manageable problems that can be solved through engineering.

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Career Readiness, Life Literacies, and Key Skills

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

Students explore multiple ways to represent and solve quadratic equations (graphing, factoring, completing the square, quadratic formula) to creatively solve real-world problems.

9.4.12.CT.2 – *Develop multiple solutions to a problem and evaluate short- and long-term impacts of each solution.*

Students analyze the pros and cons of different solving strategies in various contexts, such as projectile motion, to determine the most efficient method.

9.4.12.IML.5 – *Evaluate, synthesize, and apply information on a variety of topics from multiple authoritative sources to express original ideas and reflect on the process.*

Students use digital resources, calculators, and simulations to synthesize learning and develop deeper understanding of quadratic applications

Technology Integration

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

- 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem.

Students will access the Big Ideas online ebook to further investigate lesson concepts and demonstrate understanding of standards.

- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
- 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.

Supplemental instruction and math games will be presented using IXL Math and Video Tutor bigideasmath.com.

- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task

Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion utilizing pre-learned etiquette about blended learning platforms.

- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Students will use graphing calculators to use math tools strategically and attend to precision and will use Desmos in order to discover new concepts involving graphing and functions.

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping

Career Education

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- 9.4.12.CI.1** – Demonstrate the ability to reflect, analyze, and creatively adapt to complex situations.
9.4.12.CI.2 – Collaborate with others to expand thinking about a topic or problem.
9.4.12.CT.1 – Identify a problem, use critical thinking and logic to solve it.
9.4.12.CT.2 – Evaluate alternate solutions based on their effectiveness and potential consequences.
9.4.12.CT.3 – Use critical thinking skills to improve academic and technical performance.

Time Frame	10 cycles (30 ~ 56 minute blocks)
Topic	
Polynomials and Polynomial Functions	
Alignment to Standards	
A.APR.2 – Understand the Relationship Between Zeros and Factors of Polynomials 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.3 – Identify Zeros of Polynomials When Suitable Factoring is Available Standard: 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.4 (+) – Use Polynomial Identities to Solve Problems Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples. F.IF.7.c – Analyze Functions Using Different Representations Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. N.CN.9(+) – Use Complex Numbers in Polynomial Identities and Equations Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.	
Learning Objectives and Activities	
SWBAT answer the following questions:	

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- Why is math used to model real-world situations?
- How do we use polynomial patterns to make real-world predictions?
- How can I use the remainder and factor theorems to solve polynomials?

SWBAT demonstrate understanding of the following:

- The arithmetic of rational expressions is governed by the same rules as the arithmetic of rational numbers.
- Defining and solving the problem begins by selecting the appropriate procedural tool.
- The characteristics of polynomial functions and their representations are useful in solving real-world problems.
- The domain and range of polynomial functions can be extended to include the set of complex numbers.

Learning Activities:

- Algebra Tile Activity to divide polynomials
- Dividing Polynomials Lab

Assessments

Formative:

- Rich Thinking Tasks
- Classroom Observation
- Student Reflections and Math Talks
- Targeted Practice via IXL

Summative:

- Mid-unit Quizzes
- Topic Tests
- Performance Tasks/Projects

Alternative:

- NJGPA Released Problems

Interdisciplinary Connections

ELA:

SL.11-12.4 – Present information, findings, and supporting evidence clearly and logically.

Students present polynomial modeling problems and explain how polynomial degrees and roots relate to real-world applications (e.g., profit, motion, engineering design).

Science:

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HS-LS4-2 – Construct explanations based on evidence for how evolution results from various factors.

Polynomial models can be used to represent biological growth, rates of change, or population fluctuations under varying conditions.

Career Readiness, Life Literacies, and Key Skills

9.3.ST.2: When determining a regression model that fits data students will use technology to acquire, manipulate, analyze and report data.

Technology Integration

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

- 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem.

Students will access the Big Ideas online ebook to further investigate lesson concepts and demonstrate understanding of standards.

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Students will use graphing calculators to use math tools strategically and attend to precision and will use Desmos in order to discover new concepts involving graphing and functions.

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping

Career Education

9.4.12.CI.1 – Demonstrate the ability to reflect, analyze, and creatively adapt to complex situations.

9.4.12.CI.2 – Collaborate with others to expand thinking about a topic or problem.

9.4.12.CT.1 – Identify a problem and use critical thinking and logic to solve it.

9.4.12.CT.2 – Evaluate alternate solutions based on their effectiveness.

9.4.12.CT.3 – Use critical thinking to improve academic and technical performance.

9.4.12.TL.3 – Analyze the effectiveness of current and emerging technologies and how they can

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DEPARTMENT: Mathematics

COURSE: Algebra II

support or hinder productivity.

9.4.12.IML.5 – Evaluate and responsibly use digital tools to enhance research and productivity.

Time Frame	3 cycles (9~ 56 minute blocks)
Topic	
Inverses and Radical Functions and Relations	
Alignment to Standards	
N.RN.1 – Explain the Properties of Rational and Irrational Numbers Explain how the properties of exponents extend to rational exponents. N.RN.2 – Rewrite Expressions Involving Radicals and Rational Exponents Rewrite expressions involving radicals and rational exponents using the properties of exponents. F.IF.4 – Interpret Functions That Arise in Applications in Terms of the Context For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities F.IF.7b – Graph Functions Expressed Symbolically and Show Key Features of the Graph Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. F.IF.9 – Compare Properties of Two Functions Each Represented in a Different Way Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions) F.BF.1b – Build a Function That Models a Relationship Between Two Quantities Combine standard function types using arithmetic operations F.BF.1c(+) – Compose Functions Compose functions. For example, if $T(y)$ is the temperature in the atmosphere as a function of height, and $h(t)$ is the height of a weather balloon as a function of time, then $T(h(t))$ is the temperature at the location of the weather balloon as a function of time F.BF.4a – Find Inverse Functions Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse F.BF.4b(+) – Verify by Composition That One Function is the Inverse of Another Verify by composition that one function is the inverse of another F.BF.4c(+) – Read Values of an Inverse Function from a Graph or a Table Read values of an inverse function from a graph or a table, given that the function has an inverse. F.BF.4d(+) – Produce an Invertible Function from a Non-Invertible Function by Restricting the Domain	





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Produce an invertible function from a non-invertible function by restricting the domain.

A.REI.2 – Solve Simple Rational and Radical Equations in One Variable

Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise

Learning Objectives and Activities

SWBAT answer the following questions:

- How can you choose a model to represent a set of data?
- How do we apply mathematical principles?
- What makes an algebraic algorithm both effective and efficient?
- How do operations affect numbers?

SWBAT demonstrate understanding of the following:

- Algebraic representations can be used to generalize patterns in mathematics
- Patterns and relationships can be represented graphically, numerically, symbolically, or verbally.

Learning Activities:

- Miras to show inverse is the reflection over $y=x$
- Green Globes activity- square root function
- Sketch and graph a given function- state domain and range
- Use communicators or dry erase board set

Assessments

Formative:

- Rich Thinking Tasks
- Classroom Observation
- Student Reflections and Math Talks
- Targeted Practice via IXL

Summative:

- Mid-unit Quizzes
- Topic Tests
- Performance Tasks/Projects

Alternative:

- NJGPA Released Problems

Interdisciplinary Connections

ELA:





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SL.11-12.1 – Initiate and participate effectively in a range of collaborative discussions.

Students discuss how to identify, solve, and verify inverse and radical functions in real-world applications (e.g., reverse engineering, architecture, physics).

Career Readiness, Life Literacies, and Key Skills

Standard 9.4.12.CT.2 – Identify opportunities for innovation through recognizing patterns in radical or inverse functions.

Technology Integration

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

- 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem.

Students will access the Big Ideas online ebook to further investigate lesson concepts and demonstrate understanding of standards.

- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Students will use internet based game sites such as Quizizz, Kahoot, and Quizlet live to reflect on their learning progress.

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

Supplemental instruction and math games will be presented using IXL Math and Video Tutor bigideasmath.com.

- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task

Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion utilizing pre-learned etiquette about blended learning platforms.

- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Students will use graphing calculators to use math tools strategically and attend to precision and will use Desmos in order to discover new concepts involving graphing and functions.

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping

Career Education

9.4.12.CI.3 – Collaborate with individuals of diverse backgrounds to produce quality work.

9.4.12.CI.4 – Demonstrate effective communication and collaboration in a digital environment.

9.4.12.IML.4 – Explain how a message and its delivery can impact how it is understood.

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9.4.12.TL.3 – Analyze the effectiveness of current and emerging technologies and how they can support or hinder productivity.
9.4.12.IML.5 – Evaluate and responsibly use digital tools and resources to enhance productivity.

Time Frame	10 cycles (30 ~ 56 minute blocks)
Topic	
Exponential and Logarithmic Functions and Relations	
Alignment to Standards	
N.Q.2 – Reason Quantitatively and Use Units to Solve Problems Define appropriate quantities for the purpose of descriptive modeling F.BF.1.b – Build a Function That Models a Relationship Between Two Quantities Combine standard function types using arithmetic operations. F.BF.5(+) – Understand the Inverse Relationship Between Exponents and Logarithms Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. F.IF.7.f (t) – Analyze Functions Using Different Representations Graph trigonometric functions, showing period, midline, and amplitude. F.IF.8.b – Write a Function Defined by an Expression in Different but Equivalent Forms Use the properties of exponents to interpret expressions for exponential functions. F.LE.2 – Construct and Compare Linear, Quadratic, and Exponential Models and Solve Problems Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs F.LE.4 – Construct and Compare Linear, Quadratic, and Exponential Models and Solve Problems Standard: For exponential models, 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. F.LE.5 – Interpret Expressions for Functions in Terms of the Situation They Model Interpret the parameters in a linear or exponential function in terms of a context. A.SSE.3.c – Choose and Produce an Equivalent Form of an Expression to Reveal and Explain Properties of the Quantity Represented by the Expression Use the properties of exponents to transform expressions for exponential functions.	
Learning Objectives and Activities	
SWBAT answer the following questions:	

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- How can you make good decisions?
- What factors can affect good decision making?
- What is the difference between exponential growth and decay?
- Why do we need "e"?
- How are logs and exponents related?
- When graphing $y=ab^x+c$, what does a, b, and c do to the graph?
- How do you solve a log problem with a base other than 10?

SWBAT demonstrate understanding of the following:

- Nth roots are inverses of power functions.
- Understanding the properties of power functions and how inverses behave explains the properties of nth roots.
- Computing with rational exponents is no different from computing with integral exponents.
- Exponential and logarithmic functions behave the same as other functions with respect to graphical transformations.
- Two special logarithmic functions are the common log and natural log. These special functions occur often in nature.

Learning Activities:

- M & M Lab- exponential decay
- Compound Interest Activity
- Population Growth Activity

Assessments

Formative:

- Rich Thinking Tasks
- Classroom Observation
- Student Reflections and Math Talks
- Targeted Practice via IXL

Summative:

- Mid-unit Quizzes
- Topic Tests
- Performance Tasks/Projects

Alternative:

- NJGPA Released Problems

Interdisciplinary Connections

Science:

HS-PS1-4 – Develop a model to describe the macroscopic properties of a substance based on

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COURSE: Algebra II

particle-level interactions.

Students use exponential and logarithmic models to understand processes like radioactive decay or chemical reactions, where rates change exponentially over time.

HS-LS2-4 – Use mathematical representations to describe and predict the effects of interactions.

Exponential growth models are used to study population dynamics, while logarithmic models can describe the relationship between light intensity and distance in biological systems.

HS-ESS3-6 – Evaluate or model solutions to reduce human impact on the environment.

Exponential decay models are applied to environmental science problems, such as modeling the degradation of pollutants over time.

Career Readiness, Life Literacies, and Key Skills

9.1.12.CDM.8: In the logarithmic unit students will compare and compute interest and compound interest and develop an amortization table using business tools.

9.1.12.CDM.6: When learning exponential equations students will compute and assess the accumulating effect of interest paid over time when using a variety of sources of credit (e.g., student loans, credit cards, auto loans, mortgages, etc.)

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- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping

Career Education

9.4.12.CI.1 – Demonstrate the ability to reflect, analyze, and refine creative ideas to improve a product or solution.

9.4.12.CI.2 – Evaluate diverse perspectives and incorporate them to develop creative solutions.

9.4.12.CI.3 – Work collaboratively to produce innovative solutions in real-world contexts.

9.4.12.CT.1 – Identify problem-solving strategies used in the development of a product or solution.

9.4.12.CT.2 – Analyze a complex problem and determine steps to reach a viable solution.

9.4.12.CT.3 – Evaluate solutions for their effectiveness and refine them as needed.

Time Frame	4 cycles (12~ 56 minute blocks)
Topic	
Rational Functions and Relations	
Alignment to Standards	
A.APR.6 – Rational Expressions Standard: 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(+) – Rational Expressions Standard: 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. A.CED.1 – Creating Equations Standard: 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.2 – Creating Equations Standard: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A.REI.2 – Reasoning with Equations and Inequalities Standard: Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. F.IF.7.d(+) – Interpreting Functions	

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Standard: Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

F.IF.9 – Interpreting Functions

Standard: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Learning Objectives and Activities

SWBAT answer the following questions:

- Why are graphs useful?
- How do we decide which method is most appropriate when solving rational equations?
- When are asymptotes used to graph rational functions?

SWBAT demonstrate understanding of the following:

- Mastering a procedure is not the same as mastering the concept.
- Simplified expressions are essential in being able to solve equations.
- Domain affects graphing and solving of rational functions.

Learning Activities:

- “Inverse Variation” Lab
- Wind Chimes
- Paint Puzzler
- Harvir Needs a Car

Assessments

Formative:

- Rich Thinking Tasks
- Classroom Observation
- Student Reflections and Math Talks
- Targeted Practice via IXL

Summative:

- Mid-unit Quizzes
- Topic Tests
- Performance Tasks/Projects

Alternative:

- NJGPA Released Problems

Interdisciplinary Connections

ELA:





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NJSLSA.R1 – Read closely to determine what the text says explicitly and make logical inferences from it; cite specific textual evidence.

Students read and interpret word problems and real-world contexts involving rational functions, identifying key relationships between variables and reasoning through their solutions.

Science:

HS-PS2-4 – Use mathematical representations to describe a physical system.

Rational functions can be used to model systems with inverse relationships, such as velocity and time, or electrical resistance and current in circuits.

Career Readiness, Life Literacies, and Key Skills

9.4.12.CT.2:

Develop multiple solutions to a problem and evaluate short- and long-term impacts of each solution.

Students analyze and compare multiple algebraic strategies when solving inverse or radical equations.

Technology Integration

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

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- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

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- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using

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formatting techniques such as form, position, size, color, movement, and spatial grouping

Career Education

- **9.4.12.TL.3** – Use digital tools to enhance productivity in a variety of contexts.
- **9.4.12.TL.1** – Analyze the impact of technology on personal and professional productivity.
- 9.4.12.IML.5** – Evaluate digital tools for effectiveness and reliability in gathering and using information.

Time Frame	4 cycles (16~ 56 minute blocks)
Topic	
Trigonometry	
Alignment to Standards	
F.TF.1 – Understand Radian Measure of an Angle as the Length of the Arc on the Unit Circle Subtended by the Angle Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle F.TF.2 (+)– Explain How the Unit Circle in the Coordinate Plane Enables the Extension of Trigonometric Functions to All Real Numbers 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 F.TF.5 (+) – Choose Trigonometric Functions to Model Periodic Phenomena with Specified Amplitude, Frequency, and Midline Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline F.TF.8 (+) – Prove the Pythagorean Identity and Use It to Find Trigonometric Functions Given Others Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle F.TF.A.1 (+) Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	
Learning Objectives and Activities	
SWBAT answer the following questions: ● How can I make connections to angles to determine basic trigonometric values?	

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- How can I evaluate trigonometric functions at any domain value by connecting experiences with special right triangles gained in Geometry?
- How can I select and apply trigonometric functions to solve problems in contexts that model cyclical behavior?

SWBAT demonstrate understanding of the following:

- Build new functions from existing function.
- Model periodic phenomena with trigonometric functions
- Analyze functions using different representations
- Extend the domain of trigonometric functions using the unit circle

Learning Activities:

- Construct a color coded unit circle
- Define trigonometric functions using x , y , and r
- Ferris Wheel Problem
- Tide Problem
- Spaghetti Lab
- Graphing calculator activity discovering properties of periodic functions

Assessments

Formative:

- Rich Thinking Tasks
- Classroom Observation
- Student Reflections and Math Talks
- Targeted Practice via IXL

Summative:

- Mid-unit Quizzes
- Topic Tests
- Performance Tasks/Projects

Alternative:

- NJGPA Released Problems

Interdisciplinary Connections

ELA:

W.11-12.1: Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

When students are justifying their reasoning on short answer and extended constructed response questions they write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

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Career Readiness, Life Literacies, and Key Skills

9.4.12.IML.6 – *Use advanced tools to create digital artifacts to communicate or solve real-world problems.*

Students use Desmos, graphing calculators, and digital platforms to present and analyze trigonometric models of periodic behavior in various applied contexts.

Technology Integration

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

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Students will access the Big Ideas online ebook to further investigate lesson concepts and demonstrate understanding of standards.

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9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping)

Career Education

9.4.12.CI.1: Demonstrate use of technical knowledge and skills.

9.4.12.CT.2: Explain the value of academic and technical skills in the workplace.

9.4.12.CT.1: Identify problem-solving strategies.

9.4.12.CT.3: Analyze complex problems and develop possible solutions.

9.4.12.TL.3: Use digital tools to enhance productivity.

9.4.12.IML.5: Evaluate and select digital tools for effective communication and collaboration.





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Modifications (ELL, Special Education, At-Risk Students, Gifted & Talented, & 504 Plans)

ELL:

- Work toward longer passages as skills in English increase
- Use visuals
- Introduce key vocabulary before lesson
- Teacher models reading aloud daily
- Provide peer tutoring
- Use of Bilingual Dictionary
- Guided notes and/or scaffold outline for written assignments
- Provide students with English Learner leveled readers.

Supports for Students With IEPs:

- Allow extra time to complete assignments or tests
- Guided notes and/or scaffold outline for written assignments
- Work in a small group
- Allow answers to be given orally or dictated
- Use large print books, Braille, or books on CD (digital text)
- Follow all IEP modifications

At-Risk Students:

- Guided notes and/or scaffold outline for written assignments
- Introduce key vocabulary before lesson
- Work in a small group
- Lesson taught again using a differentiated approach
- Allow answers to be given orally or dictated
- Use visuals / Anchor Charts
- Leveled texts according to ability

Gifted and Talented:

- Create an enhanced set of introductory activities (e.g. advance organizers, concept maps, concept puzzles)
- Provide options, alternatives and choices to differentiate and broaden the curriculum
- Organize and offer flexible small group learning activities
- Provide whole group enrichment explorations
- Teach cognitive and methodological skills
- Use center, stations, or contracts

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- Organize integrated problem-solving simulations
- Propose interest-based extension activities
- Expose students to beyond level texts.

Supports for Students With 504 Plans:

- Follow all the 504 plan modifications
- Text to speech/audio recorded selections
- Amplification system as needed
- Leveled texts according to ability
- Fine motor skill stations embedded in rotation as needed
- Modified or constrained spelling word lists
- Provide anchor charts with high frequency words and phonemic patterns

Algebra 2 Honors Course Content Enhancements

Conic Sections:

- Study of circles, ellipses, parabolas, and hyperbolas as intersections of planes and cones.
- Derivation of conic equations using geometric definitions and completing the square.
- Exploration of reflective properties and applications in real-world systems (e.g., telescopes, architecture, sound engineering).

Standards Alignment:

- A.CED.2: Create equations in two or more variables to represent relationships between quantities.
- A.CED.4: Rearrange formulas to highlight a quantity of interest.
- A.SSE.1.b: Interpret parts of expressions as single entities.
- F.IF.9: Compare properties of functions represented in different ways.
- A.REI.11: Explain solutions as the x-coordinates of intersecting graphs.
- G.GPE.1: Derive the equation of a circle.

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- G.GPE.2: Derive the equation of a parabola from a focus and directrix.
- G.GPE.3(+): Derive equations of ellipses and hyperbolas using focal properties.

Sequences and Series:

- Analysis of arithmetic and geometric sequences and series in both explicit and recursive forms.
- Modeling with sequences to represent linear and exponential patterns.
- Use of the Binomial Theorem for expansion and application in probability contexts.

Standards Alignment:

- N.Q.2: Define appropriate quantities for descriptive modeling.
- F.IF.3–6: Interpret functions and their representations in context.
- F.BF.1.a, F.BF.2: Build and write arithmetic and geometric sequences.
- F.LE.2: Construct linear and exponential models.
- A.CED.4: Rearranging formulas to highlight a quantity.
- A.SSE.1.b: Interpreting structure of expressions.
- A.SSE.4: Derive and use sum formulas for finite geometric series.
- A.APR.5(+): Apply the Binomial Theorem.

Instructional Adjustments

Accelerated Pacing:

- Each unit is taught across three cycles (~9 class periods), allowing deeper conceptual exploration and integration of advanced mathematical reasoning.

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- Additional content such as polar forms, eccentricity, and real-world modeling is incorporated where appropriate.

Higher-Level Problem-Solving:

- Students engage in multi-step applications involving conic sections and sequences, interpreting and comparing graphs, equations, and verbal models.
- Modeling of complex systems such as orbital motion, economic growth, and acoustics.

Independent Inquiry:

- Inquiry-based learning through labs and activities:
 - *Wax Paper Parabola Fold, Ellipse String Activity, Family Probability Lab, and more.*
- Use of digital tools such as Desmos, GeoGebra, and graphing calculators to explore and visualize patterns and systems.
- Opportunities for extension projects and student-driven investigations.

Assessment Modifications

Increased Rigor:

- Assessments challenge students to demonstrate conceptual understanding, interpret structures, and evaluate real-world mathematical models.
- Focus on analyzing multiple representations and solving systems graphically and algebraically.

Enrichment Tasks:

- Use of alternate assessments like digital modeling projects, presentations, and reflection pieces.

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- Classroom activities incorporate exploratory work and higher-order questioning.

Performance-Based Evaluation:

- Assessments include real-world tasks such as designing reflective satellite dishes, interpreting planetary motion, or budgeting through series modeling.
- Evaluation based on process, strategy, and interpretation — not just final answers.

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