



Park Hill School District

Building Successful Futures • Each Student • Every Day

High School Applied Algebra 2 Curriculum

Course Description: Applied Algebra 2 is a problem-based course where students explore Algebra 2 concepts through meaningful applications and modeling. Each unit connects mathematical ideas to practical contexts. Students will analyze patterns, make predictions, and solve problems that mirror authentic situations, building both mathematical understanding and decision-making skills.

Course Standards: Missouri Department of Elementary and Secondary Education Algebra 2 Standards

Scope and Sequence:

Timeframe	Unit
11-12 Blocks	Unit 1 - Foundations in Focus: Modeling with Algebra
13-14 Blocks	Unit 2 - Flight Paths & Functions: Modeling with Quadratics
12-13 Blocks	Unit 3 - Patterns and Pathways: Modeling with Polynomials
12-13 Blocks	Unit 4 - Rates that Matter: Modeling with Rationals
9-10 Blocks	Unit 5 - The Power of Roots: Modeling with Radicals
15-16 Blocks	Unit 6 - Functions that Change the Universe: Modeling with Exponentials & Logarithms
5-10 Blocks	Unit 7 - From Data to Decisions: Modeling with Statistics & Probability

Unit 1 - Foundations in Focus: Modeling with Algebra

Subject: Applied Algebra 2

Name of Unit: Foundations in Focus: Modeling with Algebra

Length of Unit: 11-12 blocks

Overview of Unit: This review unit reinforces key basic Algebra skills: solving equations and inequalities, interpreting and modeling with functions, factoring expressions, and solving systems of equations. Students will connect prior knowledge to new applications using graphs, tables, and equations to solve real-world problems. The unit emphasizes choosing appropriate strategies, understanding function behavior, and recognizing how algebra is used in everyday situations.

Priority Standards for unit:

- A2.REI.A: Solve equations and inequalities
- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.FM.A: Use functions to model real-world problems

Supporting Standards for unit:

- A2.REI.A.1: Create and solve equations and inequalities, including those that involve absolute value
- A2.REI.B: Solve general systems of equations and inequalities

Essential Questions:

1. WHAT are we studying in this unit?
2. WHO uses these concepts in “real life”? / WHO created this concept?
3. WHERE is the connection between prior knowledge and new knowledge?
4. WHEN are these concepts applied?
5. HOW do you demonstrate your understanding of these concepts?
6. WHY is this concept meaningful?

Enduring Understanding/Big Ideas:

1. **Linear equations represent constant rates of change and can model real-world relationships.**
They describe patterns such as distance over time, cost per item, or income over hours worked.
2. **Linear functions can be represented in multiple forms: equations, graphs, tables, and word problems.**

The slope and y-intercept of a linear equation provide key information about the relationship between variables.

Slope describes how one variable changes in relation to another, while the y-intercept represents the starting value.

3. **Factoring rewrites quadratic expressions into simpler components that reveal key features like solutions (roots).**

It is essential for solving equations, simplifying expressions, and connecting to graphing. Factoring builds on understanding of multiplication and the distributive property.

4. **Systems of equations model situations with multiple constraints or conditions.**

Examples include comparing plans, budgeting, mixing solutions, or finding break-even points.

Understanding this concept supports visual reasoning and real-world problem solving.

5. **There are multiple methods to solve systems: graphing, substitution, and elimination.**

Each method offers strategic advantages depending on the problem's format.

Solutions to systems represent points of intersection—where two relationships are true at the same time.

Unit Vocabulary:

- Line
- Slope
 - Rate of change
- Intercept (x and y)
- Factor
- System of equations
- Solution
- Domain
- Range
- Linear vs. non-linear
- Distributive property
 - FOIL

Learning Targets:

Priority Standard: A2.REI.A: Solve equations and inequalities	
Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to solve a multi-step equation and inequality.	1
	Understanding
Students will be able to solve a system graphically	1
	Understanding
Students will be able to solve a quadratic function using different factoring techniques	2
	Applying
Priority Standard: A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems	
Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to identify the slope and y-intercept of linear functions in multiple forms.	1
	Understanding
Students will be able to graph linear functions and inequalities using multiple modalities	2
	Applying
Students will be able to create a linear regression model (using technology) from a table of values	2
	Applying

Priority Standard: A2.FM.A: Use functions to model real-world problems

Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to create a linear regression model (using technology) and use the model to interpret real-world scenarios.	3
	Analyzing
Students will be able to write and solve a system of equations from a real-world scenario.	3
	Analyzing

Engaging Experiences

Engaging Experience 1

Title: Linear Equation Project

Suggested Length of Time: 2 Blocks

Standards Addressed

Priority:

- A2.REI.A: Solve equations and inequalities
- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.FM.A: Use functions to model real-world problems

Detailed Description/Instructions: Students will take ownership of their learning by choosing from a variety of engaging activities in this Linear Equation Project to demonstrate their understanding of linear equations. They will work towards showing mastery by completing tasks that fit their interests and strengths, such as creating presentations, writing and solving word problems, designing tests, making videos, and developing games or flashcards.

Bloom's Levels: Applying

Webb's DOK: 2

Engaging Experience 2

Title: Marbleslides: Linear (Desmos)

Suggested Length of Time: ½ Block

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems

Detailed Description/Instructions: Students will explore and deepen their understanding of linear functions through the interactive Desmos Marbleslides activity. They will manipulate key features such as slope and intercepts by sliding points to create different linear graphs, observing how changes affect the equation and graph simultaneously.

Bloom's Levels: Applying

Webb's DOK: 2

Engaging Experience 3

Title: Sales Jobs Comparison

Suggested Length of Time: 1 Block

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.FM.A: Use functions to model real-world problems

Supporting:

- A2.REI.B: Solve general systems of equations and inequalities

Detailed Description/Instructions: Students explore real-world trends represented by linear equations through a comparison of two commission-based sales jobs. They write and interpret equations, identify key components (fixed salary, commission rate), and solve a system algebraically and graphically to find the sales point where both jobs pay equally.

Bloom's Levels: Applying

Webb's DOK: 2

Engaging Experience 4

Title: Car Comparisons

Suggested Length of Time: 1 Block

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.FM.A: Use functions to model real-world problems

Supporting:

- A2.REI.B: Solve general systems of equations and inequalities

Detailed Description/Instructions: Students will apply systems of linear equations to a real-world decision-making scenario by comparing the total costs of owning a hybrid versus a regular sedan over time. They will research car prices and gas mileage, calculate monthly fuel expenses, write equations representing each car's total cost, and solve the system both graphically and algebraically.

Bloom's Levels: Analyzing

Webb's DOK: 3

Engaging Experience 5

Title: How Much is a Taco?

Suggested Length of Time: 1 Block

Standards Addressed

Priority:

- A2.REI.A: Solve equations and inequalities
- A2.FM.A: Use functions to model real-world problems

Supporting:

- A2.REI.A.1: Create and solve equations and inequalities, including those that involve absolute value
- A2.REI.B: Solve general systems of equations and inequalities

Detailed Description/Instructions: Students will use systems of linear equations to solve real-world problems involving the cost of menu items. They will write and analyze equations based on orders of tacos, burritos, pizza slices, and cannolis to determine the price of each item. This project develops skills in modeling situations algebraically, interpreting solutions in context, and applying problem-solving strategies to everyday scenarios involving multiple variables.

Bloom's Levels: Analyzing

Webb's DOK: 3

Engaging Experience 6

Title: Lights Factoring

Suggested Length of Time: ½ Block

Standards Addressed

Priority:

- A2.REI.A: Solve equations and inequalities

Detailed Description/Instructions: Students will engage in a differentiated factoring activity where they select problems based on difficulty levels—green (easy), yellow (medium), and red (challenging).

Bloom's Levels: Understanding

Webb's DOK: 1

Engaging Experience 7

Title: Factoring Flow Chart

Suggested Length of Time: ½ Block

Standards Addressed

Priority:

- A2.REI.A: Solve equations and inequalities
- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems

Detailed Description/Instructions: Students will create a "Factoring Decision Flow Chart" to guide them in determining which factoring method to use based on the structure of a given expression. They will analyze key features—such as number of terms, presence of a greatest common factor (GCF), perfect squares, or a leading coefficient—and write branching questions that lead to methods like GCF factoring, difference of squares, grouping, or trinomials. To demonstrate their understanding, students will also generate one original example problem for each category in the flow chart, explaining why it fits and how it would be factored using the chosen method.

Bloom's Levels: Analyzing

Webb's DOK: 3

Summary of Engaging Learning Experiences

Engaging Experience Title	Description	Suggested Length of Time
Linear Equation Project	Students will take ownership of their learning by choosing from a variety of engaging activities in this Linear Equation Project to demonstrate their understanding of linear equations. They will work towards showing mastery by completing tasks that fit their interests and strengths, such as creating presentations, writing and solving word problems, designing tests, making videos, and developing games or flashcards.	2 Blocks
Marbleslides: Linear (Desmos)	Students will explore and deepen their understanding of linear functions through the interactive Desmos Marbleslides activity. They will manipulate key features such as slope and intercepts by sliding points to create different linear graphs, observing how changes affect the equation and graph simultaneously.	$\frac{1}{2}$ Block
Sales Jobs Comparison	Students explore real-world trends represented by linear equations through a comparison of two commission-based sales jobs. They write and interpret equations, identify key components (fixed salary, commission rate), and solve a system algebraically and graphically to find the sales point where both jobs pay equally.	1 Block
Car Comparisons	Students will apply systems of linear equations to a real-world decision-making scenario by comparing the total costs of owning a hybrid versus a regular sedan over time. They will research car prices and gas mileage, calculate monthly fuel expenses, write equations representing each car's total cost, and solve the system both graphically and algebraically.	1 Block

How much is a Taco?	Students will use systems of linear equations to solve real-world problems involving the cost of menu items. They will write and analyze equations based on orders of tacos, burritos, pizza slices, and cannolis to determine the price of each item. This project develops skills in modeling situations algebraically, interpreting solutions in context, and applying problem-solving strategies to everyday scenarios involving multiple variables.	1 Block
Lights Factoring	Students will engage in a differentiated factoring activity where they select problems based on difficulty levels—green (easy), yellow (medium), and red (challenging).	½ Block
Factoring Flow Chart	Students will create a "Factoring Decision Flow Chart" to guide them in determining which factoring method to use based on the structure of a given expression. They will analyze key features—such as number of terms, presence of a greatest common factor (GCF), perfect squares, or a leading coefficient—and write branching questions that lead to methods like GCF factoring, difference of squares, grouping, or trinomials. To demonstrate their understanding, students will also generate one original example problem for each category in the flow chart, explaining why it fits and how it would be factored using the chosen method.	½ Block

Unit 2 - Flight Paths & Functions: Modeling with Quadratics

Subject: Applied Algebra 2

Name of Unit: Flight Paths & Functions: Modeling with Quadratics

Length of Unit: 13-14 Blocks

Overview of Unit: Students explore quadratic functions as tools to model real-world situations involving motion, area, and optimization. By analyzing key features across multiple representations and connecting to prior knowledge of linear functions, students deepen their understanding of quadratic behavior and transformations. Through problem solving and modeling, they strengthen algebraic and geometric reasoning skills and learn how quadratics help make sense of and solve real-world problems.

Priority Standards for unit:

- A2.REI.A: Solve equations and inequalities
- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions
- A2.FM.A: Use functions to model real-world problems

Supporting Standards for unit:

- A2.NQ.B: Use complex numbers
- A2.REI.B: Solve general systems of equations and inequalities
- A2.BF.A.1: Create new functions by applying the four arithmetic operations and composition of functions (modifying the domain and range as necessary)
- A2.FM.A.1: Create functions and use them to solve applications of quadratic and exponential function model problems

Essential Questions:

1. WHAT are we studying in this unit?
2. WHO uses these concepts in “real life”? / WHO created this concept?
3. WHERE is the connection between prior knowledge and new knowledge?
4. WHEN are these concepts applied?
5. HOW do you demonstrate your understanding of these concepts?
6. WHY is this concept meaningful?

Enduring Understanding/Big Ideas:

- 1. Quadratic functions model real-world situations involving area, motion, and optimization.**

Understanding quadratic equations helps us analyze projectile motion, calculate maximum/minimum values, and solve problems involving area or revenue.

- 2. The structure of a quadratic equation reveals important features of its graph and behavior.**

Different forms (standard, vertex, factored) provide different insights:

- *Standard form* reveals the y-intercept.
- *Vertex form* shows the maximum or minimum point.
- *Factored form* highlights the x-intercepts (roots/zeros).

- 3. There are multiple strategies to solve quadratic equations, the best method depends on the situation, and the discriminant can be used to predict the number and type of solutions.**

- 4. Quadratic relationships are connected to previous understanding of linear functions and extend into nonlinear behavior.**

Students build on linear patterns by exploring parabolas in different modalities (equation, graph, table) and how changes in coefficients affect shape, direction, and position.

- 5. Graphing quadratic functions connects algebraic and geometric reasoning.**

Students use symmetry, vertex, axis of symmetry, and intercepts to graph and interpret quadratic behavior visually and algebraically.

- 6. Mathematics models can help identify optimal outcomes.**

Quadratics are frequently used to find maximum profit, minimum cost, or optimal dimensions in real-life scenarios.

Unit Vocabulary:

- Vertex
- Axis of symmetry
- Intercepts (x and y)
- Factor
- Quadratic Formula
- Parabola
- Roots/Zeros/Solutions
- Projectile
- Complex Number - real vs. imaginary
- Discriminant
- Domain
- Range

Learning Targets:

Priority Standard: A2.REI.A: Solve equations and inequalities	
Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to calculate the solutions to a quadratic equation algebraically	2
	Applying
Students will be able to identify the solutions to a quadratic equation graphically.	1
	Understanding
Priority Standard: A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems	
Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to algebraically calculate the key characteristics of a quadratic equation	2
	Applying
Students will be able to (with or without technology) graphically identify the key characteristics of a quadratic equation	1
	Remembering
Students will use a table of values to create a quadratic equation and graph with technology	3
	Analyzing

Priority Standard: A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions

Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to differentiate between different quadratic vs. linear equations when looking at graphical representations	2
	Applying
Students will graph parabolas using transformations of the parent function	2
	Applying
Students will be able to identify vertical and horizontal transformations in a quadratic function.	1
	Remembering

Priority Standard: A2.FM.A: Use functions to model real-world problems

Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to explain what the vertex represents in a real world situation	4
	Evaluating
Students will be able to explain what the x-intercepts represent in a quadratic real world situation	4
	Evaluating
Students will be able to identify the domain and range of a quadratic real world situation	4
	Evaluating

Engaging Scenario

Engaging Scenario (An Engaging Scenario is a culminating activity that includes the following components: situation, challenge, specific roles, audience, product or performance.)

Punt, Pass, and Kick Challenge

Students will explore the real-world application of quadratic functions through a "Punt, Pass & Kick" challenge on the football field. Working in small groups, students will engage in hands-on data collection by measuring the distance, maximum height, and flight time of footballs launched through punts, passes, and kicks. Using these measurements, students will create quadratic equations that model each trajectory, analyze key features such as vertex, intercepts, and axis of symmetry, and interpret how these features relate to the motion of the ball. Finally, students will present their findings through graphs and presentations, comparing results across groups to draw conclusions about the factors influencing projectile motion.

Engaging Experiences

Engaging Experience 1

Title: Angry Birds Opening Activity

Suggested Length of Time: 1 Block

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions

Detailed Description/Instructions: Students will spend part Day 1 playing *Angry Birds* to explore the motion of parabolic paths. Using a digital version of the game, students will launch virtual birds toward targets and observe the different arcs created. As they play, they'll be prompted to think about and discuss the shape of the flight paths, introducing the concept of a parabola in an accessible, hands-on context. Students will identify key parts of the parabolic path, including the vertex (highest point), axis of symmetry (line through the vertex dividing the parabola into mirror images), x-intercepts (where the bird lands), and the effect of changing launch angles and speeds on the shape and direction of the curve.

**Find the website and make sure it isn't blocked for students before beginning this activity.*

Bloom's Levels: Remembering

Webb's DOK: 1

Engaging Experience 2

Title: Angry Birds Equation Builder

Suggested Length of Time: 1 Block

Standards Addressed

Priority:

- A2.REI.A: Solve equations and inequalities
- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions

- A2.FM.A: Use functions to model real-world problems
Supporting:
- A2.BF.A.1: Create new functions by applying the four arithmetic operations and composition of functions (modifying the domain and range as necessary)
- A2.FM.A.1: Create functions and use them to solve applications of quadratic and exponential function model problems

Detailed Description/Instructions: Students engage with quadratic functions through “Angry Birds”-themed activities designed to make parabolas meaningful. Using graphs, tables, equations, and vertex information for different birds, students practice identifying key features such as x-intercepts, vertex, and maximum height, and connect these to real-world interpretations like time in the air and flight path height. They work through multiple representations, graph each bird’s flight, and analyze how different parameters affect the shape and position of the parabola.

Bloom’s Levels: Applying
Webb’s DOK: 2

Engaging Experience 3

Title: Desmos Quadratic Marbleslides

Suggested Length of Time: ½ Block

Standards Addressed

Priority:

- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions

Supporting:

- A2.FM.A.1: Create functions and use them to solve applications of quadratic and exponential function model problems

Detailed Description/Instructions: Students work in pairs to explore and apply their understanding of quadratic functions through Desmos Quadratic Marbleslides. Students adjust equations to guide marbles through stars on the screen, using transformations and careful manipulation of quadratic equations to achieve each goal. This interactive activity challenges students to consider how changing coefficients and constants impact the graph’s shape, direction, and position in real time.

Bloom’s Levels: Analyzing
Webb’s DOK: 3

Board Approved: December 11, 2025

Summary of Engaging Learning Experiences

Engaging Experience Title	Description	Suggested Length of Time
Angry Birds Opening Activity	Students will spend part Day 1 playing <i>Angry Birds</i> to explore the motion of parabolic paths. Using a digital version of the game, students will launch virtual birds toward targets and observe the different arcs created. As they play, they'll be prompted to think about and discuss the shape of the flight paths, introducing the concept of a parabola in an accessible, hands-on context. Students will identify key parts of the parabolic path, including the vertex (highest point), axis of symmetry (line through the vertex dividing the parabola into mirror images), x-intercepts (where the bird lands), and the effect of changing launch angles and speeds on the shape and direction of the curve. <i>*Find the website and make sure it isn't blocked for students before beginning this activity.</i>	1 Block
Angry Birds Equation Builder	Students engage with quadratic functions through "Angry Birds"-themed activities designed to make parabolas meaningful. Using graphs, tables, equations, and vertex information for different birds, students practice identifying key features such as x-intercepts, vertex, and maximum height, and connect these to real-world interpretations like time in the air and flight path height. They work through multiple representations, graph each bird's flight, and analyze how different parameters affect the shape and position of the parabola.	1 Block
Desmos Quadratic Marbleslides	Students work in pairs to explore and apply their understanding of quadratic functions through Desmos Quadratic Marbleslides. Students adjust equations to guide marbles through stars on the screen, using transformations and careful manipulation of	$\frac{1}{2}$ Block

	quadratic equations to achieve each goal. This interactive activity challenges students to consider how changing coefficients and constants impact the graph's shape, direction, and position in real time.	
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Unit 3 - Patterns & Pathways: Modeling with Polynomials

Subject: Applied Algebra 2

Name of Unit: Patterns and Pathways: Modeling with Polynomials

Length of Unit: 12-13 Blocks

Overview of Unit: Students will deepen their understanding of polynomial functions through algebraic manipulation, graphical analysis, and modeling. Building from prior knowledge of quadratics, students will explore higher-degree polynomials, examining how the degree, leading coefficient, and roots influence the shape and behavior of a graph.

Priority Standards for unit:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions
- A2.FM.A: Use functions to model real-world problems

Supporting Standards for unit:

- A2.NQ.B.7: Know and apply the Fundamental Theorem of Algebra
- A2.APR.A: Perform operations on polynomials and rational expressions
- A2.BF.A.1: Create new functions by applying the four arithmetic operations and composition of functions (modifying the domain and range as necessary)

Essential Questions:

1. WHAT are we studying in this unit?
2. WHO uses these concepts in “real life”? / WHO created this concept?
3. WHERE is the connection between prior knowledge and new knowledge?
4. WHEN are these concepts applied?
5. HOW do you demonstrate your understanding of these concepts?
6. WHY is this concept meaningful?

Enduring Understanding/Big Ideas:

1. **Polynomial functions model complex real-world phenomena involving multiple changes in direction or rate.**
Real-life examples include volume modeling, profit/cost functions, physics simulations, and population predictions.
2. **The degree and leading coefficient of a polynomial determine the function’s end behavior.**

Understanding how polynomials behave as $x \rightarrow \infty$ and $x \rightarrow -\infty$ helps predict trends and long-term outcomes.

3. The number and multiplicity of roots (zeros) shape the graph of a polynomial.

Roots indicate where the function crosses or touches the x-axis; multiplicity affects whether it bounces or crosses.

Factoring/Synthetic division reveals roots and breaks the polynomial down into simpler parts.

The skills learned in solving and graphing quadratics extend to polynomials of degree 3, 4, and higher.

4. Polynomial operations (add, subtract, multiply, divide) follow consistent algebraic rules and patterns.

Mastering these operations builds fluency and supports success in higher-level math, including calculus.

5. Graphs of polynomials reveal important information about intervals of increase/decrease, local maxima and minima, and turning points.

Students interpret and analyze polynomial graphs to understand real-world behaviors and constraints.

6. The connection between algebraic expressions and graphs supports deeper conceptual understanding.

Students learn how changes in the equation affect the graph's shape, direction, and features, reinforcing function behavior.

Unit Vocabulary:

- Zeros/Roots/Solutions
- Degree (Quadratic, Cubic, Quartic)
- Leading Coefficient
- End Behavior
 - Increasing/Decreasing
- Transformations
- Max/Min extrema
- Turning Point
- Domain
- Range
- Synthetic Division
- Multiplicity of zeros
- Intercepts (x and y)

Learning Targets:

Priority Standard: A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems

Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to identify key features (zeros, y-intercept, end behavior) from a graph	1
	Remembering
Students will be able to identify key features (zeros, y-intercept, end behavior) from both standard form and factored form.	3
	Analyzing
Students will use a table of values to create a polynomial equation using technology.	3
	Analyzing

Priority Standard: A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions

Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to identify vertical and horizontal transformations on a polynomial using function notation.	2
	Applying
Students will be able to identify reflections and how that changes the end behavior of the polynomial function.	2
	Applying

Priority Standard: A2.FM.A: Use functions to model real-world problems

Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to explain what the zeros of a polynomial function mean in a real life scenario	4
	Evaluating
Students will be able to explain what the domain/range/end behavior of a polynomial function mean in a real life scenario	4
	Evaluating
Students will be able to use polynomial operations to create a different real-world model.	4
	Evaluating

Engaging Scenario

Engaging Scenario (An Engaging Scenario is a culminating activity that includes the following components: situation, challenge, specific roles, audience, product or performance.)

Roller Coaster Engineer

Students take on the role of roller coaster engineers as they design a ride using polynomial functions. Beginning with a rough sketch, they plan key features such as zeros, maximums, and minimums while adhering to real-world constraints, such as starting with the tallest hill. Students then bring their designs to life in Desmos by plotting their points and experimenting with polynomial regression to fit their intended shape. Through trial, error, and revision, they refine their function and solidify understanding of key concepts like degree, end behavior, and intervals of increase and decrease. The project concludes with analytical reflection questions that ask students to connect the structure of their function to the context of their roller coaster, making this an authentic and creative application of polynomial modeling.

Engaging Experiences

Engaging Experience 1

Title: Stain Glass Polynomials

Suggested Length of Time: 1 Block

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions

Detailed Description/Instructions: Students will graph 8–12 different polynomial functions on a shared coordinate plane, intentionally designing how the curves intersect and create distinct geometric regions. Once the graph is complete, students will bring it to life by coloring the enclosed sections to resemble stained glass.

Bloom's Levels: Understanding

Webb's DOK: 1

Engaging Experience 2

Title: Future Salary Polynomials

Suggested Length of Time: 2 Blocks

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.FM.A: Use functions to model real-world problems

Supporting:

- A2.APR.A: Perform operations on polynomials and rational expressions
- A2.BF.A.1: Create new functions by applying the four arithmetic operations and composition of functions (modifying the domain and range as necessary)

Detailed Description/Instructions: Using projected salaries from careers of their choice, students will explore how income is taxed, calculate take-home pay, and model responsible budgeting through functions. From estimating federal, state, and payroll taxes to analyzing the

cost of a dream home using inverse functions, students gain a meaningful understanding of financial literacy concepts rooted in mathematics.

Bloom's Levels: Evaluating

Webb's DOK: 4

Engaging Experience 3

Title: Zeros of a Function Marbleslides (Desmos)

Suggested Length of Time: ½ Block

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions

Supporting:

- A2.NQ.B.7: Know and apply the Fundamental Theorem of Algebra

Detailed Description/Instructions: Students explore the concept of zeros by adjusting polynomial equations to hit targets with virtual marbles. As they manipulate equations and observe how changes affect the graph, students deepen their understanding of x-intercepts, roots, and the connection between algebraic and graphical representations of functions.

Bloom's Levels: Creating

Webb's DOK: 4

Engaging Experience 4

Title: Drag and Drop Polynomials

Suggested Length of Time: ½ Block

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and

dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions

Supporting:

- A2.NQ.B.7: Know and apply the Fundamental Theorem of Algebra

Detailed Description/Instructions: Students analyze and classify polynomial graphs based on end behavior and degree. Given a variety of polynomial graphs, students will drag each one into one of four categories: even degree with positive leading coefficient, even degree with negative leading coefficient, odd degree with positive leading coefficient, and odd degree with negative leading coefficient.

Bloom's Levels: Understanding

Webb's DOK: 1

Engaging Experience 5

Title: Birthday Polynomials

Suggested Length of Time: ½ Block

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions

Supporting:

- A2.NQ.B.7: Know and apply the Fundamental Theorem of Algebra

Detailed Description/Instructions: Students build a polynomial function using the digits of their birthdate—transforming something as familiar as their birthday into a mathematical model. After constructing their function, students graph it using Desmos, explore how altering coefficients and signs affects its shape, and analyze key features like intercepts, rational roots, end behavior, and more.

Bloom's Levels: Applying

Webb's DOK: 2

Summary of Engaging Learning Experiences

Engaging Experience Title	Description	Suggested Length of Time
Stain Glass Polynomials	Students will graph 8–12 different polynomial functions on a shared coordinate plane, intentionally designing how the curves intersect and create distinct geometric regions. Once the graph is complete, students will bring it to life by coloring the enclosed sections to resemble stained glass.	1 Block
Future Salary Polynomials	Using projected salaries from careers of their choice, students will explore how income is taxed, calculate take-home pay, and model responsible budgeting through functions. From estimating federal, state, and payroll taxes to analyzing the cost of a dream home using inverse functions, students gain a meaningful understanding of financial literacy concepts rooted in mathematics.	2 Blocks
Zeros of a Function Marbleslides (Desmos)	Students explore the concept of zeros by adjusting polynomial equations to hit targets with virtual marbles. As they manipulate equations and observe how changes affect the graph, students deepen their understanding of x-intercepts, roots, and the connection between algebraic and graphical representations of functions.	$\frac{1}{2}$ Block
Drag and Drop Polynomials	Students analyze and classify polynomial graphs based on end behavior and degree. Given a variety of polynomial graphs, students will drag each one into one of four categories: even degree with positive leading coefficient, even degree with negative leading coefficient, odd degree with positive leading coefficient, and odd degree with negative leading coefficient.	$\frac{1}{2}$ Block

Birthday Polynomials	Students build a polynomial function using the digits of their birthdate—transforming something as familiar as their birthday into a mathematical model. After constructing their function, students graph it using Desmos, explore how altering coefficients and signs affects its shape, and analyze key features like intercepts, rational roots, end behavior, and more.	$\frac{1}{2}$ Block
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Unit 4 - Rates that Matter: Modeling with Rationals

Subject: Applied Algebra 2

Name of Unit: Rates that Matter: Modeling with Rationals

Length of Unit: 12-13 Blocks

Overview of Unit: This unit explores rational functions, which model real-world situations involving rates, ratios, and inverse relationships, such as medication concentration, average costs, and flow rates. Students will learn how to analyze these functions using graphs, tables, and algebra, focusing on key features like asymptotes, and domain restrictions that influence function behavior.

Priority Standards for unit:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions
- A2.FM.A: Use functions to model real-world problems

Essential Questions:

1. WHAT are we studying in this unit?
2. WHO uses these concepts in “real life”? / WHO created this concept?
3. WHERE is the connection between prior knowledge and new knowledge?
4. WHEN are these concepts applied?
5. HOW do you demonstrate your understanding of these concepts?
6. WHY is this concept meaningful?

Enduring Understanding/Big Ideas:

1. **Rational functions model real-world relationships that involve rates, ratios, or inverse variation.**

These functions are used in science (concentration, velocity), economics (average cost), and engineering (electrical resistance, flow rate).

Rational functions are used to model how one variable increases while another decreases (e.g., work, speed, intensity, pressure).

2. **The behavior of rational functions is shaped by their asymptotes, discontinuities, and excluded values.**

Vertical asymptotes, holes, and horizontal/slant asymptotes help describe the function's long-term behavior and domain restrictions.

3. Rational expressions follow the same arithmetic rules as numerical fractions.

Adding, subtracting, multiplying, and dividing rational expressions requires common denominators, factoring, and simplification.

Factoring polynomials is essential in simplifying rational expressions and solving rational equations.

4. Solving rational equations requires attention to domain restrictions.

Not all algebraic answers make sense in the context of rational equations; excluded values must be checked against solutions.

5. Graphs of rational functions reveal key features such as asymptotes, intercepts, and end behavior.

Students interpret these graphs to describe what is happening as inputs get very large or approach restricted values.

6. Mathematical models help identify limits and discontinuities in real-life systems.

Understanding asymptotic behavior helps describe situations where something approaches—but never reaches—a limit.

Unit Vocabulary:

- Asymptote
- Domain Restriction/Extraneous Solution
- End Behavior
- Inverse Variation
- Discontinuity
 - Hole
 - Vertical Asymptote
- Intercept (x and y)
- Limit
- Domain
- Range
- Transformations

Learning Targets:

Priority Standard: A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems	
Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to identify key features (x and y-intercepts, end behavior and asymptotes) from a graph	1
	Remembering
Students will be able to identify key features(x and y-intercepts, end behavior and asymptotes) from both standard form and factored form.	3
	Analyzing
Students will use a table of values to create a rational equation using technology.	3
	Analyzing
Priority Standard: A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions	
Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to differentiate between different rationals vs. polynomial equations when looking at graphical representations	2
	Applying
Students will graph rationals using transformations of the parent rational function	2
	Applying
Students will be able to identify vertical and horizontal transformations in a rational function.	1
	Remembering

Priority Standard: A2.FM.A: Use functions to model real-world problems

Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to explain what the x- and y-intercepts represents in a real world situation	4
	Evaluating
Students will be able to explain what the horizontal and vertical asymptotes represent in a quadratic real world situation	4
	Evaluating
Students will be able to identify the domain and range of a rational real world situation	4
	Evaluating
Students will be able to use rational equations to solve for values in a real-world scenario.	3
	Analyzing

Engaging Scenario

Engaging Scenario (An Engaging Scenario is a culminating activity that includes the following components: situation, challenge, specific roles, audience, product or performance.)

Anesthesiology Concentration

Students will use rational expressions to understand how drugs are absorbed, metabolized, and eliminated, tracking dosage levels to ensure effectiveness without toxicity. They will explore how rational functions help anesthesiologists keep patients safe by modeling the concentration of medication in the bloodstream over time.

Engaging Experiences

Engaging Experience 1

Title: Let's Get to Work

Suggested Length of Time: 1 Block

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.FM.A: Use functions to model real-world problems

Detailed Description/Instructions: Students apply rational functions to a real-world scenario by exploring work rates in various trades. They will choose a trade, research job times, and analyze how different workers' speeds affect completion times individually and collaboratively. Through creating and graphing equations in Desmos, students investigate how increasing the number of workers impacts the total time needed to finish large projects.

Bloom's Levels: Creating

Webb's DOK: 4

Engaging Experience 2

Title: Beat the Phone Company

Suggested Length of Time: 1 Block

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.FM.A: Use functions to model real-world problems

Detailed Description/Instructions: Students will explore how group phone plans affect individual costs by calculating total monthly bills and per-person prices for different numbers of lines. They will write and analyze expressions that model these costs, helping them understand how adding more people influences the price each person pays.

Bloom's Levels: Analyzing

Webb's DOK: 3

Engaging Experience 3

Title: Rational Function Graphs

Suggested Length of Time: 2 Blocks

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions

Detailed Description/Instructions: Students will deepen their understanding of rational functions by analyzing and creating graphs. In Part 1, they are given two rational functions and must accurately graph each one, labeling key features including zeros, vertical and horizontal asymptotes. In Part 2, students reverse-engineer graphs by writing equations that meet specific characteristics, such as a given asymptote or number of zeros, reinforcing their conceptual grasp of how algebraic structure influences graphical behavior.

Bloom's Levels: Creating

Webb's DOK: 4

Engaging Experience 4

Title: Marbleslides: Rationals (Desmos)

Suggested Length of Time: ½ Block

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions

Detailed Description/Instructions: Students will use Desmos Marbleslides to explore rational functions by matching marble paths to their corresponding equations. This interactive activity helps them visualize how features like asymptotes, holes, and intercepts appear graphically, deepening their understanding of rational function behavior in an engaging, hands-on way.

Bloom's Levels: Analyzing

Webb's DOK: 3

Board Approved: December 11, 2025

Summary of Engaging Learning Experiences

Engaging Experience Title	Description	Suggested Length of Time
Let's Get to Work	Students apply rational functions to a real-world scenario by exploring work rates in various trades. They will choose a trade, research job times, and analyze how different workers' speeds affect completion times individually and collaboratively. Through creating and graphing equations in Desmos, students investigate how increasing the number of workers impacts the total time needed to finish large projects.	1 Block
Beat the Phone Company	Students will explore how group phone plans affect individual costs by calculating total monthly bills and per-person prices for different numbers of lines. They will write and analyze expressions that model these costs, helping them understand how adding more people influences the price each person pays.	1 Block
Rational Function Graphs	Students will deepen their understanding of rational functions by analyzing and creating graphs. In Part 1, they are given two rational functions and must accurately graph each one, labeling key features including zeros, vertical and horizontal asymptotes. In Part 2, students reverse-engineer graphs by writing equations that meet specific characteristics, such as a given asymptote or number of zeros, reinforcing their conceptual grasp of how algebraic structure influences graphical behavior.	2 Blocks
Marbleslides: Rationals (Desmos)	Students will use Desmos Marbleslides to explore rational functions by matching marble paths to their corresponding equations. This interactive activity helps them visualize how features like asymptotes, holes, and intercepts appear graphically, deepening their understanding of rational function behavior in an engaging, hands-on way.	$\frac{1}{2}$ Block

Unit 5 - The Power of Roots: Modeling with Radicals

Subject: Applied Algebra 2

Name of Unit: The Power of Roots: Modeling with Radicals

Length of Unit: 9-10 Blocks

Overview of Unit: Students explore square and cube root functions as tools for modeling real-world relationships involving distance, area, and motion. Building on their understanding of exponents, students simplify and operate with radical expressions, solve radical equations, and interpret domain restrictions. They analyze and transform radical function graphs, connecting symbolic, numerical, and graphical representations. Through applications in science, engineering, and everyday problem solving, students see how radical functions help make sense of complex, nonlinear situations.

Priority Standards for unit:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions
- A2.FM.A: Use functions to model real-world problems

Supporting Standards for unit:

- A2.REI.A: Solve equations and inequalities

Essential Questions:

1. WHAT are we studying in this unit?
2. WHO uses these concepts in “real life”? / WHO created this concept?
3. WHERE is the connection between prior knowledge and new knowledge?
4. WHEN are these concepts applied?
5. HOW do you demonstrate your understanding of these concepts?
6. WHY is this concept meaningful?

Enduring Understanding/Big Ideas:

1. **Radical expressions and functions model real-world relationships involving area, distance, and physical laws.**
They appear in geometry (Pythagorean Theorem), physics (acceleration, velocity), and engineering (stress and force equations).
2. **Radicals are the inverse of exponents and follow a consistent set of algebraic rules.**
Simplifying, adding, subtracting, multiplying, and dividing radicals requires understanding how roots relate to powers.

There is a connection between radicals and rational exponents.

3. Solving radical equations involves isolating the radical and checking for extraneous solutions.

Because squaring can introduce invalid solutions, verifying answers is a critical part of the process.

4. Radical functions often have restricted domains due to the nature of square roots and even roots.

Students learn how domain restrictions arise from the need to take the square root of non-negative values (for real solutions).

5. Graphs of radical functions show increasing behavior with a curved shape, often starting from a specific point (the "starting value").

Students interpret transformations (shifts, stretches, reflections) based on changes to the radical function.

6. Radical expressions build on students' understanding of integers, fractions, and exponents.

This unit deepens previous knowledge of roots and exponents and extends it into more complex algebraic reasoning.

Mathematical models involving radicals help solve nonlinear problems involving distance, time, and optimization.

Unit Vocabulary:

- Radical
- Rational Exponent
- Root
- Index
- Radicand
- Solution
- Cube Root
 - Inflection Point
- Square Root
- Nth root
- Domain
- Range
- Transformations
- Extraneous solutions
- Inverse

Learning Targets:

Priority Standard: A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems

Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to identify key features (zeros, y-intercept, domain/range, root value) from a graph	1
	Remembering
Students will use a table of values to create a radical equation using technology.	3
	Analyzing

Priority Standard: A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions

Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to identify vertical and horizontal transformations on a radical using function notation and on a graph.	2
	Applying
Students will be able to identify reflections (both over x- and y-axis) and how that changes the domain and range of the radical function.	2
	Applying

Priority Standard: A2.FM.A: Use functions to model real-world problems

Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to explain what the starting point/inflection point of a radical function mean in a real life scenario	4
	Evaluating
Students will be able to explain what the domain/range/end behavior of a radical function mean in a real life scenario	4
	Evaluating

Engaging Scenario

Engaging Scenario (An Engaging Scenario is a culminating activity that includes the following components: situation, challenge, specific roles, audience, product or performance.)

In the *"Stop Right There!" Braking Distance Project*, students explore the mathematical relationship between vehicle speed and stopping distance. Through research, data analysis, and modeling, students use square root functions to analyze braking performance under varying conditions. They graph their findings, reflect on the behavior of radical functions, and communicate their results in a creative public-safety campaign format (infographic, PSA poster, or simulation).

Engaging Experiences

Engaging Experience 1

Title: Tsunami Exploration

Suggested Length of Time: 1 Block

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions
- A2.FM.A: Use functions to model real-world problems

Supporting:

- A2.REI.A: Solve equations and inequalities

Detailed Description/Instructions: Students explore how tsunami wave speeds are influenced by ocean depth using radical equations derived from physics. They'll investigate and calculate wave speeds at various depths.

Bloom's Levels: Analyzing

Webb's DOK: 3

Engaging Experience 2

Title: Square Root and Cube Root Marbleslides

Suggested Length of Time: ½ Block

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions

Detailed Description/Instructions: Students will engage with square root and cube root functions by manipulating equations to guide marbles through targets on the graph. As they adjust parameters, they'll explore how shifts, stretches, and reflections affect the shape and position of these root functions.

Bloom's Levels: Analyzing

Webb's DOK: 3

Engaging Experience 3

Title: Radical Speed Bump Activity

Suggested Length of Time: 1 Block

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.FM.A: Use functions to model real-world problems

Supporting:

- A2.REI.A: Solve equations and inequalities

Detailed Description/Instructions: Students take on the role of math-driven city engineers working to design safer school zones. Using a real-world formula involving square roots, they analyze how speed bump height affects vehicle speed. After interpreting variables and completing guided calculations, students graph their results, connect the function's shape to its context, and make data-driven recommendations for an ideal bump height.

Bloom's Levels: Analyzing

Webb's DOK: 3

Summary of Engaging Learning Experiences

Engaging Experience Title	Description	Suggested Length of Time
Tsunami Exploration	Students explore how tsunami wave speeds are influenced by ocean depth using radical equations derived from physics. They'll investigate and calculate wave speeds at various depths.	1 Block
Square Root and Cube Root Marbleslides	Students will engage with square root and cube root functions by manipulating equations to guide marbles through targets on the graph. As they adjust parameters, they'll explore how shifts, stretches, and reflections affect the shape and position of these root functions.	½ Block
Radical Speed Bump Activity	Students take on the role of math-driven city engineers working to design safer school zones. Using a real-world formula involving square roots, they analyze how speed bump height affects vehicle speed. After interpreting variables and completing guided calculations, students graph their results, connect the function's shape to its context, and make data-driven recommendations for an ideal bump height.	1 Block

Unit 6 - Functions that Change the Universe: Modeling with Exponentials & Logarithms

Subject: Applied Algebra 2

Name of Unit: Functions that Change the Universe: Modeling with Exponentials & Logarithms

Length of Unit: 15-16 blocks

Overview of Unit: Students explore exponential and logarithmic functions to model real-world growth and decay, solve equations involving unknown exponents, and analyze transformations and asymptotes. By connecting algebraic, graphical, and contextual representations, they see how these functions apply to science, finance, and engineering, building essential skills for interpreting and solving problems.

Priority Standards for unit:

- A2.SSE.A: Define and use logarithms
- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions
- A2.FM.A: Use functions to model real-world problems

Supporting Standards for unit:

- A2.SSE.A.4: Understand why logarithmic scales are used, and use them to solve problems
- A2.REI.A: Solve equations and inequalities
- A2.FM.A.1: Create functions and use them to solve applications of quadratic and exponential function model problems

Essential Questions:

1. WHAT are we studying in this unit?
2. WHO uses these concepts in “real life”?/ WHO created this concept?
3. WHERE is the connection between prior knowledge and new knowledge?
4. WHEN are these concepts applied?
5. HOW do you demonstrate your understanding of these concepts?
6. WHY is this concept meaningful?

Enduring Understanding/Big Ideas:

1. Exponential and logarithmic functions model real-world growth and decay processes.

Applications include population growth, radioactive decay, interest calculations, cooling rates, sound intensity, and earthquake magnitudes.

Exponential growth and decay represent situations where change occurs by constant *multiples*, not constant *differences*.

2. Logarithms are the inverse of exponentials and help solve problems involving unknown exponents.

Transformations of exponential and logarithmic graphs reveal key characteristics and support real-world interpretations.

Shifts, reflections, and stretches affect the graph's shape and relate to changes in context (e.g., starting amount, rate of change).

3. Logarithmic and exponential equations can be solved using properties and rules such as the product, quotient, and power rules.

Mastery of these properties helps simplify and solve complex equations and expressions.

4. Understanding asymptotic behavior helps describe limits and real-world constraints.

Exponential and logarithmic functions have horizontal or vertical asymptotes, modeling limits like maximum capacity or zero decay.

Just as subtraction undoes addition, logarithms “undo” exponentials—allowing us to solve equations like $2^x = 10$ and $\log_2 10 = x$

5. These functions are essential tools in fields like science, finance, computer science, and engineering.

Professionals use exponential and logarithmic models in algorithms, compound interest, drug dosage decay, data compression, and more.

Unit Vocabulary:

- Exponential function
- Logarithmic function
- Base
- Asymptote
 - Vertical
 - horizontal
- growth/decay rate
- Argument
- Inverse
- Domain
- Range
- Transformations
- Intercepts (x and y)
- Half-life

Learning Targets:

Priority Standard: A2.SSE.A: Define and use logarithms	
Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to convert between a logarithm and exponential	1
	Understanding
Students will be able to use the inverse relationship between exponentials and logarithms to solve problems.	2
	Applying
Students will be able to use log properties to create equivalent expressions.	2
	Applying
Priority Standard: A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems	
Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to identify key features in an exponential graph	1
	Remembering
Students will be able to identify key features in a logarithmic graph	1
	Remembering
Students will be able to write an exponential or logarithmic function from a table using technology.	2
	Applying

Priority Standard: A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions

Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to perform transformations on a graph of the exponential parent function	3
	Analyzing
Students will be able to perform transformations on a graph of the logarithmic parent function	3
	Analyzing

Priority Standard: A2.FM.A: Use functions to model real-world problems

Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to use half-life and exponential growth/decay to model real world situations	4
	Creating
Students will be able to identify and explain an asymptote of an exponential/logarithm and its importance in the real world model	4
	Evaluating

Engaging Scenario

Engaging Scenario (An Engaging Scenario is a culminating activity that includes the following components: situation, challenge, specific roles, audience, product or performance.)

Snap Back: A Mathematical Mission to Retrieve the Gauntlet

Students step into the role of mathematical strategists for the *Avengers*, exploring exponential and logarithmic functions. Working through a series of "missions" led by different heroes, students apply exponential growth and decay models, analyze risk and timing, solve logarithmic puzzles, and interpret their results to make critical strategic decisions. This experience promotes collaboration, critical thinking, and deep conceptual understanding as students create and interpret models, analyze graphs, and communicate mathematical reasoning through a final strategy report.

Engaging Experiences

Engaging Experience 1

Title: Skittles Lab

Suggested Length of Time: 1 - 1 ½ Block(s)

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.FM.A: Use functions to model real-world problems

Supporting:

- A2.FM.A.1: Create functions and use them to solve applications of quadratic and exponential function model problems

Detailed Description/Instructions: Students work with Skittles (or M&Ms) to model exponential decay, helping them visualize key concepts behind exponential functions. Students remove Skittles to represent exponential decay, modeling phenomena such as radioactive decay or drug elimination. Throughout, they create and interpret scatterplots, calculate decay rates, write exponential equations, and compare theoretical predictions to experimental results. This interactive experience makes abstract mathematical concepts tangible, promotes data analysis skills, and sparks rich discussion around the meaning of parameters and the real-world significance of exponential change.

Bloom's Levels: Applying

Webb's DOK: 2

Engaging Experience 2

Title: Car Depreciation

Suggested Length of Time: ½ Block

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.FM.A: Use functions to model real-world problems

Supporting:

- A2.REI.A: Solve equations and inequalities
- A2.FM.A.1: Create functions and use them to solve applications of quadratic and exponential function model problems

Detailed Description/Instructions: Students explore exponential decay by analyzing how car values depreciate over time using data from Kelley Blue Book. Students select a new car, determine its value after five years, and calculate the annual depreciation rate using an exponential decay formula. They create an equation to model their car's value, graph it using Desmos, and use logarithms to solve for when the car's value will drop to a specific amount. Through extensions, they compare multiple vehicles, analyze resale trends, and reflect on investment decisions.

Bloom's Levels: Applying

Webb's DOK: 2

Engaging Experience 3

Title: Desmos Exponential Marbleslides

Suggested Length of Time: ½ Block

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions

Supporting:

- A2.FM.A.1: Create functions and use them to solve applications of quadratic and exponential function model problems

Detailed Description/Instructions: Students use Desmos Exponential Marbleslides to deepen their understanding of exponential functions and transformations. Working individually or in pairs, they adjust exponential equations to guide marbles through targets on the screen, exploring how changes to the base and coefficients affect the graph's growth, direction, and position. As they experiment in a game-like setting, students receive immediate visual feedback, encouraging them to test conjectures and refine their thinking. This activity reinforces key concepts such as growth rates and horizontal or vertical shifts.

Bloom's Levels: Analyzing

Webb's DOK: 3

Engaging Experience 4

Title: Desmos Logarithm Marbleslides

Suggested Length of Time: ½ Block

Standards Addressed

Priority:

- A2.SSE.A: Define and use logarithms
- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions

Supporting:

- A2.SSE.A.4: Understand why logarithmic scales are used, and use them to solve problems
- A2.FM.A.1: Create functions and use them to solve applications of quadratic and exponential function model problems

Detailed Description/Instructions: Students strategically modify logarithmic equations to direct marbles through various targets, requiring them to analyze and predict how shifts, stretches, and reflections impact the graph. As students adjust their functions and see immediate results, they develop a stronger conceptual understanding of logarithms as inverses of exponential functions and how they behave graphically.

Bloom's Levels: Analyzing

Webb's DOK: 3

Engaging Experience 5

Title: Sound Level Investigator

Suggested Length of Time: 3 Blocks

Standards Addressed

Priority:

- A2.SSE.A: Define and use logarithms
- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems
- A2.FM.A: Use functions to model real-world problems

Supporting:

- A2.SSE.A.4: Understand why logarithmic scales are used, and use them to solve problems
- A2.REI.A: Solve equations and inequalities
- A2.FM.A.1: Create functions and use them to solve applications of quadratic and exponential function model problems

Detailed Description/Instructions: Students explore the real-world application of logarithms through sound intensity and the decibel scale. Students use online sound level meters to measure the decibel levels of various sounds around the school (e.g., a whisper, classroom chatter, hallway noise, music). They learn that the decibel scale is logarithmic and investigate how increases in intensity correspond to changes in decibel levels using the formula: $L = 10 \log_{10}(I/I_0)$, where L is the sound level in decibels, I is the measured intensity, and I_0 is a reference intensity. Students compare different sound sources, calculate relative intensities, and solve for unknown values using logarithms. By connecting logarithms to something concrete and personally relevant, this activity reinforces the concept of logarithms as inverse operations and supports understanding of log scales in science and everyday life. It also promotes critical thinking as students analyze and communicate their findings in a creative report or presentation.

Bloom's Levels: Applying

Webb's DOK: 2

Summary of Engaging Learning Experiences

Engaging Experience Title	Description	Suggested Length of Time
Skittles Lab	Students work with Skittles (or M&Ms) to model exponential decay, helping them visualize key concepts behind exponential functions. Students remove Skittles to represent exponential decay, modeling phenomena such as radioactive decay or drug elimination. Throughout, they create and interpret scatterplots, calculate decay rates, write exponential equations, and compare theoretical predictions to experimental results. This interactive experience makes abstract mathematical concepts tangible, promotes data analysis skills, and sparks rich discussion around the meaning of parameters and the real-world significance of exponential change.	1 - 1 ½ Block(s)
Car Depreciation	Students explore exponential decay by analyzing how car values depreciate over time using data from Kelley Blue Book. Students select a new car, determine its value after five years, and calculate the annual depreciation rate using an exponential decay formula. They create an equation to model their car's value, graph it using Desmos, and use logarithms to solve for when the car's value will drop to a specific amount. Through extensions, they compare multiple vehicles, analyze resale trends, and reflect on investment decisions.	½ Block
Desmos Exponential Marbleslides	Students use Desmos Exponential Marbleslides to deepen their understanding of exponential functions and transformations. Working individually or in pairs, they adjust exponential equations to guide marbles through targets on the screen, exploring how changes to the base and coefficients affect the graph's growth, direction, and position. As they experiment in a game-like setting, students receive immediate visual	½ Block

	feedback, encouraging them to test conjectures and refine their thinking. This activity reinforces key concepts such as growth rates and horizontal or vertical shifts.	
Desmos Logarithm Marbleslides	Students strategically modify logarithmic equations to direct marbles through various targets, requiring them to analyze and predict how shifts, stretches, and reflections impact the graph. As students adjust their functions and see immediate results, they develop a stronger conceptual understanding of logarithms as inverses of exponential functions and how they behave graphically.	½ Block
Sound Level Investigator	Students explore the real-world application of logarithms through sound intensity and the decibel scale. Students use online sound level meters to measure the decibel levels of various sounds around the school (e.g., a whisper, classroom chatter, hallway noise, music). They learn that the decibel scale is logarithmic and investigate how increases in intensity correspond to changes in decibel levels using the formula: $L=10\log_{10}(I/I_0)$, where L is the sound level in decibels, I is the measured intensity, and I_0 is a reference intensity. Students compare different sound sources, calculate relative intensities, and solve for unknown values using logarithms. By connecting logarithms to something concrete and personally relevant, this activity reinforces the concept of logarithms as inverse operations and supports understanding of log scales in science and everyday life. It also promotes critical thinking as students analyze and communicate their findings in a creative report or presentation.	3 Blocks

Unit 7 - From Data to Decisions: Modeling with Statistics & Probability

Subject: Applied Algebra 2

Name of Unit: From Data to Decisions: Modeling with Statistics & Probability

Length of Unit: 6-7 Blocks

Overview of Unit: Students explore how data, statistics, and probability help make sense of the world. They organize and interpret data, describe trends, and calculate measures of center and variability. Students also apply probability to predict outcomes and evaluate fairness, connecting concepts to real-world situations and decision-making. The unit concludes with students creating their own board game and data collection scenarios.

Priority Standards for unit:

- A2.DS.A Make inferences and justify conclusions
- A2.DS.A.2: Determine whether a specified model is consistent with a given data set

Supporting Standards for unit:

- A2.DS.A.4: Use data from a sample to estimate characteristics of the population and recognize the meaning of the margin of error in these estimates

Essential Questions:

1. WHAT are we studying in this unit?
2. WHO uses these concepts in “real life”?/ WHO created this concept?
3. WHERE is the connection between prior knowledge and new knowledge?
4. WHEN are these concepts applied?
5. HOW do you demonstrate your understanding of these concepts?
6. WHY is this concept meaningful?

Enduring Understanding/Big Ideas:

1. **Data can be collected, organized, and analyzed to make informed decisions and predictions.**

Understanding data allows us to describe trends, test assumptions, and make reasoned conclusions in real-life contexts.

2. **Statistical measures (mean, median, standard deviation, etc.) describe the center and spread of data sets.**

These measures help us interpret data, compare groups, and understand variability and consistency.

3. **Probability quantifies the likelihood of an event and helps make predictions in uncertain situations.**

Probability models are used in fields like medicine, business, gaming, insurance, and science to assess risk and make decisions.

4. **Simulations and theoretical models can help estimate probabilities and test outcomes when experimentation is not feasible.**
Students use randomization, probability rules, and technology to simulate real-world scenarios.
5. **Statistical reasoning involves questioning the reliability, validity, and source of data.**
Understanding bias, sampling methods, and variability is essential to evaluating how trustworthy data and conclusions are.

Unit Vocabulary:

- Ratio
- Proportion
- Probability
- Event
- Mean
- Median
- Standard deviation
- Function of best fit
- Bias
- Sampling methods

Learning Targets:

Priority Standard: A2.DS.A Make inferences and justify conclusions	
Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to calculate the measures of central tendency and interpret the meaning in context	2
	Applying
Students will be able to create a probability model using the principles of probability	4
	Creating

Priority Standard: A2.DS.A.2: Determine whether a specified model is consistent with a given data set

Learning Targets	Webb's DOK Level
	Bloom's Level
Students will be able to use random sampling to collect data	3
	Analyzing
Students will be able to understand how random sampling reduces bias.	1
	Understanding
Students will be able to distinguish between different methods of random sampling.	1
	Understanding
Students will be able to calculate the measures of central tendency and interpret the meaning in context	2
	Applying

Engaging Scenario

Engaging Scenario (An Engaging Scenario is a culminating activity that includes the following components: situation, challenge, specific roles, audience, product or performance.)

Game of Chances

In this student-centered project, learners design and play board games by taking ideas from original board games and creating their own. Through creating and exploring each other's games, students investigate probability concepts, compare outcomes, and experience diverse approaches to game design.

Engaging Experiences

Engaging Experience 1

Title: Board Game Exploration

Suggested Length of Time: 1 block

Standards Addressed

Priority:

- A2.DS.A Make inferences and justify conclusions

Supporting:

- A2.DS.A.4: Use data from a sample to estimate characteristics of the population and recognize the meaning of the margin of error in these estimates

Detailed Description/Instructions: Students will engage in playing a variety of board games while analyzing and calculating the probability of winning. This hands-on activity encourages strategic thinking, reinforces probability concepts, and promotes collaboration in a fun, interactive setting.

Bloom's Levels: Understanding

Webb's DOK: 1

Engaging Experience 2

Title: WNBA Sampling Activity

Suggested Length of Time: 1 - 1 ½ Block(s)

Standards Addressed

Priority:

- A2.DS.A Make inferences and justify conclusions
- A2.DS.A.2: Determine whether a specified model is consistent with a given data set

Supporting:

- A2.DS.A.4: Use data from a sample to estimate characteristics of the population and recognize the meaning of the margin of error in these estimates

Detailed Description/Instructions: In this activity, students will create WNBA “Fantasy Teams” for both the Eastern and Western Conferences using probability sampling methods. By gathering and analyzing player statistics from online sources, students will apply probability and statistical reasoning to predict the outcome of a matchup between their Eastern and Western Conference teams.

Bloom's Levels: Applying

Webb's DOK: 2

Engaging Experience 3

Title: Student Questionnaire Data Collection

Suggested Length of Time: 1 Block

Standards Addressed

Priority

- A2.DS.A Make inferences and justify conclusions
- A2.DS.A.2: Determine whether a specified model is consistent with a given data set

Supporting:

- A2.DS.A.4: Use data from a sample to estimate characteristics of the population and recognize the meaning of the margin of error in these estimates

Detailed Description/Instructions: In this activity, students design two survey questions—one requiring a numeric response and one with a yes/no response—and collect data from their classmates. Using a checklist to track responses, students gather and organize information for later analysis, while also practicing skills in data collection and survey design.

Bloom's Levels: Analyzing

Webb's DOK: 3

Summary of Engaging Learning Experiences

Engaging Experience Title	Description	Suggested Length of Time
Board Game Exploration	Students will engage in playing a variety of board games while analyzing and calculating the probability of winning. This hands-on activity encourages strategic thinking, reinforces probability concepts, and promotes collaboration in a fun, interactive setting.	1 Block
WNBA Sampling Activity	In this activity, students will create WNBA “Fantasy Teams” for both the Eastern and Western Conferences using probability sampling methods. By gathering and analyzing player statistics from online sources, students will apply probability and statistical reasoning to predict the outcome of a matchup between their Eastern and Western Conference teams.	1 - 1 ½ Block(s)
Student Questionnaire Data Collection	In this activity, students design two survey questions—one requiring a numeric response and one with a yes/no response—and collect data from their classmates. Using a checklist to track responses, students gather and organize information for later analysis, while also practicing skills in data collection and survey design.	1 Block

Unit of Study Terminology

Appendices: All Appendices and supporting material can be found in this course's shell course in the District's Learning Management System.

Assessment Leveling Guide: A tool to use when writing assessments in order to maintain the appropriate level of rigor that matches the standard.

Big Ideas/Enduring Understandings: Foundational understandings teachers want students to be able to discover and state in their own words by the end of the unit of study. These are answers to the essential questions.

Engaging Experience: Each topic is broken into a list of engaging experiences for students. These experiences are aligned to priority and supporting standards, thus stating what students should be able to do. An example of an engaging experience is provided in the description, but a teacher has the autonomy to substitute one of their own that aligns to the level of rigor stated in the standards.

Engaging Scenario: This is a culminating activity in which students are given a role, situation, challenge, audience, and a product or performance is specified. Each unit contains an example of an engaging scenario, but a teacher has the ability to substitute with the same intent in mind.

Essential Questions: Engaging, open-ended questions that teachers can use to engage students in the learning.

Priority Standards: What every student should know and be able to do. These were chosen because of their necessity for success in the next course, the state assessment, and life.

Supporting Standards: Additional standards that support the learning within the unit.

Topic: These are the main teaching points for the unit. Units can have anywhere from one topic to many, depending on the depth of the unit.

Unit of Study: Series of learning experiences/related assessments based on designated priority standards and related supporting standards.

Unit Vocabulary: Words students will encounter within the unit that are essential to understanding. Academic Cross-Curricular words (also called Tier 2 words) are those that can be found in multiple content areas, not just this one. Content/Domain Specific vocabulary words are those found specifically within the content.