

# 1 Searching for Patterns

This chapter begins with opportunities for students to analyze and describe various patterns. Questions ask students to represent algebraic expressions in different forms and use algebra and graphs to determine whether they are equivalent. Lessons provide opportunities for students to identify linear, exponential, and quadratic functions using multiple representations. Lessons introduce students to the concept of building new functions on a coordinate plane by operating on separate functions.

**Standards:** A.2C, A.3C, A.6C, A.7A, A.9C, A.9D, A.12C, 2A.4E, 2A.4D, 2A.5A, 2A.5B, 2A.7B, 2A.8A

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
1.1	<b>Patterns: They're Grrrrrowing!</b>	Exploring and Analyzing Patterns	2A.5B	<ul style="list-style-type: none"> <li>Identify multiple patterns within a sequence.</li> <li>Use patterns to solve problems.</li> </ul>	
1.2	<b>Are They Saying the Same Thing?</b>	Using Patterns to Generate Algebraic Expressions	2A.5B	<ul style="list-style-type: none"> <li>Generate algebraic expressions using geometric patterns.</li> <li>Represent algebraic expressions in different forms.</li> <li>Determine whether expressions are equivalent.</li> <li>Identify patterns as linear, exponential, or quadratic using a visual model, a table of values, or a graph.</li> </ul>	
1.3	<b>Are All Functions Created Equal?</b>	Comparing Multiple Representations of Functions	2A.4E 2A.7B	<ul style="list-style-type: none"> <li>Identify equivalent forms of functions in various representations.</li> <li>Model situations using tables, graphs, and equations.</li> <li>Use functions to make predictions.</li> <li>Determine whether two forms of a function are equivalent.</li> </ul>	<ul style="list-style-type: none"> <li>Relation</li> <li>Function</li> <li>Function notation</li> </ul>
1.4	<b>Water Under the Bridge</b>	Modeling with Functions	2A.4D 2A.8A	<ul style="list-style-type: none"> <li>Use multiple representations of functions to model and solve problems.</li> <li>Use multiple representations of functions to analyze problems.</li> </ul>	
1.5	<b>I've Created a Monster, <math>m(x)</math></b>	Analyzing Graphs to Build New Functions	2A.7B	<ul style="list-style-type: none"> <li>Model operations on functions graphically.</li> <li>Sketch the graph of the sum, difference, and product of two functions on a coordinate plane.</li> <li>Predict and verify the graphical behavior of functions.</li> <li>Build functions graphically.</li> <li>Predict and verify the behavior of functions using a table of values.</li> <li>Build functions using a table of values.</li> </ul>	<ul style="list-style-type: none"> <li>Zero Product Property</li> <li>Polynomial</li> <li>Degree</li> </ul>
<b>Learning Individually with MATHia or Skills Practice</b>			A.2C A.3C A.6C A.7A A.9C A.9D A.12C 2A.5A	In the MATHia software, students analyze patterns to generate algebraic expressions. They compare representations of, identify key characteristics of graphs of, and determine transformations performed on linear, quadratic, and exponential functions.	

## 2 Linear Systems and Matrices

This chapter begins with a review of a system of two linear equations in two variables. The graphing, substitution, and elimination methods to solve systems of two linear equations are also reviewed. Students recall what the solution to a system of equations means, as well as the instances of no solution or infinite solutions. The methods to solve are then applied to systems of one linear and one quadratic equation, and systems of three linear equations in three variables. Next, students are introduced to the concept of matrices. Problem situations explore basic matrix operations and their properties. Technology is used to calculate inverse matrices, and the identity matrix is introduced. Finally, students use matrices to solve systems of linear equations in three variables.

**Standards:** 2A.3A, 2A.3B, 2A.3C, 2A.3D

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
2.1	<b>A Tale of Two Systems</b>	Solving Systems of Two Equations	2A.3A 2A.3C 2A.3D	<ul style="list-style-type: none"> <li>Solve systems of two linear equations.</li> <li>Solve systems of equations involving one linear and one quadratic equation.</li> </ul>	
2.2	<b>We Can Work It Out</b>	Solving Systems of Three Equations Algebraically	2A.3A 2A.3B	<ul style="list-style-type: none"> <li>Formulate and solve systems of three linear equations in three variables by using substitution.</li> <li>Formulate and solve systems of three linear equations in three variables by using Gaussian elimination.</li> </ul>	<ul style="list-style-type: none"> <li>Gaussian elimination</li> </ul>
2.3	<b>Step Inside the Matrix</b>	Introduction to Matrices and Matrix Operations	2A.3B	<ul style="list-style-type: none"> <li>Determine the dimensions of a matrix.</li> <li>Identify specific matrix elements.</li> <li>Perform matrix operations such as addition, subtraction, and multiplication.</li> </ul>	<ul style="list-style-type: none"> <li>Matrix (matrices)</li> <li>Dimensions</li> <li>Square matrix</li> <li>Matrix element</li> <li>Scalar multiplication</li> <li>Matrix multiplication</li> </ul>
2.4	<b>Another Tool in the Toolbox</b>	Solving Matrix Equations	2A.3A 2A.3B	<ul style="list-style-type: none"> <li>Determine the inverse of a matrix.</li> <li>Use matrices to solve systems of equations.</li> </ul>	<ul style="list-style-type: none"> <li>Multiplicative identity matrix</li> <li>Multiplicative inverse of a matrix</li> <li>Matrix equation</li> <li>Coefficient matrix</li> <li>Variable matrix</li> <li>Constant matrix</li> </ul>

## 3 Quadratic Functions

This chapter begins with a matching and sorting activity to review the different forms of quadratic functions. Key characteristics of quadratic functions and graphs are identified. Lessons then provide opportunities for students to explore and identify transformations performed on a quadratic function  $f(x)$  to form a new function  $g(x) = Af(B(x - C)) + D$ . This transformational function form is introduced in order to abstract the general principle that transformations on a graph always have the same effect regardless of the type of underlying function. In the later part of the chapter, lessons provide opportunities for students to explore and understand what conditions are necessary to write a unique quadratic function. The set of complex numbers is introduced and students will operate with the imaginary number  $i$ . Finally, students will solve quadratic functions over the set of complex numbers.

**Standards:** A.6B, A.7A, A.7C, 2A.4A, 2A.4B, 2A.4D, 2A.4E, 2A.4F, 2A.7A, 2A.7B, 2A.7G

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
3.1	<b>Shape and Structure</b>	Forms of Quadratic Functions	2A.4B 2A.4D	<ul style="list-style-type: none"> <li>Match a quadratic function with its corresponding graph.</li> <li>Identify key characteristics of quadratic functions based on the form of the function.</li> <li>Analyze the different forms of quadratic functions.</li> <li>Use key characteristics of specific forms of quadratic functions to write equations.</li> <li>Write quadratic functions to represent problem situations.</li> </ul>	<ul style="list-style-type: none"> <li>Standard form of a quadratic function</li> <li>Factored form of a quadratic function</li> <li>Vertex form of a quadratic function</li> <li>Concavity of a parabola</li> </ul>
3.2	<b>Function Sense</b>	Translating Functions	2A.4A 2A.4D	<ul style="list-style-type: none"> <li>Analyze the basic form of a quadratic function.</li> <li>Identify the reference points of the basic form of a quadratic function.</li> <li>Understand the structure of the basic quadratic function.</li> <li>Graph quadratic functions through transformations.</li> <li>Identify the effect on a graph by replacing <math>f(x)</math> by <math>f(x - C) + D</math>.</li> <li>Identify transformations given equations of quadratic functions.</li> <li>Write quadratic functions given a graph.</li> </ul>	<ul style="list-style-type: none"> <li>Reference points</li> <li>Transformation</li> <li>Rigid motion</li> <li>Argument of a function</li> <li>Translation</li> </ul>
3.3	<b>Up and Down</b>	Vertical Dilations of Quadratic Functions	2A.4B 2A.4D 2A.4E	<ul style="list-style-type: none"> <li>Graph quadratic functions through vertical dilations.</li> <li>Identify the effect on a graph by replacing <math>f(x)</math> by <math>Af(x)</math>.</li> <li>Write quadratic functions given a graph.</li> </ul>	<ul style="list-style-type: none"> <li>Vertical dilation</li> <li>Vertical stretching</li> <li>Vertical compression</li> <li>Reflection</li> <li>Line of reflection</li> </ul>
3.4	<b>Side to Side</b>	Horizontal Dilations of Quadratic Functions	2A.4B 2A.4D 2A.4E	<ul style="list-style-type: none"> <li>Graph quadratic functions through horizontal dilations.</li> <li>Identify the effect on a graph by replacing <math>f(x)</math> by <math>f(Bx)</math>.</li> <li>Write quadratic functions given a graph.</li> </ul>	<ul style="list-style-type: none"> <li>Horizontal dilation</li> <li>Horizontal stretching</li> <li>Horizontal compression</li> </ul>
3.5	<b>What's the Point?</b>	Deriving Quadratic Functions	2A.4B 2A.4D 2A.4E	<ul style="list-style-type: none"> <li>Determine how many points are necessary to create a unique quadratic equation.</li> <li>Derive a quadratic equation given a variety of information using reference points.</li> <li>Derive a quadratic equation given three points using a system of equations.</li> <li>Derive a quadratic equation given three points using a graphing calculator to perform a quadratic regression.</li> </ul>	

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
3.6	<b>Now It's Getting Complex . . . But It's Really Not Difficult!</b>	Complex Number Operations	2A.7A 2A.7B	<ul style="list-style-type: none"> <li>• Add, subtract, and multiply polynomials.</li> <li>• Calculate powers of <math>i</math>.</li> <li>• Interpret the real numbers as part of the complex number system.</li> <li>• Add, subtract, and multiply complex numbers.</li> <li>• Add, subtract, and multiply complex polynomial expressions.</li> <li>• Understand that the product of complex conjugates is a real number.</li> <li>• Rewrite quotients of complex numbers.</li> </ul>	<ul style="list-style-type: none"> <li>• The imaginary number <math>i</math></li> <li>• Principal square root of a negative number</li> <li>• Set of imaginary numbers</li> <li>• Pure imaginary number</li> <li>• Set of complex numbers</li> <li>• Real part of a complex number</li> <li>• Imaginary part of a complex number</li> <li>• Complex conjugates</li> <li>• Monomial</li> <li>• Binomial</li> <li>• Trinomial</li> </ul>
3.7	<b>You Can't Spell Fundamental Theorem of Algebra without F-U-N!</b>	Quadratics and Complex Numbers	2A.4F	<ul style="list-style-type: none"> <li>• Determine the number and type of zeros of a quadratic function.</li> <li>• Solve quadratic equations with complex solutions.</li> <li>• Use the Fundamental Theorem of Algebra.</li> <li>• Choose an appropriate method to determine zeros of quadratic functions.</li> </ul>	<ul style="list-style-type: none"> <li>• Imaginary roots</li> <li>• Discriminant</li> <li>• Imaginary zeros</li> <li>• Fundamental Theorem of Algebra</li> <li>• Double root</li> </ul>
<b>Learning Individually with MATHia or Skills Practice</b>			A.6B A.7A A.7C 2A.4B 2A.4F 2A.7A 2A.7G	In the MATHia software, students examine the shape and structure of quadratic functions. They model with quadratics and solve quadratic equations and systems of quadratic equations. Students operate with complex numbers.	

## 4 Polynomial Functions

This chapter begins with two different problem situations to explore how cubic functions are built. Lessons provide opportunities for students to connect characteristics and behaviors of cubic functions to their factors. An emphasis is placed on verifying equivalence between different forms both algebraically and graphically. Students will explore polynomial functions to gain an understanding of end behavior, symmetry, and whether a function is even, odd, or neither. Questions then ask students to graph, write, and explain the effects of transformations on cubic functions, and then draw conclusions about how symmetry is preserved in transformed functions. In the later part of the chapter, lessons focus on building various polynomial functions by operating with the basic power functions on a coordinate plane and in a table of values. Questions then ask students to compare and contrast the various polynomials to understand all the possible shapes and key characteristics for linear, quadratic, cubic, quartic, and quintic functions. At the end of the chapter, lessons focus on students' understanding that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication.

**Standards:** 2A.2A, 2A.6A, 2A.7B, 2A.7D, 2A.7I

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
4.1	<b>Planting the Seeds</b>	Exploring Cubic Functions	2A.2A 2A.6A 2A.7I	<ul style="list-style-type: none"> <li>• Represent cubic functions using words, tables, equations, and graphs.</li> <li>• Interpret the key characteristics of the graphs of cubic functions.</li> <li>• Analyze cubic functions in terms of their mathematical context and problem context.</li> <li>• Connect the characteristics and behaviors of cubic functions to its factors.</li> <li>• Compare cubic functions with linear and quadratic functions.</li> <li>• Build cubic functions from linear and quadratic functions.</li> </ul>	<ul style="list-style-type: none"> <li>• Relative maximum</li> <li>• Relative minimum</li> <li>• Cubic function</li> <li>• Multiplicity</li> </ul>
4.2	<b>Polynomial Power</b>	Power Functions	2A.2A	<ul style="list-style-type: none"> <li>• Determine the general behavior of the graph of even and odd degree power functions.</li> <li>• Derive a general statement and explanation to describe the graph of a power function as the value of the power increases.</li> <li>• Use graphs and algebraic functions to determine symmetry of even and odd functions.</li> <li>• Determine whether a function is even or odd based on an algebraic function or graph.</li> <li>• Understand the structure of the basic cubic function.</li> <li>• Graph the basic cubic function using reference points and symmetry.</li> </ul>	<ul style="list-style-type: none"> <li>• Power function</li> <li>• End behavior</li> <li>• Symmetric about a line</li> <li>• Symmetric about a point</li> <li>• Even function</li> <li>• Odd function</li> </ul>
4.3	<b>Function Makeover</b>	Transformations and Symmetry of Polynomial Functions	2A.2A 2A.6A	<ul style="list-style-type: none"> <li>• Dilate, reflect, and translate cubic and quartic functions.</li> <li>• Understand that not all polynomial functions can be formed through transformations.</li> <li>• Explore differences between even and odd functions, and even and odd degree functions.</li> <li>• Use power functions to build cubic, quartic, and quintic functions.</li> <li>• Explore the possible graphs of cubic, quartic, and quintic functions, and extend graphical properties to higher degree functions.</li> </ul>	<ul style="list-style-type: none"> <li>• Polynomial function</li> <li>• Quartic function</li> <li>• Quintic function</li> </ul>

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
4.4	<b>Polynomial DNA</b>	Key Characteristics of Polynomial Functions	2A.2A 2A.7I	<ul style="list-style-type: none"> <li>Interpret polynomial key characteristics in the context of a problem situation.</li> <li>Generalize the key characteristics of polynomials.</li> <li>Sketch the graph of any polynomial given certain key characteristics.</li> </ul>	<ul style="list-style-type: none"> <li>Absolute maximum</li> <li>Absolute minimum</li> <li>Extrema</li> </ul>
4.5	<b>That Graph Looks a Little Sketchy</b>	Building Cubic and Quartic Functions	2A.2A 2A.7D	<ul style="list-style-type: none"> <li>Construct cubic functions graphically from three linear functions.</li> <li>Construct cubic functions graphically from one quadratic and one linear function.</li> <li>Connect graphical behavior of a cubic function to key characteristics of its factors.</li> <li>Construct quartic polynomial functions.</li> <li>Determine the number of real and imaginary roots for polynomial functions based on their factors.</li> </ul>	
4.6	<b>Closing Time</b>	The Closure Property	2A.7B	<ul style="list-style-type: none"> <li>Compare functions that are closed under addition, subtraction, and multiplication to functions that are not closed under these operations.</li> <li>Analyze the meaning for polynomials to be closed under an operation.</li> <li>Compare integer and polynomial operations.</li> </ul>	<ul style="list-style-type: none"> <li>Closed under an operation</li> </ul>
<b>Learning Individually with MATHia or Skills Practice</b>			2A.2A 2A.7D	In the MATHia software, students identify the key characteristics of polynomial functions from their equations and graphs and interpret them in context. They identify the zeros of a polynomial and use the zeros to sketch its graph. Students compare polynomial functions in different representations.	

## 5 Polynomial Expressions and Equations

This chapter presents opportunities for students to analyze, factor, solve, and expand polynomial functions. The chapter begins with an analysis of key characteristics of polynomial functions and graphs. Lessons then provide opportunities for students to divide polynomials using two methods and to expand on this knowledge in order to determine whether a divisor is a factor of the dividend. In addition, students will solve polynomial equations over the set of complex numbers using the Rational Root Theorem. In the later part of the chapter, lessons provide opportunities for students to utilize polynomial identities to rewrite numeric expressions and identify patterns. Students will also explore Pascal's Triangle and the Binomial Theorem as methods to expand powers of binomials.

**Standards:** 2A.4F, 2A.6A, 2A.6B, 2A.7A, 2A.7C, 2A.7D, 2A.7E, P.5F

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
5.1	<b>Don't Take This Out of Context</b>	Analyzing Polynomial Functions	2A.6A	<ul style="list-style-type: none"> <li>Analyze the key characteristics of polynomial functions in a problem situation.</li> <li>Determine the average rate of change of a polynomial function.</li> <li>Solve equations and inequalities graphically.</li> </ul>	<ul style="list-style-type: none"> <li>Average rate of change</li> </ul>
5.2	<b>The Great Polynomial Divide</b>	Polynomial Division	2A.7C 2A.7D 2A.7E	<ul style="list-style-type: none"> <li>Describe similarities between polynomials and integers.</li> <li>Determine factors of a polynomial using one or more roots of the polynomial.</li> <li>Determine factors through polynomial long division.</li> <li>Compare polynomial long division to integer long division.</li> </ul>	<ul style="list-style-type: none"> <li>Polynomial long division</li> <li>Synthetic division</li> </ul>
5.3	<b>The Factors of Life</b>	The Factor Theorem and Remainder Theorem	2A.7D 2A.7E	<ul style="list-style-type: none"> <li>Use the Remainder Theorem to evaluate polynomial equations and functions.</li> <li>Use the Factor Theorem to determine if a polynomial is a factor of another polynomial.</li> <li>Use the Factor Theorem to calculate factors of polynomial equations and functions.</li> </ul>	<ul style="list-style-type: none"> <li>Remainder Theorem</li> <li>Factor Theorem</li> </ul>
5.4	<b>Break It Down</b>	Factoring Higher Order Polynomials	2A.7D 2A.7E	<ul style="list-style-type: none"> <li>Factor higher order polynomials using a variety of factoring methods.</li> </ul>	
5.5	<b>Getting to the Root of It All</b>	Rational Root Theorem	2A.7D 2A.7E	<ul style="list-style-type: none"> <li>Use the Rational Root Theorem to determine possible roots of a polynomial.</li> <li>Use the Rational Root Theorem to factor high order polynomials.</li> <li>Solve higher order polynomials.</li> </ul>	<ul style="list-style-type: none"> <li>Rational Root Theorem</li> </ul>

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
5.6	<b>Identity Theft</b>	Exploring Polynomial Identities	2A.7A	<ul style="list-style-type: none"> <li>• Use polynomial identities to rewrite numeric expressions.</li> <li>• Use polynomial identities to generate Pythagorean triples.</li> <li>• Identify patterns in numbers generated from polynomial identities.</li> <li>• Prove statements involving polynomials.</li> </ul>	• Euclid's Formula
5.7	<b>The Curious Case of Pascal's Triangle</b>	Pascal's Triangle and the Binomial Theorem	2A.7A	<ul style="list-style-type: none"> <li>• Identify patterns in Pascal's Triangle.</li> <li>• Use Pascal's Triangle to expand powers of binomials.</li> <li>• Use the Binomial Theorem to expand powers of binomials.</li> <li>• Extend the Binomial Theorem to expand binomials of the form <math>(ax + by)^n</math>.</li> </ul>	• Binomial Theorem
<b>Learning Individually with MATHia or Skills Practice</b>			2A.4F 2A.6B 2A.7B 2A.7C 2A.7D P.5F	In the MATHia software, students multiply polynomials. They solve quadratic equations by factoring. Students use synthetic division to divide a polynomial by a linear divisor. They factor higher-order polynomials. Students solve polynomial functions set equal to 0. They expand powers of binomials using Pascal's Triangle and the Binomial Theorem.	

## 6 Polynomial Models

This chapter provides opportunities for students to solve polynomial inequalities algebraically and graphically. Lessons present various problem situations and ask students to use a graphing calculator to determine the polynomial regression function that best models the data. Students then use their regression functions to answer questions. Piecewise functions are introduced for situations where a single polynomial function is not the most appropriate model for a set of data. At the end of the chapter, the lesson provides opportunities for students to compare properties of two functions each represented in a different way. Questions present functions that are represented using a graph, table of values, equation, or description of its key characteristics.

**Standards:** 2A.2A, 2A.4E, 2A.4H, 2A.6A, 2A.7I, 2A.8A, 2A.8B, 2A.8C, P.5K

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
6.1	<b>Unequal Equals</b>	Solving Polynomial Inequalities	2A.4H	<ul style="list-style-type: none"> <li>Determine all roots of polynomial equations.</li> <li>Determine solutions to polynomial inequalities algebraically and graphically.</li> </ul>	
6.2	<b>America's Next Top Polynomial Model</b>	Modeling with Polynomials	2A.4E 2A.8A 2A.8B 2A.8C	<ul style="list-style-type: none"> <li>Determine the appropriate regression equation to model a problem situation.</li> <li>Predict outcomes using a regression equation.</li> <li>Sketch polynomial functions that appropriately model a problem situation.</li> </ul>	<ul style="list-style-type: none"> <li>Regression equation</li> <li>Coefficient of determination</li> </ul>
6.3	<b>Connecting Pieces</b>	Piecewise Functions	2A.4E 2A.7I 2A.8A 2A.8B 2A.8C	<ul style="list-style-type: none"> <li>Write a piecewise function to model data.</li> <li>Graph a piecewise function.</li> <li>Determine intervals for a piecewise function to best model data.</li> </ul>	<ul style="list-style-type: none"> <li>Piecewise function</li> </ul>
6.4	<b>Modeling Gig</b>	Modeling Polynomial Data	2A.4E 2A.8A 2A.8B 2A.8C	<ul style="list-style-type: none"> <li>Model a problem situation with a polynomial function.</li> <li>Solve problems using a regression equation.</li> </ul>	
6.5	<b>The Choice Is Yours</b>	Comparing Polynomials in Different Representations	2A.2A 2A.6A	<ul style="list-style-type: none"> <li>Compare polynomials using different representations.</li> <li>Analyze key characteristics of polynomials.</li> </ul>	
<b>Learning Individually with MATHia or Skills Practice</b>			2A.7I 2A.8A 2A.8C P.5K	In the MATHia software, student solve polynomial inequalities. They identify the domain of piecewise functions involving polynomial functions. Students determine polynomial regression equations to model problem and situations and use them to answer questions.	

## 7 Sequences and Series

This chapter begins with a review of arithmetic and geometric sequences and their explicit and recursive formulas. Lessons provide opportunities for students to explore finite and infinite arithmetic series, and then finite and infinite geometric series are used to derive formulas to compute each type of series. Students will explore and analyze the common ratios of several infinite geometric series to understand under what conditions the series is either divergent or convergent. In the later part of the chapter, lessons provide opportunities for students to apply their understanding of geometric series to solve problems.

**Standards:** 2A.5B, 2A.7B, P.5A

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
7.1	<b>Sequence — Not Just Another Glittery Accessory</b>	Arithmetic and Geometric Sequences	2A.5B	<ul style="list-style-type: none"> <li>Recognize patterns as sequences.</li> <li>Determine the next term in a sequence.</li> <li>Write explicit and recursive formulas for arithmetic and geometric sequences.</li> <li>Use formulas to determine unknown terms of a sequence.</li> </ul>	<ul style="list-style-type: none"> <li>Arithmetic sequence</li> <li>Geometric sequence</li> <li>Finite sequence</li> <li>Infinite sequence</li> </ul>
7.2	<b>This Is Series(ous) Business</b>	Finite Arithmetic Sequences	2A.7B	<ul style="list-style-type: none"> <li>Compute a finite series.</li> <li>Use sigma notation to represent a sum of a finite series.</li> <li>Use Gauss's method to calculate a sum of a finite arithmetic series.</li> <li>Write a function to represent the sum of a finite arithmetic series.</li> <li>Use finite arithmetic series to solve real world problems.</li> </ul>	<ul style="list-style-type: none"> <li>Tessellation</li> <li>Series</li> <li>Finite series</li> <li>Infinite series</li> <li>Arithmetic series</li> </ul>
7.3	<b>I Am Having a Series Craving (For Some Math)!</b>	Geometric Series	2A.7B	<ul style="list-style-type: none"> <li>Generalize patterns to derive the formula for the sum of a finite geometric series.</li> <li>Compute a finite geometric series.</li> </ul>	<ul style="list-style-type: none"> <li>Geometric series</li> </ul>
7.4	<b>These Series Just Go On . . . And On . . . And On . . .</b>	Infinite Geometric Series	2A.7B	<ul style="list-style-type: none"> <li>Write a formula for an infinite geometric series.</li> <li>Compute an infinite geometric series.</li> <li>Draw diagrams to model infinite geometric series.</li> <li>Determine whether series are convergent or divergent.</li> <li>Use a formula to compute a convergent infinite geometric series.</li> </ul>	<ul style="list-style-type: none"> <li>Convergent series</li> <li>Divergent series</li> </ul>
7.5	<b>The Power of Interest (It's a Curious Thing)</b>	Geometric Series Applications	2A.5B 2A.7B	<ul style="list-style-type: none"> <li>Apply your understanding of series to problem situations.</li> <li>Write the formula for a geometric series representing a problem situation.</li> </ul>	

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
7.6	<b>A Series of Unfortunate Events</b>	Applications of Arithmetic and Geometric Series	2A.5B 2A.7B	<ul style="list-style-type: none"><li>• Apply your understanding of series to problem situations.</li><li>• Determine whether a situation is best modeled by a geometric or arithmetic series.</li></ul>	
<b>Learning Individually with MATHia or Skills Practice</b>			P.5A	In the MATHia software, students calculate sums of finite series both in mathematical and real-world contexts.	

## 8 Rational Functions

This chapter presents opportunities for students to analyze, graph, and transform rational functions. The chapter begins with an analysis of key characteristics of rational functions and graphs. Lessons then expand on this knowledge for transformations of rational functions. Students will determine whether graphs of rational functions have vertical asymptotes, removable discontinuities, both, or neither, and then sketch graphs of rational functions detailing all holes and asymptotes. Finally, students will explore problem situations modeled by rational functions and answer questions related to each scenario.

**Standards:** 2A.2A, A.6G, 2A.6K, 2A.6H, 2A.6I, 2A.6J

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
8.1	<b>A Rational Existence</b>	Introduction to Rational Functions	2A.2A 2A.6G 2A.6K	<ul style="list-style-type: none"> <li>Graph rational functions.</li> <li>Compare rational functions in multiple representations.</li> <li>Compare the basic rational function to various basic polynomial functions.</li> <li>Analyze the key characteristics of rational functions.</li> </ul>	<ul style="list-style-type: none"> <li>Rational function</li> <li>Vertical asymptote</li> </ul>
8.2	<b>A Rational Shift in Behavior</b>	Translating Rational Functions	2A.2A 2A.6G 2A.6K	<ul style="list-style-type: none"> <li>Analyze rational functions with a constant added to the denominator.</li> <li>Compare rational functions in different forms.</li> <li>Identify vertical asymptotes of rational functions.</li> </ul>	
8.3	<b>A Rational Approach</b>	Exploring Rational Functions Graphically	2A.2A 2A.6G 2A.6K	<ul style="list-style-type: none"> <li>Graph rational functions.</li> <li>Determine graphical behavior of rational functions from the form of the equation.</li> <li>Translate rational functions.</li> </ul>	
8.4	<b>There's a Hole in My Function, Dear Liza</b>	Graphical Discontinuities	2A.6G 2A.6K	<ul style="list-style-type: none"> <li>Sketch rational functions with removable discontinuities.</li> <li>Rewrite rational expressions.</li> <li>Compare removable discontinuities to vertical asymptotes.</li> <li>Identify domain restrictions of rational functions.</li> </ul>	<ul style="list-style-type: none"> <li>Removable discontinuity</li> </ul>
8.5	<b>The Breaking Point</b>	Using Rational Functions to Solve Problems	2A.6H 2A.6I 2A.6J	<ul style="list-style-type: none"> <li>Model situations with rational functions.</li> <li>Use rational expressions to solve real-world problems.</li> </ul>	
<b>Learning Individually with MATHia or Skills Practice</b>			2A.6G 2A.6H 2A.6K	In the MATHia software, students sort functions as rational functions or not. They describe the asymptotes of a rational function given its graph or equation. Students model a scenario with a rational function and use the function to solve for independent and dependent quantities.	

## 9 Solving Rational Equations

This chapter provides opportunities for students to connect their knowledge of operations with rational numbers to operations with rational expressions. Lessons provide opportunities for students to analyze and compare the process to add, subtract, multiply, and divide rational numbers to the same operations with rational expressions. Students conclude rational expressions are similar to rational numbers and are closed under all the operations. In the later part of the chapter, lessons provide opportunities for students to write and solve rational equations and list restrictions. Student work is presented throughout the chapter to demonstrate efficient ways to operate with rational expressions and efficient ways to solve rational equations based on the structure of the original equation.

**Standards:** 2A.6H, 2A.6I, 2A.6J, 2A.6L, 2A.7F

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
9.1	<b>There Must Be a Rational Explanation</b>	Adding and Subtracting Rational Expressions	2A.7F	<ul style="list-style-type: none"> <li>Add and subtract rational expressions.</li> <li>Factor to determine a least common dominator.</li> </ul>	
9.2	<b>Different Client, Same Deal</b>	Multiplying and Dividing Rational Expressions	2A.7F	<ul style="list-style-type: none"> <li>Multiply rational expressions.</li> <li>Divide rational expressions.</li> </ul>	
9.3	<b>Things Are Not Always as They Appear</b>	Solving Rational Equations	2A.6I 2A.6J	<ul style="list-style-type: none"> <li>Solve rational equations in one variable.</li> </ul>	<ul style="list-style-type: none"> <li>Rational equation</li> <li>Extraneous solution</li> </ul>
9.4	<b>Get to Work, Mix It Up, Go the Distance, and Lower the Cost!</b>	Using Rational Equations to Solve Real• World Problems	2A.6I 2A.6J 2A.6L	<ul style="list-style-type: none"> <li>Use rational equations to model and solve work problems.</li> <li>Use rational equations to model and solve mixture problems.</li> <li>Use rational equations to model and solve distance problems.</li> <li>Use rational equations to model and solve cost problems.</li> <li>Formulate and solve equations involving inverse variation.</li> </ul>	
<b>Learning Individually with MATHia or Skills Practice</b>			2A.6H 2A.6I 2A.6L 2A.7F	In the MATHia software, students operate with and rewrite rational expressions. They solve rational equations in both mathematical and real• world contexts.	

# 10 Radical Functions

This chapter presents opportunities for students to explore radical functions, simplify radical expressions, and solve radical equations. The chapter begins with an introduction to radical functions as inverses of power functions. Students will graph radical functions, write their equations, and determine their key characteristics. Lessons then expand on this knowledge for transformations of radical functions. In the later part of the chapter, lessons provide opportunities for students to rewrite radicals using rational exponents and extract roots from radical expressions. Students will also multiply, divide, add, and subtract radical expressions. Finally, students will analyze solution strategies for radical equations, and solve real-world problem situations using radical equations.

**Standards:** 2A.2A, 2A.2B, 2A.2C, 2A.2D, 2A.4C, 2A.4F, 2A.4G, 2A.6A, 2A.6B, 2A.7G, 2A.7H, 2A.7I

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
10.1	<b>With Great Power . . .</b>	Inverses of Power Functions	2A.2B	<ul style="list-style-type: none"> <li>Graph the inverses of power functions.</li> <li>Use the Vertical Line Test to determine whether an inverse relation is a function.</li> <li>Use graphs to determine whether a function is invertible.</li> <li>Use the Horizontal Line Test to determine whether a function is invertible.</li> <li>Graph inverses of higher-degree power functions.</li> <li>Generalize about inverses of even- and odd-degree power functions.</li> </ul>	<ul style="list-style-type: none"> <li>Inverse of a function</li> <li>Invertible function</li> <li>Horizontal Line Test</li> </ul>
10.2	<b>The Root of the Matter</b>	Radical Functions	2A.2A 2A.2B 2A.2C 2A.2D 2A.7I	<ul style="list-style-type: none"> <li>Restrict the domain of <math>f(x) = x^2</math> to graph the square root function.</li> <li>Determine equations for the inverses of power functions.</li> <li>Identify characteristics of square root and cube root functions, such as domain and range.</li> <li>Use composition of functions to determine whether two functions are inverses of each other.</li> <li>Solve real-world problems using the square root and cube root functions.</li> </ul>	<ul style="list-style-type: none"> <li>Square root function</li> <li>Cube root function</li> <li>Radical function</li> <li>Composition of functions</li> </ul>
10.3	<b>Making Waves</b>	Transformations of Radical Functions	2A.2C 2A.4C 2A.6A 2A.7I	<ul style="list-style-type: none"> <li>Graph transformations of radical functions.</li> <li>Analyze transformations of radical functions using transformational function form.</li> <li>Describe transformations of radical functions using algebraic, graphical, and verbal representations.</li> <li>Generalize about the effects of transformations on power functions and their inverses.</li> </ul>	
10.4	<b>Keepin' It Real</b>	Extracting Roots and Rewriting Radicals	2A.2A 2A.7G	<ul style="list-style-type: none"> <li>Extract roots from radicals.</li> <li>Rewrite radicals as powers that have rational exponents.</li> <li>Rewrite powers that have rational exponents as radicals.</li> </ul>	
10.5	<b>Time to Operate!</b>	Multiplying, Dividing, Adding, and Subtracting Radicals	2A.7G	<ul style="list-style-type: none"> <li>Rewrite radicals by extracting roots.</li> <li>Multiply, divide, add, and subtract radicals.</li> </ul>	

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
10.6	<b>Look to the Horizon</b>	Solving Radical Equations	2A.4F 2A.4G 2A.6B 2A.7H	<ul style="list-style-type: none"> <li>• Use algebra to solve radical equations.</li> <li>• Write the solution steps of a radical equation using radical notation.</li> <li>• Write the solution steps of a radical equation using exponential notation.</li> <li>• Identify extraneous roots when solving radical equations.</li> </ul>	
<b>Learning Individually with MATHia or Skills Practice</b>			2A.2A 2A.2B 2A.7G	In the MATHia software, students identify, graph, and determine the equation of the inverse of a function. They graph square root and cube root functions and analyze transformations on these functions. Students operate with and rewrite numerical and algebraic radical expressions.	

# 11 Graphs of Exponential and Logarithmic Functions

This chapter presents opportunities for students to analyze, graph, and transform exponential and logarithmic functions. The chapter begins with an exploration of exponential functions. Students will analyze key characteristics of exponential functions and graphs. Lessons then expand on this knowledge for transformations of exponential functions. In the later part of the chapter, lessons focus on logarithmic functions. Student will determine key characteristics of logarithmic functions and graphs. Students will also transform logarithmic functions and make generalizations about the effect of a transformation on an inverse function.

**Standards:** 2A.2A, 2A.2B, 2A.2C, 2A.5B, 2A.5C

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
11.1	<b>Small Investment, Big Reward</b>	Exponential Functions	2A.5B	<ul style="list-style-type: none"> <li>Construct an exponential function from a geometric sequence.</li> <li>Classify functions as exponential growth or decay.</li> <li>Compare tables, graphs, and equations of exponential functions.</li> </ul>	<ul style="list-style-type: none"> <li>Half-life</li> </ul>
11.2	<b>We Have Liftoff!</b>	Properties of Exponential Graphs	2A.2A	<ul style="list-style-type: none"> <li>Identify the domain and range of exponential functions.</li> <li>Investigate graphs of exponential functions through intercepts, asymptotes, intervals of increase and decrease, and end behavior.</li> <li>Explore the irrational number <math>e</math>.</li> </ul>	<ul style="list-style-type: none"> <li>Natural base <math>e</math></li> </ul>
11.3	<b>I Like to Move It</b>	Transformations of Exponential Functions	2A.2A 2A.5A	<ul style="list-style-type: none"> <li>Dilate, reflect, and translate exponential functions using reference points and transformational function form.</li> <li>Investigate graphs of exponential functions through intercepts, asymptotes, intervals of increase and decrease, and end behavior.</li> <li>Describe how transformations of exponential functions affect their key characteristics.</li> </ul>	
11.4	<b>I Feel the Earth Move</b>	Logarithmic Functions	2A.2A 2A.2B 2A.2C 2A.5B 2A.5C	<ul style="list-style-type: none"> <li>Graph the inverses of exponential functions with bases of 2, 10, and <math>e</math>.</li> <li>Recognize the inverse of an exponential function as a logarithm.</li> <li>Identify the domain and range of logarithmic functions.</li> <li>Investigate graphs of logarithmic functions through intercepts, asymptotes, intervals of increase and decrease, and end behavior.</li> </ul>	<ul style="list-style-type: none"> <li>Logarithm</li> <li>Logarithmic function</li> <li>Common logarithm</li> <li>Natural logarithm</li> </ul>
11.5	<b>More Than Meets the Eye</b>	Transformations of Logarithmic Functions	2A.2B 2A.2C 2A.5A	<ul style="list-style-type: none"> <li>Dilate, reflect, and translate logarithmic functions using reference points.</li> <li>Investigate graphs of logarithmic functions through intercepts, asymptotes, intervals of increase and decrease, and end behavior.</li> </ul>	
<b>Learning Individually with MATHia or Skills Practice</b>			2A.5A 2A.5B	In the MATHia software, students solve real-world problems using the formula for continuous growth or decay. They evaluate, identify, and analyze logarithmic functions.	

# 12 Exponential and Logarithmic Equations

In this chapter, students use their understanding of exponential and logarithmic functions to solve exponential and logarithmic equations. Students begin by building understanding and fluency with exponential and logarithmic expressions, including estimating the values of logarithms on a number line and then use this understanding to derive the properties of logarithms. Students explore alternative methods for solving logarithmic equations and solve exponential and logarithmic equations in context.

**Standards:** 2A.5B, 2A.5C, 2A.5D, 2A.5E

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
12.1	<b>All the Pieces of the Puzzle</b>	Exponential and Logarithmic Forms	2A.5C 2A.5D	<ul style="list-style-type: none"> <li>Convert exponential equations into logarithmic equations.</li> <li>Convert logarithmic equations into exponential equations.</li> <li>Solve exponential and simple logarithmic equations.</li> <li>Estimate the values of logarithms on a number line.</li> <li>Evaluate logarithmic expressions.</li> </ul>	<ul style="list-style-type: none"> <li>Logarithmic equation</li> </ul>
12.2	<b>Mad Props</b>	Properties of Logarithms	2A.5C	<ul style="list-style-type: none"> <li>Derive the properties of logarithms.</li> <li>Expand logarithmic expressions using the properties of logarithms.</li> <li>Rewrite multiple logarithmic expressions as a single logarithmic expression.</li> </ul>	<ul style="list-style-type: none"> <li>Zero Property of Logarithms</li> <li>Logarithms with Same Base and Argument</li> <li>Product Rule of Logarithms</li> <li>Quotient Rule of Logarithms</li> <li>Power Rule of Logarithms</li> </ul>
12.3	<b>What's Your Strategy?</b>	Solving Exponential Equations	2A.5B 2A.5D	<ul style="list-style-type: none"> <li>Solve exponential equations using the Change of Base Formula.</li> <li>Solve exponential equations by taking the log of both sides.</li> <li>Analyze different solution strategies to solve exponential equations.</li> </ul>	<ul style="list-style-type: none"> <li>Change of Base Formula</li> </ul>
12.4	<b>Logging On</b>	Solving Logarithmic Equations	2A.5D 2A.5E	<ul style="list-style-type: none"> <li>Solve for the base, argument, and exponent of logarithmic equations.</li> <li>Solve logarithmic equations using logarithmic properties.</li> <li>Solve logarithmic equations arising from real-world situations.</li> <li>Complete a decision tree to determine efficient methods for solving exponential and logarithmic equations.</li> </ul>	
12.5	<b>So When Will I Use This?</b>	Applications of Exponential and Logarithmic Equations	2A.5B 2A.5D 2A.5E	<ul style="list-style-type: none"> <li>Use exponential models to analyze problem situations.</li> <li>Use logarithmic models to analyze problem situations.</li> </ul>	
<b>Learning Individually with MATHia or Skills Practice</b>			2A.5C 2A.5D	In the MATHia software, students solve logarithmic equations with base 2, 10, or e.	

# 13 Working with Functions

In this chapter, students broaden their study of functions by exploring additional function types. Students begin by applying their knowledge of transformations to the graph of the basic absolute value function. Next, students solve absolute value equations, absolute value inequalities, and linear inequalities in two variables. Function composition is developed, and students apply function composition to solve contextual problems. Students also use functions to model optimal solutions, and to study situations modeled by logistic growth, such as the spread of infectious diseases.

**Standards:** 2A.2A, 2A.2B, 2A.2D, 2A.3E, 2A.3F, 2A.3G, 2A.4F, 2A.6C, 2A.6D, 2A.6E, 2A.6F, 2A.6E, 2A.7I

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
13.1	<b>This Will Be Absolutely FUN</b>	Graphing Absolute Value Functions	2A.2A 2A.6C	<ul style="list-style-type: none"> <li>Graph and analyze the basic absolute value function.</li> <li>Investigate key characteristics of the basic absolute value function.</li> <li>Graph transformations of absolute value functions.</li> <li>Analyze transformations of absolute value functions using transformational function form.</li> <li>Generalize about the effects of transformations on key characteristics of absolute value functions.</li> </ul>	
13.2	<b>Play Ball!</b>	Absolute Value Equations and Inequalities	2A.6D 2A.6E 2A.6F	<ul style="list-style-type: none"> <li>Understand and solve absolute values.</li> <li>Solve linear absolute value equations.</li> <li>Solve and graph linear absolute value inequalities on number lines.</li> <li>Graph linear absolute values and use the graph to determine solutions.</li> </ul>	<ul style="list-style-type: none"> <li>Linear absolute value equation</li> <li>Linear absolute value inequality</li> <li>Equivalent compound inequality</li> </ul>
13.3	<b>Make the Most of It</b>	Optimization	2A.3E 2A.3F 2A.3G	<ul style="list-style-type: none"> <li>Formulate systems of linear inequalities in two variables.</li> <li>Solve systems of two or more linear inequalities in two variables.</li> <li>Determine possible solutions in the solution set of systems of two or more linear inequalities in two variables.</li> <li>Determine constraints from a problem situation.</li> <li>Analyze a function to calculate maximum or minimum values.</li> </ul>	<ul style="list-style-type: none"> <li>Solution of a system of inequalities</li> <li>Linear programming</li> </ul>
13.4	<b>It's Not New, It's Recycled</b>	Composition of Functions	2A.2B 2A.2D 2A.4F 2A.7I	<ul style="list-style-type: none"> <li>Perform the composition of two functions graphically and algebraically.</li> <li>Use the composition of functions to determine whether two functions are inverses of each other.</li> <li>Add, subtract, multiply, and divide with functions.</li> <li>Determine the restricted domain of a composite function.</li> </ul>	<ul style="list-style-type: none"> <li>Identity function</li> </ul>
13.5	<b>A Graph Is Worth a Thousand Words</b>	Interpreting Graphs	2A.5A	<ul style="list-style-type: none"> <li>Interpret the contextual meaning of a graph and analyze it in terms of a problem situation</li> <li>Write a logistic growth function to model a data set.</li> <li>Use technology to generate random numbers in order to conduct an experiment modeling logistic growth.</li> </ul>	<ul style="list-style-type: none"> <li>Logistic functions</li> <li>Carrying capacity</li> </ul>
<b>Learning Individually with MATHia or Skills Practice</b>			2A.2D 2A.3F 2A.6D 2A.6E 2A.6F	In the MATHia software, students build absolute value functions using transformations. They use graphs of absolute value functions to identify transformations and determine solutions. Students graph and solve absolute value equations and inequalities on a number line. They explore and graph linear inequalities and two variables before determining the region of a graph that represents the solution set of a system of linear inequalities. Students compose linear functions.	

# 14 Modeling with Functions

In this chapter, students explore various real-world and purely mathematical situations that are modeled with functions. Function composition is developed, and students apply function composition to solve contextual problems. Students also use functions to draw graphics, to model optimal solutions and self-similarity, and to study situations modeled by logistic growth, such as the spread of infectious diseases. Students end the chapter by choosing appropriate functions to model a variety of problem situations.

**Standards:** 2A.2C, 2A.4B, 2A.4C, 2A.4F, 2A.4E, 2A.5A, 2A.5B, 2A.5D, 2A.6A, 2A.6C, 2A.6H, 2A.6I, 2A.8A, 2A.8B, 2A.8C

Lesson	Lesson Title	Lesson Subtitle	TEKS	Key Math Objectives	Key Terms
14.1	<b>Paint by Numbers</b>	Art and Transformations	2A.4C 2A.5A 2A.6A 2A.6C	<ul style="list-style-type: none"> <li>Use transformations of functions and other relations to create artwork.</li> <li>Write equations for transformed functions and other relations given an image.</li> </ul>	
14.2	<b>This Is the Title of This Lesson</b>	Fractals	2A.5B	<ul style="list-style-type: none"> <li>Build expressions and equations to model the characteristics of self-similar objects.</li> <li>Write sequences to model situations and use them to identify patterns.</li> <li>Analyze the counterintuitive.</li> </ul>	<ul style="list-style-type: none"> <li>Fractal</li> <li>Self-similar</li> <li>Iterative process</li> </ul>
14.3	<b>It's Time to Focus</b>	Parabolas as Conics	2A.4B 2A.4E	<ul style="list-style-type: none"> <li>Identify the focus and directrix of a parabola centered horizontally and vertically.</li> <li>Write the equation of a parabola using given attributes, including vertex, focus, directrix, axis of symmetry, and direction of opening.</li> <li>Formulate square root equations using technology given a table of data.</li> </ul>	<ul style="list-style-type: none"> <li>Locus of points</li> <li>Parabola</li> <li>Focus of a parabola</li> <li>Directrix of a parabola</li> <li>Conic form of a parabola</li> <li>Concavity</li> </ul>
14.4	<b>But I Regres . . .</b>	Regression	2A.4E 2A.5B 2A.8A 2A.8B 2A.8C	<ul style="list-style-type: none"> <li>Analyze data to select the appropriate model from among linear, quadratic, and exponential models.</li> <li>Use regression methods available through technology to write a linear, quadratic, and an exponential function from a given set of data.</li> <li>Predict and make decisions and critical judgments from a given set of data using linear, quadratic, and exponential models.</li> </ul>	
14.5	<b>Grab Bag</b>	Choosing Functions to Model Situations	2A.2C 2A.4F 2A.5B 2A.5D 2A.6H 2A.6I 2A.8A 2A.8B 2A.8C	<ul style="list-style-type: none"> <li>Use technology to determine regression equations that model data.</li> <li>Choose functions to model problem situations.</li> <li>Graph and analyze function characteristics in terms of problem situations.</li> </ul>	