ALGEBRA II

CURRICULUM

CARLISLE AREA SCHOOL DISTRICT

DATE OF BOARD APPROVAL: **March 17, 2022**

COURSE OVERVIEW

Title:	Algebra II
Grade Level:	Grades 10-12
Level:	High School - Option II
Length:	Full Year
Duration:	85 Minute Periods
Frequency:	90 Days
Pre-Requisites:	Successful completion of Algebra I, Algebra IA and IB, and either Geometry or Honors Geometry
Credit:	1 Credit
Description:	Algebra II is designed for students who need to extend algebraic skills begun in Algebra I or Algebra IA and Algebra IB in a more practical and less theoretical setting than in Honors Algebra II. The course studies functions: linear, absolute value and quadratic equations and inequalities; and polynomial, rational and radical equations. This course may not be selected if Honors Algebra II has been successfully completed.

COURSE TIMELINE

UNIT	TITLE	KEY CONCEPTS	DURATION (DAYS)
1	Relations and Functions	• Representing, identifying, and evaluating relations and functions. • Domain and range • Function operations and composition • Function inverses	6-8 Days
2	Linear Functions	• Slope of a line • Graphing linear function • Writing linear functions • Direct variation	7-9 Days
3	Absolute Value Functions	• Graphing absolute functions using transformations • Graphing linear and absolute value inequalities • Graphing systems of linear and absolute value inequalities	8-10 Days
4	Graphing Quadratic Functions	• Quadratic functions in standard form • Quadratic functions in vertex form • Quadratic functions in intercept form • Quadratic inequalities • Graph systems of inequalities including quadratics • Modeling with quadratic functions (quadratic regression)	11-13 Days
5	Solving Quadratic Equations	• Solving by factoring • Simplifying square roots • Simplifying expressions with complex numbers • Solving by square root method • Solving using the quadratic formula	15-17 Days

6	Rational Functions	• Properties of exponents • Factoring difference of squares, sum and difference of cubes, trinomials in quadratic form, and grouping with polynomials of degree 3 or higher • Simplifying rational expressions using factoring and properties of exponents • Multiplying and dividing rational expressions • Adding and subtracting rational expressions • Solving rational equations and checking for extraneous solutions • Parent graphs of rational functions • Graphing rational function using transformations	15-17 Days
7	Radical Functions	• Parent graphs of radical functions • Graphing radical functions using transformation • Writing the equation of a radical function • Operations with radical expressions • Evaluating radical expressions • Simplifying radical/rational exponent expressions • Solving radical/rational exponent equations	14-16 Days

DISCIPLINARY SKILLS and PRACTICES

DISCIPLINARY SKILL/PRACTICE	DESCRIPTION
Make sense of problems and persevere in solving them	Make conjectures about how real world application problems may be solved, monitor progress toward a solution, and make adjustments in the problem solving plan if necessary.
Reason abstractly and quantitatively	Estimate and check answers to problems and determine the reasonableness of results.
Construct viable arguments and critique the reasoning of others	Justify and communicate conclusions effectively and respond to arguments logically.
Model with mathematics	Use mathematics to model real world problems, interpreting the mathematical results in the context of the situation.
Use appropriate tools strategically	Consider the tools available in solving problems and understand the insights gained by using the tool as well as the limitation of the tool.
Attend to precision	Calculate accurately and efficiently within the context of problems and communicate results precisely.
Look for and make use of structure	Examine problems to discern a pattern or structure and utilize this finding in similar problems.
Look for and express regularity in repeated reasoning	Notice repeated calculations or processes and generalize from those insights in order to solve problems.

Note: These disciplinary practices originate from the *Pennsylvania Department of Education* PA Core Standards.

UNIT 1

Unit Title	Relations and Functions
Unit Description	Functions are equations that satisfy the criteria of having *exactly* one output for each input. This unit focuses on determining whether a relation or equation is a function by examining its domain and range. Functions will be given to students as graphs, equations, tables, mappings, and real life applications. Students will add, subtract, multiply, and divide functions as well as find the composition of functions. Certain functions have inverses. Students will explore the characteristics of inverse functions and determine whether or not given functions have an inverse. Students will find the inverse of invertible functions.
Unit Assessment	Common Unit Assessment

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
How can you tell if a relation is a function and how do you evaluate functions using function notation? **2 Days**	☐ Represent a function in various ways. ☐ Evaluate functions using function notation. ☐ Describe when a relation is a function and when a relation is not a function.	**Vocabulary:** relation, function, discrete, continuous, bounded, unbounded, half-bounded, mapping diagram, set notation, function notation **Concepts:** -Vertical line test -Function notation	CC.2.2.HS.C.1 Use the concept and notation of functions to interpret and apply them in terms of their context.

How do you identify the domain and range of a relation or function? **2 Days**	☐ Determine the domain of a relation given various representations. ☐ Determine the range of a relation given various representations.	**Vocabulary:** domain, range, bounded, unbounded, half-bounded **Concepts:** -Interval notation -Inequality notation can be used to represent the domain and range of a relation.	CC.2.2.HS.C.6 Interpret functions in terms of the situations they model.
How do you add, subtract, multiply, divide and compose functions? **2 Days**	☐ Perform operations with functions. ☐ Compose functions and use the resulting composition to evaluate the function at a given point.	**Vocabulary:** function composition **Concepts:** -Operations with functions -Function composition is substitution of another function in for a variable	CC.2.2.HS.C.1 Use the concept and notation of functions to interpret and apply them in terms of their context. CC.2.2.HS.C.6 Interpret functions in terms of the situations they model.
How do you find the inverse relation of a given function and determine if a function is one-to-one? **2 Days**	☐ Find the inverse relation of a given function. ☐ Use function composition to determine if the given relations are inverses. ☐ Identify inverses given their graphs. ☐ Determine if a function is one-to-one.	**Vocabulary:** inverse, horizontal line test, one-to-one **Concepts:** -Using function composition, two functions are inverses if the result is x. -Inverses can be identified on graphs if the two relations are reflections across $y = x$. -A function is one-to-one if it passes the horizontal line test.	CC.2.2.HS.C.1 Use the concept and notation of functions to interpret and apply them in terms of their context. CC.2.2.HS.C.6 Interpret functions in terms of the situations they model.

UNIT 2

Unit Title	Linear Functions
Unit Description	Linear functions are used to model many real-world situations. In this unit students review and extend the skills of graphing, converting between various equations of lines, and describing solutions to linear functions to deepen their understanding of modeling situations using linear functions. The steepness and direction of a line is described using slope. Students will use slope to explore how a positive or negative linear model is used in real world situations. Using slope-intercept form, point-slope form, and standard form, students will construct linear functions given a graph, a slope and a point, and two points and then be able to use that line to model various situations. Students will explore the multiple representations of lines and how they apply to procedural and real world problems.
Unit Assessment	Common Unit Assessment

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
How do you find the slope of a line and use it to describe the line or the relationship between the lines? **2 Days**	☐ Find the slope of a line given two points, a graph, or an equation. ☐ Describe lines as parallel, perpendicular, intersecting, or coinciding.	**Vocabulary:** linear function, constant function, slope, undefined, x-intercept, y-intercept, parallel, perpendicular, coinciding, slope-intercept form, standard form, point-slope form **Concepts:** -Parallel lines have the same slope but different y-intercepts. -Perpendicular lines have slopes that are opposite reciprocals. -Intersecting lines have different slopes. -Coinciding lines have the same slopes and same y-intercepts.	CC.2.2.HS.D.8 Apply inverse operations to solve equations or formulas for a given variable. CC.2.2.HS.D.10 Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

How do you graph linear functions and identify their characteristics? **2 Days**	☐ Construct graphs of linear functions using tables and slope and y-intercept. ☐ Identify characteristics of lines and use them to draw conclusions about real world situations.	**Vocabulary:** linear function, constant function, x-intercept, y-intercept, coinciding, slope intercept form, standard form, point-slope form **Concepts:** -Two points are needed to graph a line. -They can be found by finding the y-intercept and using the slope, or by using a table and substituting two different values for x to get the corresponding y-values.	CC.2.2.HS.D.8 Apply inverse operations to solve equations or formulas for a given variable. CC.2.2.HS.D.10 Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.
How do you write the equation of a line? **3 Days**	☐ Write an equation of a line given a graph. ☐ Write an equation of a line given a point and a slope. ☐ Write an equation of a line given two points. ☐ Determine which equation form of a line is most advantageous to use based on the information given.	**Vocabulary:** slope-intercept form, point-slope form, standard form **Concepts:** -The equation of a line can be written given a graph or two points or the slope and a point.	CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems. CC.2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships. CC.2.2.HS.D.10 Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

How do you know whether two variables vary directly? **2 Days**	☐ Determine whether two variables vary directly. ☐ Write direct variation equations from graphs, tables, points, and real-world problem situations.	**Vocabulary:** direct variation, constant of variation **Concepts:** -Two variables vary directly if the line that relates them passes through the origin. -When given a table, $\frac{y}{x}$ is constant when the relation represents direct variation.	CC.2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships.

UNIT 3

Unit Title	Absolute Value Functions
Unit Description	Absolute value represents the distance from zero. The maximum or minimum of an absolute value function occurs at the vertex of the function. The general form of an absolute value function, $y = a\|x - h\| + k$, is used to describe dilations and reflections (a), horizontal translations (h), and vertical translations (k). Students will use the general form of an absolute value function to write equations of absolute value functions given a graph as well as to graph absolute value functions given an equation by using the parent function $y = \|x\|$. Students will extend the concepts of absolute value equations to absolute value inequalities as well as systems. When solving absolute value equations students have to be cognizant of potential extraneous solutions. Students will discover that they can find up to two solutions when solving absolute value equations, but also have the potential to get no solutions. Absolute value inequalities will be solved by writing them as compound inequalities.
Unit Assessment	Common Unit Assessment

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
Why is the shape of an absolute value function different from the shape of a linear function when graphed? How do you determine the maximum or minimum of an absolute value function? **2 Days**	☐ Determine the difference between absolute value and linear functions. ☐ Determine the vertex (maximum or minimum) of an absolute value function.	**Vocabulary:** absolute value, vertex, maximum, minimum **Concepts:** -Absolute value graphs are "v" shaped. The vertex of the absolute value function represents the minimum/maximum. -There is a minimum when the absolute value function is positive and opens up. -There is a maximum when the absolute value function is negative and opens down.	CC.2.2.HS.C.2 Graph an analyze functions, and use their properties to make connections between the different representations. CC.2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships.

How do you solve absolute value equations? How do you solve and graph absolute value inequalities? **2 Days**	☐ Solve absolute value equations. ☐ Solve absolute value inequalities. ☐ Construct graphs of solutions to absolute value inequalities.	**Concepts:** -Absolute value equations require two equations to solve. -Absolute value inequalities are solved similarly to absolute value equations with special attention being paid to the inequality symbols being used. -Absolute value inequalities create compound inequalities.	CC.2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships. CC.2.2.HS.D.10 Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.
How do you use rigid and non-rigid transformations to sketch the graph of an absolute value function? **3 Days**	☐ Sketch graphs of absolute value functions using rigid and non-rigid transformations. ☐ Describe transformations of a graph of absolute value functions as compared to the parent function.	**Vocabulary:** rigid, non-rigid, symmetry, transformations, translation, reflection, dilation **Concepts:** -Horizontal translations are determined from the value added/subtracted inside the absolute value bar. -Vertical translations are determined from the value added/subtracted outside the absolute value bars. -A reflection across the x-axis occurs when absolute value is negative. -A dilation occurs when a value other than one is multiplied to the absolute value bars. -Larger values result in a stretch of the graph while values between 0 and 1 result in a shrink.	CC.2.2.HS.C.4 Interpret the effects transformations have on functions.

How do you write the equation of an absolute value function given its graph? How do you write the equation of an absolute value given its vertex and a point on the graph? **1 Days**	☐ Write the equation of an absolute value function given its graph. ☐ Write the equation of an absolute value function given the vertex and a point.	**Vocabulary:** rigid, non-rigid, symmetry, transformations, translation, reflection, dilation **Concepts:** -Absolute value functions can be written from a graph using transformations.	CC.2.2.HS.C.4 Interpret the effects transformations have on functions.
How do you graph a linear and absolute value inequality in two variables? **1 Days**	☐ Construct graphs of linear inequalities in two variables. ☐ Construct graphs of absolute value inequalities in two variables.	**Vocabulary:** inequalities, linear, absolute value, shaded region, solution to an inequality **Concepts:** -Solution regions to inequalities can be found using a test point. -The solution to an inequality is a region of the coordinate plane.	CC.2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships.
How do you graph the solution of a system of inequalities? **1 Days**	☐ Graph a solution of a system of inequalities including linear and absolute value functions.	**Vocabulary:** systems of inequalities **Concepts:** -Solutions to a system of inequalities is the overlap of the shaded regions of all inequalities graphed. -If there is no overlap in shaded regions, there is no solution.	CC.2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships.

UNIT 4

Unit Title	Graphing Quadratic Functions
Unit Description	Quadratic functions are used to model many real-world situations. Students will investigate and understand the features that are unique to quadratic functions. Intercept form, vertex form, and standard form will be used to create graphs of quadratic functions. Intercept form, $y = a(x - p)(x - q)$, can be used to quickly identify the x-intercepts. Half the sum of the x-intercepts can be used to locate the vertex to construct a graph. Vertex form, $y = a(x - h)^2 + k$, can be used to easily identify the vertex, (h, k), of a quadratic function as well as transformations made to the parent function $y = x^2$. While standard form, $y = ax^2 + bx + c$, requires more computation to construct a graph, it is prevalent in many real world situations. Students can find the vertex given standard form using $x = -\frac{b}{2a}$ and substituting that into the function to find the y-value. Students will use the various forms of equations of quadratic functions to represent and construct quadratic models related to real-world problems.
Unit Assessment	Common Unit Assessment

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
How do you graph a quadratic function in vertex form? **3 Days**	☐ Graph a quadratic function in vertex form. ☐ Identify the vertex given an equation in vertex form. ☐ Identify points that lie on the graph of a quadratic function in vertex form.	**Vocabulary:** quadratic, parabola, vertex, vertex form, axis of symmetry **Concepts:** -$y = a(x - h)^2 + k$ -Vertex: (h, k) -Axis of Symmetry: $x = h$ -Transformations of a quadratic function are easily identified when quadratic functions are written in vertex form.	CC.2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships.

How do you graph a quadratic function in standard form? **3 Days**	☐ Construct graphs of quadratic functions in standard form. ☐ Find the vertex given a quadratic function in standard form. ☐ Identify points that lie on the graph of a quadratic function in standard form.	**Vocabulary:** axis of symmetry, y-intercept, $f(x) = ax^2 + bx + c$ **Concepts:** -Axis of Symmetry: $x = -\frac{b}{2a}$ -Vertex: $\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$	CC.2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships.
How do you graph a quadratic function in intercept form? **3 Days**	☐ Construct graphs of quadratic functions in intercept form. ☐ Find the vertex given a quadratic function in intercept form. ☐ Identify points that lie on the graph of a quadratic function in intercept form.	**Vocabulary:** intercept form, x-intercept, zeros, roots **Concepts:** -$y = a(x - p)(x - q)$ -Axis of Symmetry: $x = \frac{p+q}{2}$	CC.2.2.HS.C.2 Graph and analyze functions, and use their properties to make connections between the different representations. CC.2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships.
How do you graph a quadratic inequality or a system of inequalities that includes quadratics? **2 Days**	☐ Graph a quadratic inequality. ☐ Graph a system of inequalities that includes quadratic functions.	**Vocabulary:** quadratic inequality **Concepts:** -Solutions to a quadratic inequality is a region of the coordinate plane. -Solutions to a system of inequalities is the shaded region of overlap of all inequalities graphed.	CC.2.2.HS.D.10 Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

How do you model real-world problems using quadratic functions? How do you determine the parabola of best fit for quadratic data using regression? **2 Days**	☐ Model real-world problems using quadratic functions. ☐ Determine the parabola of best fit using quadratic regression. ☐ Use the parabola of best fit to make predictions.	**Vocabulary:** quadratic regression, coefficient of determination, parabola **Concepts:** -The closer the coefficient of determination is to one, the stronger the model. **-**Maximums and minimums can be found by using the vertex. **-**Graphing tools are used to calculate quadratic regression.	CC.2.2.HS.C.5 Construct and compare linear, quadratic, and exponential models to solve problems. CC.2.2.HS.C.6 Interpret functions in terms of the situations they model.

UNIT 5

Unit Title	Solving Quadratic Equations
Unit Description	Solving quadratic equations is a skill that will allow students to find the zeros of a quadratic function. Students will make a connection between the x-intercepts of a quadratic function and the solutions to that function when it is set equal to zero. Using various factoring methods, square roots, and the quadratic formula, students will evaluate the information given to them in problem situations to choose a method to solve the equation. Not every quadratic equation can be solved using factoring. In those cases, the quadratic formula must be used to find the exact answer(s) to the equation. The imaginary unit allows equations of graphs that never cross the x-axis to be solved. Operations with complex numbers will give students the tools necessary to simplify expressions containing the imaginary unit. Students will evaluate solutions to real world problems.
Unit Assessment	Common Unit Assessment

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
How do you describe quadratic functions in standard form? How do you factor out the GCF of a quadratic? **1 Day**	☐ Describe a quadratic function as a monomial, binomial, or trinomial. ☐ Identify the greatest common factor (GCF) of a quadratic function and rewrite the function in factored form.	**Vocabulary:** monomial, binomial, trinomial, greatest common factor (GCF), standard form, factored form **Concepts:** -Quadratic functions are described based on the number of terms. -Factoring is rewriting a quadratic function as a product.	CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems.

How do you factor a quadratic trinomial? **2 Days**	☐ Factor quadratic trinomials with a leading coefficient equal to one using various methods. ☐ Factor quadratic trinomials with a leading coefficient not equal to one using various methods.	**Vocabulary:** leading coefficient, factoring, greatest common factor (GCF), prime factors **Concepts:** -Factoring is a method used to rewrite a function in an equivalent form.	CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems.
How do you factor a difference of squares of perfect square trinomial? **2 Days**	☐ Factor a difference of squares. ☐ Factor perfect square trinomials.	**Vocabulary:** perfect square trinomial, difference of squares **Concepts:** -Patterns are present when factoring special forms. -$a^2 - b^2 = (a + b)(a + b)$ -$a^2 \pm 2ab + b^2 = (a \pm b)^2$	CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems.

How do you solve a quadratic equation by factoring? **3 Days**	☐ Solve quadratic equations by factoring. ☐ Identify how the zero-product property relates to factoring. ☐ Identify how the solutions found by factoring relate to the graph of the function.	**Vocabulary:** zero-product property **Concepts:** - Solutions to quadratic equations represent the x-intercept(s) of the function. -The zero-product property is used when solving quadratic equations. -Quadratic equations have two solutions including multiplicities.	CC.2.2.HS.D.3 Extend the knowledge of arithmetic operations and apply to polynomials. CC.2.2.HS.D.4 Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs. CC.2.2.HS.D.8 Apply inverse operations to solve equations or formulas for a given variable.
How do you solve a quadratic equation using the square root method? **3 Days**	☐ Solve a quadratic equation using the square root method. ☐ Compare the square root method to solving by factoring. ☐ Determine when it is appropriate to use each strategy.	**Vocabulary:** radical, radicand, index **Concepts:** -When solving equations using square roots $\pm$ is necessary because $(x)^2 = (-x)^2 = x^2$.	CC.2.2.HS.D.3 Extend the knowledge of arithmetic operations and apply to polynomials. CC.2.2.HS.D.4 Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs. CC.2.2.HS.D.8 Apply inverse operations to solve equations or formulas for a given variable.

How do you simplify expressions involving complex numbers? **3 Days**	☐ Simplify expressions involving complex numbers. ☐ Add, subtract, and multiply complex numbers.	**Vocabulary:** imaginary number, complex number **Concepts:** -Operations with complex numbers are similar to operations with real numbers. -The values of i are cyclic. -When taking the square root of negative numbers, imaginary solutions result.	CC.2.2.HS F.6 Extend the knowledge of arithmetic operations and apply to complex numbers. CC.2.2.HS.F.7 Apply concepts of complex numbers to polynomial identities and quadratic equations to solve problems.
How do you solve a quadratic equation using the quadratic formula? How do you determine the type of number of a solution to a quadratic equation? **3 Days**	☐ Solve a quadratic equation using the quadratic formula. ☐ Use the discriminant to determine the type and number of solutions to a quadratic equation and identify how that corresponds to the graph.	**Vocabulary:** quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ **Concepts:** -Solutions to quadratic equations represent the x-intercept(s) of the function. -The quadratic function can be used to solve every quadratic equation. -Solutions can be real or imaginary.	CC.2.2.HS.D.3 Extend the knowledge of arithmetic operations and apply to polynomials. CC.2.2.HS.D.4 Understand the relationship between zeroes and factors of polynomials to make generalizations about functions and their graphs. CC.2.2.HS.D.8 Apply inverse operations to solve equations or formulas for a given variable.

UNIT 6

Unit Title	Rational Functions
Unit Description	Rational functions are ratios of polynomials. Rational functions can be simplified by factoring the numerator and denominator and then reducing common factors. Factoring is also required in the process used to multiply and divide rational expressions. Products and quotients of rational functions are in simplest form once there are no common factors left in the numerator and denominator and the fraction remaining is not a complex fraction. Adding and subtracting rational functions is similar to adding and subtracting fractions as common denominators are necessary. Students will factor the denominators to find a least common denominator before adding and subtracting. All cases will require students to determine which values are excluded from the domain and range. Rational equations will be solved using methods employed in previous units to solve linear and quadratic equations. Graphs will be sketched using transformations to the rational function and the functions asymptotes.
Unit Assessment	Common Unit Assessment

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
How are properties of exponents used in simplifying rational expressions? **2 Days**	☐ Apply properties of exponents when simplifying rational expressions. ☐ Simplify rational expressions.	**Vocabulary:** rational expression, properties of exponents **Concepts:** -Rational expressions can be simplified using properties of exponents and arithmetic operations.	CC.2.2.HS.D.3 Extend the knowledge of arithmetic operations and apply to polynomials. CC.2.2.HS.D.6 Extend the knowledge of rational function to rewrite in equivalent forms. CC.2.2.HS.F.1 Apply and extend the properties of exponents to solve problems with rational exponents.

How is factoring used in simplifying rational expressions? **2 Days**	☐ Apply factoring to simplifying rational expressions.	**Vocabulary:** greatest common factor (GCF), sum (or difference) of cubes, quadratic form, factor by grouping **Concepts:** -Rational expressions can be simplified using factoring. -Rational expressions are fully simplified once there are no remaining common factors in the numerator and denominator and there are no complex fractions.	CC.2.2.HS.D.6 Extend the knowledge of rational function to rewrite in equivalent forms.
How do you multiply and divide rational expressions? **2 Days**	☐ Multiply rational expressions and simplify the final result. ☐ Divide rational expressions and simplify the final result.	**Vocabulary:** reciprocal **Concepts:** -Dividing rational expressions is a similar process to multiplying rational expressions. -To divide rational expressions, multiply by the reciprocal of the rational expression in the denominator.	CC.2.2.HS.D.6 Extend the knowledge of rational function to rewrite in equivalent forms.
How do you add and subtract rational expressions? **2 Days**	☐ Add rational expressions and simplify the final result. ☐ Subtract rational expressions and simplify the final result.	**Vocabulary:** least common multiple (LCM), least common denominator (LCD) **Concepts:** -Common denominators are needed to add and subtract rational expressions.	CC.2.2.HS.D.6 Extend the knowledge of rational function to rewrite in equivalent forms.

How do you solve rational equations? Why do rational equations sometimes have extraneous solutions? **3 Days**	☐ Solve rational equations. ☐ Explain why rational equations can have extraneous solutions.	**Vocabulary:** rational equation, proportion, extraneous solution **Concepts:** Extraneous solutions occur at points of discontinuity.	CC.2.2.HS.D.8 Apply inverse operations to solve equations or formulas for a given variable.
How do you use transformations to sketch the graph of a rational function? **3 Days**	☐ Use transformations to sketch the graph of a rational function. ☐ Identify asymptotes given a rational function.	**Vocabulary:** parent graph, hyperbola, restricted domain, vertical asymptote, horizontal asymptote, hole **Concepts:** -Horizontal and vertical translations, reflections and dilations to the parent graph, can be used to write rational functions from the graph.	CC.2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships.
How do you write the equation of a rational function given its graph? **3 Days**	☐ Write the equation of a rational function from its graph. ☐ Use characteristics of a graph to write the equation of a rational function.	**Vocabulary:** parent graph, hyperbola, restricted domain, vertical asymptote, horizontal asymptote, hole **Concepts:** -Transformations to the parent graph can be used to write rational functions from the graph.	CC.2.2.HS.D.1 Interpret the structure of expression to represent a quantity in terms of its context.

UNIT 7

Unit Title	Radical Functions
Unit Description	Radical functions use the radical symbol ($\sqrt{\ }$) to indicate the taking of a root of a number. When there is no index number specified, it is assumed to be a square root. Adding and subtracting radical expressions are similar to adding and subtracting like terms in that each term, to be combined, must contain a like-radical. Radicals might need to be simplified before being able to be combined. Proper notation requires radicals to be rationalized out of the denominators of fractions. Students will learn to multiply radicals to be able to rationalize denominators. Sometimes it is easier to work with radical expressions when they are written using rational exponent notation. Students will be able to convert between notations to suit the needs of the various problem situations. Transformations and their impact on graph shape will be introduced to students as compared to transformations previously covered.
Unit Assessment	Common Unit Assessment

Essential Question	**Learning Goals**	**Content and Vocabulary**	**Standards**
How are the parent graphs of radical functions related to each other and to the parent graphs of other functions? How are transformations used in graphing a radical function and what impact do they have on its characteristics? **3 Days**	☐ Describe how the graph of a radical function compares to graphs of other functions. ☐ Construct graphs of radical functions using transformations and identify the domain and range of the radical function. ☐ Describe how the graph of a radical function is changed due to transformations.	**Vocabulary:** radical function, end point, domain, range, vertical and horizontal transformations, dilation, reflection over the x and y-axis. **Concepts:** -Recognize the shape of the radical function parent graph. -Identify which transformation has occurred given a graph or equation of a radical function.	CC.2.2.HS.C.4 Interpret the effects transformations have on functions. CC.2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships.

How do you write the equation of a radical function given its graph or description of its characteristics? **3 Days**	☐ Write the equation of a radical function given its graph. ☐ Write the equation of a radical function given a description of its characteristics. ☐ Apply transformations to the parent graph of a radical function.	**Vocabulary:** radical function, transformation	CC.2.2.HS.C.4 Interpret the effects transformations have on functions. CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems.
How do you rewrite expressions using rational exponent notation and radical notation? **2 Days**	☐ Rewrite expressions using rational exponent notation. ☐ Rewrite expressions using radical notation. ☐ Understand there are different representations of radical functions and be able to recognize when to use radical notation or rational exponent notation.	**Vocabulary:** radical, radicand, base, index, rational exponent **Concepts:** -Radical form and rational exponent form are equivalent forms.	CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems.
How do you rationalize the denominator of a radical expression? How do you simplify radical expressions? **3 Days**	☐ Rationalize the denominator of a radical expression. ☐ Simplify radical expressions.	**Vocabulary:** rationalize, conjugate **Concepts:** -Denominators are rationalized once all radicals are simplified out of the denominator. -Radicals are simplified once there are no shared common factors in the numerator and denominator.	CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems. CC.2.2.HS.F.1 Apply and extend the properties of exponents to solve problems with rational exponents.

How do you add, subtract, multiply, and divide radical expressions? **3 Days**	☐ Add and subtract radical expressions. ☐ Multiply and divide radical expressions.	**Vocabulary:** like radicals **Concepts:** -Before radicals can be added or subtracted they must be like radicals.	CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems. CC.2.2.HS.F.1 Apply and extend the properties of exponents to solve problems with rational exponents.
How do you solve radical equations? Why do radical equations sometimes have extraneous solutions? **2 Days**	☐ Solve radical equations using exponents to isolate variables. ☐ Describe when radical equations have extraneous solutions.	**Vocabulary:** extraneous solution **Concepts:** -Extraneous solutions occur when solutions create undefined situations. -Use exponents to isolate variables.	CC.2.2.HS.D.8 Apply inverse operations to solve equations or formulas for a given variable. CC.2.2.HS.D.9 Use reasoning to solve equations and justify the solution method.

ACCOMMODATIONS AND MODIFICATIONS

Adaptations or modifications to this planned course will allow exceptional students to earn credits toward graduation or develop skills necessary to make a transition from the school environment to community life and employment. The I.E.P. team has determined that modifications to this planned course will meet the student's I.E.P. needs.

Adaptations/Modifications may include but are not limited to:

INSTRUCTION CONTENT

- Modification of instructional content and/or instructional approaches
- Modification or deletion of some of the essential elements

SETTING

- Preferential seating

METHODS

- Additional clarification of content
- Occasional need for one to one instruction
- Minor adjustments or pacing according to the student's rate of mastery
- Written work is difficult, use verbal/oral approaches
- Modifications of assignments/testing
- Reasonable extensions of time for task/project completion
- Assignment sheet/notebook
- Modified/adjusted mastery rates
- Modified/adjusted grading criteria
- Retesting opportunities

MATERIALS

- Supplemental texts and materials
- Large print materials for visually impaired students
- Outlines and/or study sheets
- Manipulative learning materials
- Calculator