Algebra 2/Honors Algebra 2 Curriculum

Board Approved: March 21, 2024

Course Information

Course Description:	Transfer Goals:
This course is designed for students who wish to continue their study of mathematics beyond Geometry. Algebra 2 is essential for students planning to attend college and should better prepare students for the ACT. This course fosters students' mathematical proficiency by encouraging problem-solving, reasoning, and communication skills, as well as promoting mathematical connections and applications to real-world situations. This course develops an understanding of algebraic concepts including but not limited to: linear, quadratic, polynomial, rational, radical, exponential and logarithmic functions as well as the study of data and statistics.	• Problem-solving skills: Learn to understand and solve problems effectively. • Logical and numerical thinking: Apply reasoning and math skills to solve different situations. • Constructing arguments and critiquing: Build strong arguments and evaluate others' reasoning. • Using math in real-life situations: Apply mathematical concepts to solve practical problems. • Strategic thinking and attention to detail: Use the right tools and techniques with precision to solve problems efficiently.

Curriculum Standards: [Algebra 2 Missouri Learning Standards]

Curriculum Resource(s): *Reveal Algebra 2 © 2020 - McGraw Hill*

Unit 1: Number and Quantity

Timeframe: ***see current scope and sequence***

<table>
<tr><td colspan="2">Unit Description: Extend and use the relationship between rational exponents and radicals. Use complex numbers.</td></tr>
<tr><td>Enduring Understandings:
Complex numbers follow the arithmetic rules as real numbers.
Conversion between radical form and rational exponent form yields equivalent representations.
Complex solutions are solutions of equations that are not x-intercepts
The Fundamental Theorem of Algebra states that the degree of a polynomial determines the number of solutions to that polynomial.</td><td>Essential Questions:
In what types of situations would you get a complex number?
Why do complex solutions always occur in pairs?
Why do polynomials with complex solutions not contain a complex component in the original equation?
How would you express a real number as a complex number?
What are different ways in which you can write an equivalent version of a given expression involving rational exponents?
How does the Fundamental Theorem of Algebra relate to the x-intercepts of a polynomial?</td></tr>
</table>

Unit 1 Standards

STANDARD CODE	STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:
A2.NQ.A.1	• I can apply exponent rules to expressions involving rational exponents. • I can simplify expressions with numbers and variables as the base using rational exponents, including those with whole numbers as the numerator other than one.
A2.NQ.A.2	• I can convert between radical form and rational exponent form. • I can understand that radicals and rational exponents represent the same mathematical concept. • I can simplify expressions involving radicals and rational exponents.
A2.NQ.A.3	• I can perform operations with radical expressions, including simplifying before combining terms. • I can use conjugates to simplify rational expressions that have radicals in the denominator.
A2.NQ.A.4	• I can solve equations involving rational exponents.

Priority standards indicated in **bold*

	• I can solve equations involving radical expressions. • I can identify extraneous solutions.
A2.NQ.B.5	• I can write any number in the form $a + bi$. • I can identify a and b in $a + bi$ as real numbers. • I can understand that i is defined as $\sqrt{-1}$.
A2.NQ.B.6	• I can add and subtract complex numbers with answers given in $a + bi$ form. • I can multiply complex numbers with answers given in $a + bi$ form. • I can divide complex numbers with answers given in $a + bi$ form, using conjugates to rationalize the denominator.
A2.NQ.B.7	• **I can recognize that the degree of a polynomial determines the number of solutions.** • **I can determine that complex solutions occur in pairs.** • **I can determine that multiplicity relates to repeated factors.**

Unit 2: Seeing Structure in Expressions

Timeframe: ***see current scope and sequence***

<table>
<tr><td colspan="2">Unit Description: Define and use logarithms.</td></tr>
<tr><td>Enduring Understandings:
Logarithmic scales are exponential in nature, meaning that each increase of 1 on a base 10 scale represents a value that is 10 times larger than the previous value.
There is an inverse relationship between exponents and logarithms.
Logarithm properties are derived from exponent rules.
Logarithms have practical applications in solving real-world problems related to the pH scale, Richter scale, sound intensity, light intensity, musical scale, and other scenarios involving logarithmic scales for comparing quantities.</td><td>Essential Questions:
What real world applications involve logarithms?
How does changing the base of the logarithm change the value?
How do graphs of logarithmic and exponential functions relate?
How are logarithm properties derived from exponent rules, and what role do they play in simplifying and solving equations?</td></tr>
</table>

<table>
<tr><th colspan="2">Unit 2 Standards</th></tr>
<tr><th>STANDARD CODE</th><th>STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:</th></tr>
<tr><td>A2.SSE.A.1</td><td>I can understand the inverse relationship between exponents and logarithms.
I can convert equations between exponential and logarithmic form.</td></tr>
<tr><td>A2.SSE.A.2</td><td>I can use the inverse relationship between exponents and logarithms to solve simple exponential equations.
I can use the inverse relationship between exponents and logarithms to solve simple logarithmic equations.</td></tr>
<tr><td>A2.SSE.A.3</td><td>I can expand expressions using properties of logarithms.
I can simplify expressions using properties of logarithms.
I can solve equations using properties of logarithms.</td></tr>
<tr><td>A2.SSE.A.4</td><td>I can apply logarithms to solve problems to real world solutions (e.g. pH scale, Richter scale, sound intensity, light intensity, and the musical scale).
I can demonstrate an understanding of how logarithmic scales are used to compare quantities.</td></tr>
</table>

*Priority standards indicated in **bold***

BOE Approved: 3/21/2024

Unit 3: Reasoning with Equations and Inequalities

Timeframe: ***see current scope and sequence***

Unit Description: Solve equations and inequalities. Solve general systems of equations and inequalities.

Enduring Understandings:	**Essential Questions:**
● Inequalities can have an infinite number of solutions. ● Solutions to equations are all points that lie on the graph of the equation. ● Equations can be written to model real-world situations and solve problems ● Solutions to systems of equations and/or inequalities are points that make all equations and/or inequalities true. ● Answers found algebraically may not be solutions.	● What does it mean to be a solution to a system of equations? ● What does it look like if your solution to a system is not a point? ● When would it be possible to get an extraneous solution? ● What are the potential solution sets for an inequality? ● How is solving this type of equation similar to previously learned techniques?

Unit 3 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
A2.REI.A.1	● **I can write equations to model situations from tables.** ○ including linear, quadratic, cubic, exponential, step, and absolute value ● **I can write equations to model situations from graphs.** ○ including linear, quadratic, cubic, exponential, step, and absolute value ● **I can write equations to model situations from verbal descriptions.** ○ including linear, quadratic, cubic, exponential, step, and absolute value ● **I can solve equations.** ○ including linear, quadratic, cubic, exponential, and absolute value ● **I can write inequalities to model real-world situations.** ● **I can solve inequalities.** ○ including linear, quadratic, cubic, exponential, and absolute value.
A2.REI.A.2	● I can solve a rational equation, including when the numerator and denominator are polynomials. ● I can check my solutions to see if they are extraneous.
A2.REI.B.3	● **I can write and solve a system of linear equations from a situation.** ● **I can write and solve a system of linear inequalities from a situation.**

Priority standards indicated in **bold*

	• **I can solve a system of equations with three variables.** • **I can solve a system of equations involving non-linear equations *(including quadratic-linear, quadratic-quadratic, and non-linear - non-linear).*** • **I can graph a system of non-linear inequalities and identify a solution.** **** technology can be used at teacher discretion***

Unit 4: Arithmetic with Polynomials and Rationals

Timeframe: ***see current scope and sequence***

Unit Description: Perform operations on polynomials and rational expressions.	
Enduring Understandings: ● There are key features that are necessary to sketch a polynomial and rational function. ● A variety of methods can be used to factor and solve polynomials with real and complex roots. ● Prime polynomials may be factorable using complex numbers. ● Long division of polynomials relates to division of numbers. ● Synthetic division is not always applicable. ● Polynomial division can be used to simplify polynomials when factoring techniques can not be used.	**Essential Questions:** ● Why is it important to simplify rational expressions? ● How can you tell if a polynomial will have complex roots? ● Given key features, how could you create multiple graphical representations of polynomial and rational functions?

Unit 4 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
A2.APR.A.1	● I can completely factor expressions that have a degree of 2 or higher. ● I can completely factor expressions that require complex coefficients to factor.
A2.APR.A.2	● **I can divide polynomials with long division given a factor.** ● **I can divide polynomials with synthetic division with a given factor.** ● **I can determine that a divisor is not a factor if the remainder is not 0.** ● **I can write the result as a quotient with a remainder.** **** technology can be used at teacher discretion***
A2.APR.A.3	● I can determine the least common multiple for two or more polynomials.
A2.APR.A.4	● I can add and subtract rational expressions, including problems with polynomial numerators and denominators as well as problems with unlike denominators. ● I can multiply and divide rational expressions, including problems with polynomial numerators and denominators.

Priority standards indicated in* ***bold*

	• I can simplify my answers so that the numerator and denominator have no common factors.
A2.APR.A.5	• I can factor polynomials and use the zero-product property to identify the zeros. • I can use the zeros and other key characteristics to sketch the function.

Unit 5: Interpreting Functions

Timeframe: *see current scope and sequence*

<table>
<tr><td colspan="2">Unit Description: Use and interpret functions.</td></tr>
<tr><td>Enduring Understandings:
Similar key features can be located on graphs, tables, and equations.
Functions can be represented in a table, graph or equation.
Different forms of an equation all represent the same graph.
Some key features are not present in all function types.</td><td>Essential Questions:
Why are some key features present in certain types of functions, but not others?
What real-world situations are modeled by these functions?
How can you provide examples where similar key features can be identified across graphs, tables, and equations?
How can the ability to recognize key features in different representations enhance our understanding and analysis of mathematical concepts?
What are different uses for various forms of equations?</td></tr>
</table>

<table>
<tr><td colspan="2">Unit 5 Standards</td></tr>
<tr><td>STANDARD CODE</td><td>STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:</td></tr>
<tr><td>A2.IF.A.1</td><td><u>Polynomial Functions:</u>
I can identify the following key features from graphs:
Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, intervals of increasing and decreasing.
I can identify the following key features from tables:
Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, and intervals of increasing and decreasing.
I can identify the following key features from equations:
Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, intervals of increasing and decreasing.
<u>Square Root Functions:</u>
I can identify the following key features from graphs:
Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, and intervals of increasing and decreasing.</td></tr>
</table>

	I can identify the following key features from tables: - Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, and intervals of increasing and decreasing. **I can identify the following key features from equations:** - Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, and intervals of increasing and decreasing. **<u>Cube Root Functions:</u>** **I can identify the following key features from graphs:** - Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, points of discontinuity, intervals of increasing and decreasing. **I can identify the following key features from tables:** - Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, points of discontinuity, intervals of increasing and decreasing, horizontal asymptotes, vertical asymptotes. **I can identify the following key features from equations:** - Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, points of discontinuity, intervals of increasing and decreasing, horizontal asymptotes, vertical asymptotes. **<u>Absolute Value of Linear Functions:</u>** **I can identify the following key features from graphs:** - Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, intervals of increasing and decreasing. **I can identify the following key features from tables:** - Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, and intervals of increasing and decreasing. **I can identify the following key features from equations:** - Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, intervals of increasing and decreasing. **<u>Simple Piece-wise defined:</u>** **I can identify the following key features from graphs:** - Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, points of discontinuity, intervals of increasing and decreasing, horizontal asymptotes, vertical asymptotes. **I can identify the following key features from tables:** - Domain, range, end behavior, x-intercepts, y-intercepts, local

	minimum values, local maximum values, symmetries, points of discontinuity, intervals of increasing and decreasing, horizontal asymptotes, vertical asymptotes. ● **I can identify the following key features from equations:** ○ Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, points of discontinuity, intervals of increasing and decreasing, horizontal asymptotes, vertical asymptotes. **<u>Step Functions:</u>** ● **I can identify the following key features from graphs:** ○ Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, points of discontinuity, intervals of increasing and decreasing. ● **I can identify the following key features from tables:** ○ Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, points of discontinuity, intervals of increasing and decreasing. ● **I can identify the following key features from equations:** ○ Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, points of discontinuity, intervals of increasing and decreasing. **<u>Exponential Functions:</u>** ● **I can identify the following key features from graphs:** ○ Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, points, intervals of increasing and decreasing, horizontal asymptotes. ● **I can identify the following key features from tables:** ○ Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, points, intervals of increasing and decreasing, horizontal asymptotes. ● **I can identify the following key features from equations:** ○ Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, points, intervals of increasing and decreasing, horizontal asymptotes. **<u>Logarithmic Functions:</u>** ● **I can identify the following key features from graphs:** ○ Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, intervals of increasing and decreasing. ● **I can identify the following key features from tables:** ○ Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, and intervals of increasing and decreasing. ● **I can identify the following key features from equations:**

	○ Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, and intervals of increasing and decreasing. **<u>Rational Functions:</u>** ● **I can identify the following key features from graphs:** ○ Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, points of discontinuity, intervals of increasing and decreasing, horizontal asymptotes (no oblique), vertical asymptotes. ● **I can identify the following key features from tables:** ○ Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, points of discontinuity, intervals of increasing and decreasing, horizontal asymptotes (no oblique), vertical asymptotes. ● **I can identify the following key features from equations:** ○ Domain, range, end behavior, x-intercepts, y-intercepts, local minimum values, local maximum values, symmetries, points of discontinuity, intervals of increasing and decreasing, horizontal asymptotes (no oblique), vertical asymptotes. ● **I can represent any function with a table, equation or graph.** ● **I can determine specific values of a function from a table, graph, or equation.** **** technology can be used at teacher discretion***
A2.IF.A.2	● I can translate between equivalent forms of functions. ● I can highlight key characteristics from various forms of a function.

Unit 6: Building Functions

Timeframe: *see current scope and sequence*

Unit Description: Create new functions from existing functions.	
Enduring Understandings: ● Operations with functions can change the domain and range. ● Operations with functions can create new functions. ● Inverse functions undo each other. ● Transformations on functions are similar for various functions.	**Essential Questions:** ● What properties or characteristics of functions and inverses allow them to undo each other? ● What properties or characteristics of the original functions are retained or modified when creating new functions? ● In what ways can operations with functions be used to model real-world situations or solve mathematical problems? ● What kind of limitations should be considered while performing operations with functions to create new functions? ● Can you provide examples where similar transformations are applied to different functions?

Unit 6 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
A2.BF.A.1	● **I can add functions to create new functions.** ○ I can determine the domain and range of the new functions. ● **I can subtract functions to create new functions.** ○ I can determine the domain and range of the new functions. ● **I can multiply functions to create new functions.** ○ I can determine the domain and range of the new functions. ● **I can divide functions to create new functions.** ○ I can determine the domain and range of the new functions. ● **I can compose functions.** ○ I can determine the domain and range of the new functions. **** technology can be used at teacher discretion***
A2.BF.A.2	● I can derive inverses of given functions. ● I can compose functions to determine if they are inverses. ● I can use the inverse function and the original function to show that they undo each other and are indeed inverses.

Priority standards indicated in **bold*

[A2.BF.A.3]()	<u>**Linear**</u> ● **I can describe the transformations algebraically using a, h, and k.** ● **I can describe the transformations graphically using the terms:** ○ Horizontal or vertical stretch (expansion) or shrink (compression), reflection, horizontal and vertical translation, and dilation. ● **I can create new equations from parent functions for specific transformations.** ● **I can graph new equations from parent functions for specific transformations.** <u>**Quadratic**</u> ● **I can describe the transformations algebraically using a, h, and k.** ● **I can describe the transformations graphically using the terms:** ○ Horizontal or vertical stretch (expansion) or shrink (compression), reflection, horizontal and vertical translation, and dilation. ● **I can create new equations from parent functions for specific transformations.** ● **I can graph new equations from parent functions for specific transformations.** <u>**Cubic**</u> ● **I can describe the transformations algebraically using a, h, and k.** ● **I can describe the transformations graphically using the terms:** ○ Horizontal or vertical stretch (expansion) or shrink (compression), reflection, horizontal and vertical translation, and dilation. ● **I can create new equations from parent functions for specific transformations.** ● **I can graph new equations from parent functions for specific transformations.** <u>**Square/Cube Root**</u> ● **I can describe the transformations algebraically using a, h, and k.** ● **I can describe the transformations graphically using the terms:** ○ Horizontal or vertical stretch (expansion) or shrink (compression), reflection, horizontal and vertical translation, and dilation. ● **I can create new equations from parent functions for specific transformations.** ● **I can graph new equations from parent functions for specific transformations.** <u>**Absolute Value**</u> ● **I can describe the transformations algebraically using a, h, and k.** ● **I can describe the transformations graphically using the terms:** ○ Horizontal or vertical stretch (expansion) or shrink (compression), reflection, horizontal and vertical translation, and dilation. ● **I can create new equations from parent functions for specific transformations.**

	I can graph new equations from parent functions for specific transformations. **<u>Exponential</u>** **I can describe the transformations algebraically using a, h, and k.** **I can describe the transformations graphically using the terms:** - Horizontal or vertical stretch (expansion) or shrink (compression), reflection, horizontal and vertical translation, and dilation. **I can create new equations from parent functions for specific transformations.** **I can graph new equations from parent functions for specific transformations.** **<u>Logarithmic</u>** **I can describe the transformations algebraically using a, h, and k.** **I can describe the transformations graphically using the terms:** - Horizontal or vertical stretch (expansion) or shrink (compression), reflection, horizontal and vertical translation, and dilation. **I can create new equations from parent functions for specific transformations.** **I can graph new equations from parent functions for specific transformations.**

Unit 7: Function Modeling

Timeframe: ***see current scope and sequence***

Unit Description: Use functions to model real-world problems.	
Enduring Understandings: ● Equations are effective tools to model real-world problems. ● Algebraic and graphical methods are used to solve quadratic and exponential equations and find solutions.	**Essential Questions:** ● What are the benefits of solving a quadratic or exponential equation graphically and algebraically? ● How can you name more than one way to solve a quadratic or exponential equation graphically?

Unit 7 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
A2.FM.A.1	● **I can create quadratic equations to model problems.** ● **I can analyze modeled problems that are quadratic.** ● **I can solve quadratic equations algebraically and graphically.** ● **I can create exponential equations to model problems.** ● **I can analyze modeled problems that are exponential.** ● **I can solve exponential equations algebraically and graphically.** ***e.g. Price-demand-cost-revenue: profit situations, compound interest problems, and exponential growth or decay.***

Unit 8: Data and Statistical Analysis

Timeframe: ***see current scope and sequence***

<table>
<tr><td colspan="2">Unit Description: Make inferences and justify conclusions. Fit a data set to a normal distribution.</td></tr>
<tr><td>Enduring Understandings:
A confidence interval is using a sample to make inferences about a population.
The normal distribution is a continuous, symmetric, bell-shaped distribution of a random variable.
A confidence interval is an estimate of a parameter stated as a range with a specific degree of certainty.
A probability may or may not be statistically significant.
Randomization is critical for ensuring accuracy in surveys, experiments, and observational studies.</td>
<td>Essential Questions:
What is the importance of random sampling?
What factors affect the width and precision of a confidence interval?
What are some real-world examples or applications where the normal distribution is commonly observed?
How does the normal distribution differ from other types of distributions?
What makes a probability statistically significant?
Can you provide examples of how randomization has been utilized in real-life studies or experiments?</td></tr>
</table>

<table>
<tr><th colspan="2">Unit 8 Standards</th></tr>
<tr><th>STANDARD CODE</th><th>STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:</th></tr>
<tr><td>A2.DS.A.1</td><td>I can understand random sampling.
I can explain how a random sample can be used to make an inference about a population.
I can analyze situations to determine if random sampling was used.</td></tr>
<tr><td>A2.DS.A.2</td><td>I can identify a correct model for a given data set - uniform, normal, skewed
I can distinguish the difference between theoretical and experimental probabilities.
I can determine if the results are statistically significant.</td></tr>
<tr><td>A2.DS.A.3</td><td>I can explain the importance of random sampling in surveys.
I can explain the importance of randomizing treatments in experiments.
I can explain the importance of randomization in observational studies.
I can explain how randomization looks different in surveys, experiments, and observational studies.</td></tr>
<tr><td>A2.DS.A.4</td><td>I can use data from a sample to estimate the population characteristics, such as a population mean or proportion.</td></tr>
</table>

Priority standards indicated in* ***bold*

	• **I can use a margin of error to determine if a population characteristic is likely to fall within a specified range.** ***Data samples should be limited to 10 and decimal values should be no more than three places.***
A2.DS.A.5	• I can explain that larger sample sizes lead to a smaller margin of error. • I can explain that larger populations require larger sample sizes to decrease the margin of error. • I can describe the appropriate size of the margin of error based on various situations.
A2.DS.A.6	• I can analyze decisions using probability concepts. • I can analyze strategies using probability concepts.
A2.DS.A.7	• I can evaluate statistical reports to determine statistical issues such as bias, validity of resources, reasonable reporting of statistical analysis, and accurate graphical representations.
A2.DS.B.8	• **I can use the 68-95-99.7% rule to determine the percentages of data above or below the mean for given standard deviations.** • **I can label a normal curve with a given mean and standard deviation along the horizontal axis.** • **I can label a normal curve using the 68-95-99.7% rule.** ***Standard deviations should be restricted to integer values from negative three to three.***
A2.DS.B.9	• I can determine from a data set if it is approximately normal using the 68-95-99.7% rule.