Algebra 2/Honors Algebra 2 Curriculum

Board Approved: March 21, 2024

Course Information

Course Description:
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.

Transfer Goals:

- 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***

Unit Description: Extend and use the relationship between rational exponents and radicals. Use complex numbers.	
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.	**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?

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.

	• 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***

Unit Description: Define and use logarithms.	
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.	**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?

Unit 2 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
A2.SSE.A.1	• I can understand the inverse relationship between exponents and logarithms. • I can convert equations between exponential and logarithmic form.
A2.SSE.A.2	• 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.
A2.SSE.A.3	• I can expand expressions using properties of logarithms. • I can simplify expressions using properties of logarithms. • I can solve equations using properties of logarithms.
A2.SSE.A.4	• **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.**

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: • 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.	**Essential Questions:** • 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.

	• 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***

Unit Description: Use and interpret functions.	
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.	**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?

Unit 5 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
A2.IF.A.1	**Polynomial Functions:** ● **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. **Square Root Functions:** ● **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.

- **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.

Cube Root Functions:

- **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.

Absolute Value of Linear Functions:

- **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.

Simple Piece-wise defined:

- **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. **Step Functions:** ● **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. **Exponential Functions:** ● **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. **Logarithmic Functions:** ● **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. **Rational Functions:** ● **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.

A2.BF.A.3	**Linear** ● **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.** **Quadratic** ● **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.** **Cubic** ● **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.** **Square/Cube Root** ● **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.** **Absolute Value** ● **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***

Unit Description: Make inferences and justify conclusions. Fit a data set to a normal distribution.	
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.	**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?

Unit 8 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
A2.DS.A.1	• 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.
A2.DS.A.2	• **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.**
A2.DS.A.3	• 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.
A2.DS.A.4	• **I can use data from a sample to estimate the population characteristics, such as a population mean or proportion.**

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.