College Algebra CURRICULUM

Board Approved: 3/20/2025

Course Information

High School
Full-year course

Course Description:
This is a year-long college-level course that will develop the student's understanding of various mathematical concepts, improve students' problem-solving skills, and enhance their ability to reason logically. Topics include linear, quadratic, and rational equations and inequalities, the algebra of functions (including polynomial, rational, exponential, and logarithmic functions), the graphs of some of these functions, and systems of equations. College credit may be available.

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: Missouri Core 42 - Precalculus Algebra

Curriculum Resource(s): College Algebra, 11e, Cengage/NGL, 2022, 9780357645796

Unit 1: Foundation of Functions

Timeframe: See current scope and sequence

Unit Description: In this unit, students will explore different types of functions and use various representations—such as graphs, tables, equations, and verbal descriptions—to investigate and analyze relationships between quantities. Students will learn how to identify and interpret the key features of functions, including linear, quadratic, exponential, and others, and understand how these features relate to real-world scenarios. By using multiple representations, students will gain a deeper understanding of how functions model relationships between varying quantities and will be able to describe and predict behavior across different contexts.

Enduring Understandings:

- Different functions can be represented in various forms, such as graphs, equations, and tables.
- Understand how quantities are related through functions to be able to describe and predict solutions to real-world problems.
- Using different types of functions allows us to model complex situations and understand how changes in one quantity affect another, allowing us to make informed decisions and predictions.
- Different families of functions have unique patterns.
- Identify key characteristics of functions from multiple representations.

Essential Questions:

- How do different representations of a function (e.g., graph, equation, table) reveal different aspects of the relationship between quantities?
- In what ways can changing the parameters of a function's equation alter its graph and the relationships it describes?
- How can you use a graph, equation, or table to solve real-world problems and make predictions about quantities?
- What insights can be gained from comparing multiple types of functions and their different representations?
- How do the different representations of a function help in understanding the behavior of quantities over time or under varying conditions?
- How can visualizing a function in multiple forms enhance your ability to interpret and communicate complex relationships between quantities?

Unit 1 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
MOTR Math 130 I.A.1	• I can identify what function notation, *f(x)*, means. • I can use function notation to write equations for real-world problems. • I can identify the input and output from function notation.
MOTR Math	• **I can identify different types of functions, like linear, quadratic,**

priority standards indicated in **bold*

130-I.A.2	**exponential, logarithmic, rational, radical, polynomial, piecewise, and absolute value, by looking at their graphs or equations.**
MOTR Math 130 I.A.3	● I can find the domain (possible inputs) of a function from a graph, equation, or a table. ● I can find the range (possible outputs) of a function from a graph, equation, or a table. ● I can explain what domain and range mean and why they are important. ● I can recognize restrictions on the domain and range based on given problems or scenarios.
MOTR Math 130 I.A.4	● I can look at a graph and find the highest points (local maximums) and lowest points (local minimums) on a given interval, of a function. ● I can determine if a function has no local maximums or minimums by observing if it only increases or decreases.
MOTR Math 130 I.A.5	● I can tell if a graph has symmetry. ● I can tell if a graph has rotational symmetry in terms of its origin. ● I can determine if a function is even (symmetric across the y-axis) or odd (symmetric about the origin) by checking its graph or equation. ● I can determine if a function f(x) is even by the condition $f(-x)=f(x)$ for all values of x in the function's domain. ● I can determine if a function f(x) is odd by the condition $f(-x)=-f(x)$ for all values of x in the function's domain.
MOTR Math 130 I.B.1	● I can identify and describe the intervals (sections of the domain) on a graph where the function is increasing. ● I can identify and describe the intervals (sections of the domain) on a graph where the function is decreasing. ● I can identify and describe the intervals (sections of the domain) on a graph where the function is constant.
MOTR Math 130 I.B.2	● I can recognize when the graph or table of a function shows a constant rate of change. ● I can identify the constant rate of change in the function's equation. ● I can identify the constant rate of change from applications of linear functions.
MOTR Math 130 I.B.3	● I can show how much the function's value changes on average over a specified interval. ● I can find the average rate of change by using the function's equation, table or from its graph.
MOTR Math 130 I.B.4	● I can use the difference quotient to understand the rate of change in functions. ● I can simplify expressions in the difference quotient using the order of operations appropriately.

Unit 2: Analysis of Functions

Timeframe: See current scope and sequence

Unit Description: In this unit, students will explore the characteristics of various function types, such as linear, quadratic, and exponential functions. They will learn to identify and describe the key features of these functions, including their behavior, graphs, and algebraic expressions. Students will also practice converting between different representations of functions, including graphs, tables, and equations, to gain a comprehensive understanding of how functions can be used to model real-world situations. Students will be able to analyze and solve meaningful problems by applying their knowledge of functions to interpret and predict relationships between quantities.

Enduring Understandings:

- Converting between different representations of functions (such as graphs, equations, and tables) allows for a more comprehensive analysis of the relationships between variables in solving complex problems.
- Analyzing functions through their various forms provides deeper insights into their properties, such as intercepts, rates of change, and asymptotic behavior, which are crucial for solving meaningful problems.
- Effective problem-solving requires translating real-world scenarios into algebraic forms and interpreting the results through different representations to find solutions and make predictions.
- The ability to switch between different forms and representations of functions demonstrates mathematical flexibility and strengthens problem-solving skills by offering multiple perspectives on a given problem.
- Understanding the unique characteristics of different function families helps in identifying their behavior, trends, and real-world applications.

Essential Questions:

- How do the characteristics of different function families influence the way they model real-world situations?
- What are the key differences and similarities between various representations of functions (graphs, equations, tables), and how do these representations help in understanding the function's behavior?
- How can converting between different forms of a function (algebraic, graphical, tabular) enhance your ability to analyze and solve complex problems?
- In what ways can analyzing the algebraic form of a function provide insights that are not immediately apparent from its graphical representation?
- What strategies can be used to choose the most effective representation for a given problem or situation?

Unit 2 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**

priority standards indicated in **bold*

MOTR Math 130 II.A.1	• I can find important values such as slope and intercepts of a function from different forms, such as equations, graphs, or tables.
MOTR Math 130 II.A.2	• I can write equations of lines given two points, a graph, a slope and a point, or a table. • I can identify parallel and perpendicular lines from equations and graphs. • I can write an equation of a line that is parallel and perpendicular to an existing line. • I can write equations in both slope-intercept and point-slope form.
MOTR Math 130 II.B.1	• I can apply the concept of inverses to exponential and logarithmic functions. • I can solve equations by switching between logarithmic and exponential functions.
MOTR Math 130 II.B.2	• I can graph exponential functions and show how they grow or decay. • I can graph logarithmic functions and explain their shape and behavior. • I can compare the graphs of exponential and logarithmic functions to see how they are related. • I can identify asymptotes for exponential and logarithmic functions.
MOTR Math 130 II.B.3	• I can describe how the growth of linear functions is constant while exponential functions grow/decay by a multiplier.
MOTR Math 130 II.B.4	• I can apply the natural logarithm to find solutions in real-world situations. • I can use *e* in formulas to model and solve practical problems involving growth and decay.
MOTR Math 130 II.B.5	• I can use the concepts of half-life and doubling time to solve problems involving growth and decay models.
MOTR Math 130 II.B.6	• I can explain what happens to exponential models over time. • I can describe how the values in an exponential model get larger or smaller over a long period.
MOTR Math 130 II.C.1	• I can find the roots/zeros of polynomial functions. • I can describe the end behavior of a polynomial function. • I can identify x-intercepts by finding real zeros. • I can graph polynomial functions. • I can graph a polynomial function using key characteristics. • I can explain how roots with different multiplicities appear in an equation and on a graph.
MOTR Math 130 II.C.2	• I can graph rational functions and show their key characteristics. • I can find vertical asymptotes of a rational function. • I can find horizontal asymptotes of a rational function. • I can find oblique asymptotes of a rational function.

MOTR Math 130 II.D.1	● **I can write an equation to shift a graph vertically and horizontally from a parent function.** ● **I can identify the translation from an equation.** ● **I can write an equation to stretch and compress a graph from a parent function.** ● **I can identify the stretch and compression of a graph from an equation.** ● **I can write an equation to reflect a graph over the x-axis from a parent function.** ● **I can identify the reflection from an equation.**
MOTR Math 130 II.D.2	● I can add, subtract, multiply, and divide functions. ● I can combine functions using arithmetic operations and identify their domains.
MOTR Math 130 II.D.3	● I can combine basic functions, using compositions to create new functions. ● I can find the domain of a new function created from composing basic functions.
MOTR Math 130 II.D.4	● I can break down a composite function into its basic functions. ● I can identify the individual functions that make up a composite function. ● I can separate a composite function into simpler functions to understand how it was built. ● I can describe how to find the basic functions used in creating a composite function.
MOTR Math 130 II.D.5	● I can determine if a function is one-to-one. ● I can identify if a function has an inverse. ● I can find the inverse of a function and describe its domain and range.

Unit 3: Algebraic Reasoning

Timeframe: See current scope and sequence

Unit Description: In this unit, students will develop and apply algebraic reasoning skills to write equivalent expressions, solve equations, and solve inequalities. They will learn to manipulate algebraic expressions to find equivalent forms and use these skills to solve linear and quadratic equations. Additionally, students will explore various methods for solving inequalities, including graphing and algebraic techniques.

Enduring Understandings:

- Equivalent expressions represent the same mathematical relationship or value and can be transformed through algebraic operations while maintaining their equivalence.
- Algebraic properties (such as distributive, associative, and commutative properties) are essential tools for rewriting expressions, solving equations, and finding solutions to inequalities.
- Inequalities represent a range of possible solutions rather than a single value.
- Algebraic reasoning involves logical thinking and problem-solving skills to justify steps, make connections between concepts, and apply strategies to write equivalent expressions, solve equations, and solve inequalities.
- Algebraic skills are used to model and solve real-world problems, providing practical solutions and insights.
- Understanding how to translate real-world situations into algebraic expressions and equations is crucial for effective problem-solving.
- Writing equivalent expressions, solving equations, and solving inequalities are interconnected skills.

Essential Questions:

- How does analyzing the intersections of different functions provide a deeper understanding of their relationships and applications?
- How can you determine if two algebraic expressions are equivalent, and what methods can be used to simplify or rewrite expressions to show their equivalence?
- What strategies and algebraic properties (such as distributive, associative, and commutative properties) can be used to manipulate and simplify algebraic expressions and equations?
- What steps are involved in solving an equation, and how can you apply inverse operations to isolate the variable and find its value?
- How do inequalities differ from equations, and what techniques are used to solve inequalities and represent their solutions on a number line or in interval notation?

Unit 3 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
MOTR Math	• I can use properties to simplify expressions with exponents.

130 III.A.1	• I can apply the properties of logarithms to solve problems. • I can expand and condense expressions using exponential and logarithmic properties.
MOTR Math 130 III.A.2	• I can simplify expressions that have rational exponents. • I can convert between rational exponents and radical expressions. • I can factor expressions involving rational exponents.
MOTR Math 130 III.B.1	• I can solve quadratic equations by factoring. • I can use the square root property to find solutions to quadratic equations. • I can complete the square to solve quadratic equations. • I can apply the quadratic formula to solve quadratic equations
MOTR Math 130 III.B.2	• **I can graphically and algebraically solve polynomial equations.** • **I can graphically and algebraically solve radical equations.** • **I can graphically and algebraically solve rational equations.** • **I can graphically and algebraically solve exponential equations.** • **I can graphically and algebraically solve logarithmic equations.**
MOTR Math 130 III.B.3	• I can identify when polynomials have complex solutions. • I can find complex roots of polynomials algebraically.
MOTR Math 130 III.B.4	• I can apply the properties of rational exponents to find solutions to equations.
MOTR Math 130 III.B.5	• I can solve systems of linear equations. • I can solve systems that include non-linear equations. • I can use solutions from systems of equations to solve real-life problems. • I can apply methods to find and use solutions for different types of equation systems. • I can use matrices to solve linear systems of equations.
MOTR Math 130 III.B.6	• I can solve quadratic inequalities. • I can solve absolute value inequalities. • I can solve polynomial inequalities. • I can solve rational inequalities.