



Park Hill School District

Building Successful Futures • Each Student • Every Day

High School College Algebra Curriculum

Course Description: The class consists of Math 120, College Algebra from the Metropolitan Community College for 3 hours college credit. This course is a study of various types of equations and inequalities, functions and their inverses, polynomials, rational functions, systems of equations and inequalities, logarithmic and exponential functions, and matrices.

Scope and Sequence:

Timeframe	Unit	Instructional Topics
10 Blocks	Algebra Fundamentals	Topic 1: Lines Topic 2: Solving Equations and Inequalities
8 Blocks	Function Characteristics	Topic 1: Functions Topic 2: Analyzing and Applying Functions
9 Blocks	Function Graphing and Operations	Topic 1: Graphing Functions Topic 2: Combining Functions Topic 3: Inverse Functions
10 Blocks	Polynomials	Topic 1: Polynomial Graphing Topic 2: Polynomial Solving
8 Blocks	Rationals	Topic 1: Rational Graphing Topic 2: Rational Solving
13 Blocks	Exponentials and Logarithms	Topic 1: Exponential Functions Topic 2: Logarithmic Functions Topic 3: Solve and Apply

10 Blocks	Systems of Equations and Inequalities (Linear and Nonlinear)	Topic 1: Systems of Equations Topic 2: Systems of Inequalities
6 Blocks	Matrices	Topic 1: Matrix Operations Topic 2: Solving Systems with Matrices
+6 Flex Block Days to be used where your students need it		

Curriculum Revision Tracking

Fall, 2022

- Updated course description to align with Metropolitan Community College as a dual credit course for 3 hours of college credit.
- Removed ISTE standards as they are embedded in priority standards and engaging scenario.

Summer, 2023

- Rewrote curriculum to align with Metropolitan Community College Math 120 curriculum.
- Updated course to include learning targets.
- Updated Essential Questions, Enduring Understandings, Vocabulary, Topics, Engaging Experiences, and Engaging Scenarios in each unit.

Unit 1: Algebra Fundamentals

Subject: College Algebra

Grade: 10, 11, 12

Name of Unit: Algebra Fundamentals

Length of Unit: 10 Blocks

Overview of Unit: In this unit, students will graph and write equations of lines, perform operations on complex numbers, solve quadratic equations, solve equations with radicals and rational exponents, and solve absolute value equations and inequalities.

Priority Standards for unit:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.
- A2.NQ.B.6: Add, subtract, multiply, and divide complex numbers.
- A2.REI.A.1: Create and solve equations and inequalities, including those that involve absolute value.
- A2.NQ.A.4: Solve equations involving rational exponents and/or radicals and identify situations where extraneous solutions may result.

Priority Standard: A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will graph lines from slope-intercept form, point-slope form, and standard form.	2
	Applying
The student will write equations of lines in slope-intercept form, point-slope form, and standard form.	2
	Applying

Priority Standard: A2.NQ.B.6: Add, subtract, multiply, and divide complex numbers.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will add, subtract, and multiply complex numbers.	2
	Applying
The student will divide complex numbers, including rationalizing.	2
	Applying

Priority Standard: A2.REI.A.1: Create and solve equations and inequalities, including those that involve absolute value.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will solve quadratic equations by factoring, completing the square, and quadratic formula.	2
	Applying
The student will solve absolute value equations.	2
	Applying
The student will solve absolute value inequalities.	2
	Applying

Priority Standard: A2.NQ.A.4: Solve equations involving rational exponents and/or radicals and identify situations where extraneous solutions may result.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will solve equations with radicals and rational exponents.	2
	Applying

Essential Questions:

1. How do you use interval notation to communicate solutions?
2. How do you solve a variety of equations (quadratic, absolute value, radical and rational exponents)?
3. How do we use given information to write the equation of a line?
4. How do you solve an absolute value inequality?

Enduring Understanding/Big Ideas:

1. Write solutions from the smallest endpoint to the largest endpoint using parentheses or brackets correctly.
2. Use factoring, completing the square, the quadratic formula or graphing for quadratics; use the definition of absolute value to split equations into two parts, checking for extraneous solutions when appropriate; use inverse operations to solve radical and rational exponent equations, checking for extraneous solutions when appropriate.
3. Use point-slope, slope intercept, or standard forms to write linear equations, depending on what is given.
4. Apply the definition of absolute value to split given inequalities into compound inequalities.

Unit Vocabulary:

- Quadratic
- Factoring
- Discriminant
- Inequalities
- Absolute Value
- Intercepts
- Slope
- Parallel
- Perpendicular
- Rate of Change
- Radical
- Rational Exponent
- Zeros / Roots / Solutions
- Complex Numbers
- Rationalize
- Complex Conjugate
- Slope-Intercept, Point-Slope, & Standard Form
- Extraneous

Resources for Vocabulary Development: Textbook

Topic 1: Lines

Engaging Experience 1

Title: Writing Equations of Lines Line-Up

Suggested Length of Time: 15-20 minutes

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.

Detailed Description/Instructions: Students will be given a card that has given information about their line. This might be a point and a slope, two points, or information about a parallel/perpendicular line. Students will find the equation of their line, written in slope-intercept form. Afterwards, they will line up from smallest y-intercept to largest y-intercept. Count the number of mistakes (if any) and have students complete the problem of the person standing next to them to check for accuracy.

Bloom's Levels: Analyze

Webb's DOK: 3

Topic 2: Solving Equations and Inequalities

Engaging Experience 1

Title: Guided Practice

Suggested Length of Time: 30 minutes

Standards Addressed

Priority:

- A2.NQ.B.6: Add, subtract, multiply, and divide complex numbers.
- A2.REI.A.1: Create and solve equations and inequalities, including those that involve absolute value.
- A2.NQ.A.4: Solve equations involving rational exponents and/or radicals and identify situations where extraneous solutions may result.

Detailed Description/Instructions: Students will be paired up. Each student will get a whiteboard. The teacher will give an equation to solve, in one variable. Each student will solve the equation, compare answers, check their solutions, find mistakes, etc. This process will continue on with a variety of types of equations (linear, quadratic, absolute value, rational, radical, etc.).

Bloom's Levels: Create, Apply

Webb's DOK: 3, 2

Engaging Scenario

Engaging Scenario (An Engaging Scenario is a culminating activity that includes the following components: situation, challenge, specific roles, audience, product or performance.)

Speed Dating: Students will be divided into two groups, an inner and outer circle. The inner circle students will have a variety of equations/inequalities that were covered within the unit. Students in the outer circle will find a problem and solve it. They will present it to the inner circle student when complete. The inner circle student will critique their answer and help guide them to the correct solution. After enough time, the outer circle will shift right and repeat the process. Once the outer circle has been to all inner circle problems, the students switch roles of inner and outer circles and repeat the process once more.

Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Lines	Writing Equations of Lines Line-Up	Students will be given a card that has given information about their line. This might be a point and a slope, two points, or information about a parallel/perpendicular line. Students will find the equation of their line, written in slope-intercept form. Afterwards, they will line up from smallest y-intercept to largest y-intercept. Count the number of mistakes (if any) and have students complete the problem of the person standing next to them to check for accuracy.	15-20 minutes
Solving Equations and Inequalities	Guided Practice	Students will be paired up. Each student will get a whiteboard. The teacher will give an equation to solve, in one variable. Each student will solve the equation, compare answers, check their solutions, find mistakes, etc. This process will continue on with a variety of types of equations (linear, quadratic, absolute value, rational, radical, etc.).	30 minutes

Unit 2: Function Characteristics

Subject: College Algebra

Grade: 10, 11, 12

Name of Unit: Function Characteristics

Length of Unit: 8 Blocks

Overview of Unit: Students will graph a variety of functions (parent, piecewise) using tables, then stating domain and range. Students will use function notation to evaluate functions, including piecewise functions. Students will analyze key features of functions and their graphs (increasing/decreasing, max/min, average rate of change). Students will apply their understanding of functions to word problems.

Priority Standards for unit:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.
- A2.FM.A.1: Use functions to model real-world problems.

Priority Standard: A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will identify functions using the vertical line test.	1
	Understanding
The student will represent functions using function notation.	1
	Understanding
The student will identify the following key characteristics of functions from graphs, tables and equations: domain, range, maxima and minima values, intervals of increasing and decreasing, and average rate of change.	2
	Applying
The student will graph parent functions, including linear, quadratic, cubic, absolute-value, square root, and cube root.	2
	Applying

The student will graph piecewise functions.	2
	Applying
The student will evaluate a function from a table, graph, or equation.	2
	Applying

Priority Standard: A2.FM.A.1: Use functions to model real-world problems.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will write functions to represent application problems.	3
	Analyzing
The student will solve equations or evaluate functions to determine the answer to application problems.	2
	Applying

Essential Questions:

1. How can you represent a function in a variety of ways?
2. How can you find the domain and range of a function?
3. How can you analyze the graph of a function?
4. How do you graph a piecewise function?

Enduring Understanding/Big Ideas:

1. Represent a function verbally, algebraically, graphically and numerically, using function notation when appropriate.
2. Determine the domain and range of a function by looking at what x and y values are covered by the graph.
3. Look for key characteristics such as where the graph is increasing, decreasing, constant, maximum/minimum, domain, range, and average rate of change.
4. Make a table of values using the domain and then use those points in conjunction with the parent function shapes to graph.

Unit Vocabulary:

- Domain
- Range
- Piecewise Function
- Function
- Independent Variable
- Dependent Variable
- Maxima
- Minima
- Average Rate of Change
- Increasing/Decreasing

Resources for Vocabulary Development: Textbook

Topic 1: Functions

Engaging Experience 1

Title: Get Moving

Suggested Length of Time: 10 minutes

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.

Detailed Description/Instructions: Teacher will call out a variety of parent functions and students will “model” these functions using their bodies/arms.

Bloom’s Levels: Understand

Webb’s DOK: 2

Topic 2: Analyzing and Applying Functions

Engaging Experience 1

Title: Guided Practice

Suggested Length of Time: 30 minutes

Standards Addressed

Priority:

- A2.FM.A.1: Use functions to model real-world problems.

Detailed Description/Instructions: Teacher will give students 10-15 word/real-life examples. Students can work in pairs to create functions or graphs to help find a solution. Students will check in with the teacher periodically to ensure correctness.

Bloom’s Levels: Apply, Analyze, Evaluate

Webb’s DOK: 2,3

Engaging Scenario

Engaging Scenario (An Engaging Scenario is a culminating activity that includes the following components: situation, challenge, specific roles, audience, product or performance.)

Use [Function Carnival](#) from Desmos Teacher Activities to have students put different parent functions together in a piecewise function. Students will also need to use the concepts of increasing and decreasing intervals to identify where to place maximum and minimum points.

Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Functions	Get Moving	Teacher will call out a variety of parent functions and students will “model” these functions using their bodies/arms.	10 minutes
Analyzing and Applying Functions	Guided Practice	Teacher will give students 10-15 word/real-life examples. Students can work in pairs to create functions or graphs to help find a solution. Students will check in with the teacher periodically to ensure correctness.	30 minutes

Unit 3: Function Graphing and Operations

Subject: College Algebra

Grade: 10, 11, 12

Name of Unit: Function Graphing and Operations

Length of Unit: 9 Blocks

Overview of Unit: Students will graph transformations of parent functions. They will use function notation to combine functions and determine if a function has symmetry. Students will find inverses to a function algebraically, graphically and numerically.

Priority Standards for unit:

- A2.BF.A.1: Create new functions by applying the four arithmetic operations and composition of functions (modifying the domain and range as necessary).
- A2.BF.A.2: Derive inverses of functions and compose the inverse with the original function to show that the functions are inverses.
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions.
- A2.IF.A.1 Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.

Priority Standard: A2.BF.A.1: Create new functions by applying the four arithmetic operations and composition of functions (modifying the domain and range as necessary).	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will add, subtract, multiply and divide functions to create new functions, and determine the domain and range of the new function, (modifying the domain and range as necessary). <i>*You may need extra days here to review operations on algebraic and rational expressions.</i>	2
	Applying
The student will compose functions and determine the domain and range of the new function.	3
	Analyzing

Priority Standard: A2.BF.A.2: Derive inverses of functions, and compose the inverse with the original function to show that the functions are inverses.

Learning Targets	Webb's DOK Level
	Bloom's Level
The student will derive inverses of given functions and restrict domains as needed.	2
	Applying
The student will compose functions to determine if they are inverses.	2
	Applying

Priority Standard: A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions.

Learning Targets	Webb's DOK Level
	Bloom's Level
The student will create graphs from quadratic, cubic, square and cube root, absolute value parent graphs that demonstrate vertical stretch (expansion) or shrink (compression), horizontal and vertical reflection, horizontal and vertical translation.	2
	Applying
The student will describe the effects of transformations algebraically using a, h, and k, given an equation in the form $f(x)=a*f(x-h)+k$, or given other general forms of the functions listed.	2
	Applying

Priority Standard: A2.IF.A.1 Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will decide if a function is even/odd/neither and state what type of corresponding symmetry a function has (if any).	3
	Analyzing

Essential Questions:

1. How do you transform parent functions?
2. How do you decide if a function is even/odd/neither?
3. How do you combine functions?
4. How do you find the inverse of a function?

Enduring Understanding/Big Ideas:

1. Transform a graph or describe transformations to a graph that is quadratic, cubic, square root, cube root, or absolute value using vertical and horizontal translations, reflections, and dilations (vertical).
2. If given a graph, use knowledge of symmetry; if given a function, evaluate at $-x$.
3. Use prior algebra skills to add, subtract, multiply, divide, and compose functions to obtain new functions.
4. Use the key idea of switching inputs and outputs to generate an inverse function, restricting domains as necessary to make them one-to-one.

Unit Vocabulary:

- Even and Odd Functions
- Composition
- One to One
- Horizontal Line Test
- Transformations
- Reflection
- Translation
- Vertical Stretch
- Vertical Compression
- Inverse
- Parent Function
- Symmetry

Resources for Vocabulary Development: Textbook

Topic 1: Graphing Functions

Engaging Experience 1

Title: [Polygraph - Transformations](#)

Suggested Length of Time: 45 minutes

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions.

Detailed Description/Instructions: Students will complete the Polygraph - Transformations Desmos Activity linked above.

Bloom's Levels: Understand and Analyze

Webb's DOK: 2, 3

Topic 2: Combining Functions

Engaging Experience 1

Title: [Kahoot-Combine Function](#)

Suggested Length of Time: 30 minutes

Standards Addressed

Priority:

- A2.BF.A.1: Create new functions by applying the four arithmetic operations and composition of functions (modifying the domain and range as necessary).

Detailed Description/Instructions: Teacher will present the Kahoot linked above, and students will compete.

Bloom's Levels: Apply

Webb's DOK: 2

Topic 3: Inverse Functions

Engaging Experience 1

Title: Inverse function partner share

Suggested Length of Time: 30 minutes

Standards Addressed

Priority:

- A2.BF.A.2: Derive inverses of functions and compose the inverse with the original function to show that the functions are inverses.

Detailed Description/Instructions: The teacher will begin by writing a function on the board (for example $3x^2 + 1$) and as a class they should generate the sequence of steps needed to evaluate the function (1 - square the input, 2 - multiply by 3, 3- add 1). From here the class will divide into teams of 2. Each team of two will be given two different functions that are not inverses of each other, however another team should have functions that are inverses of another team's functions. Students should write out the sequence of steps for each of their functions and provide 3 ordered pairs which satisfy their functions. Once each team is done, they should seek out a team that mirrors their steps. Once they have found their other half, they should discuss what they notice about their functions (the steps are in the opposite order - steps are "undone", they should notice their ordered pairs are also reversed). This should lead to a class discussion of what an inverse is, the process of finding an inverse, and the domain-range relationship between functions and their inverses.

Bloom's Levels: Apply, Analyze

Webb's DOK: 2, 3

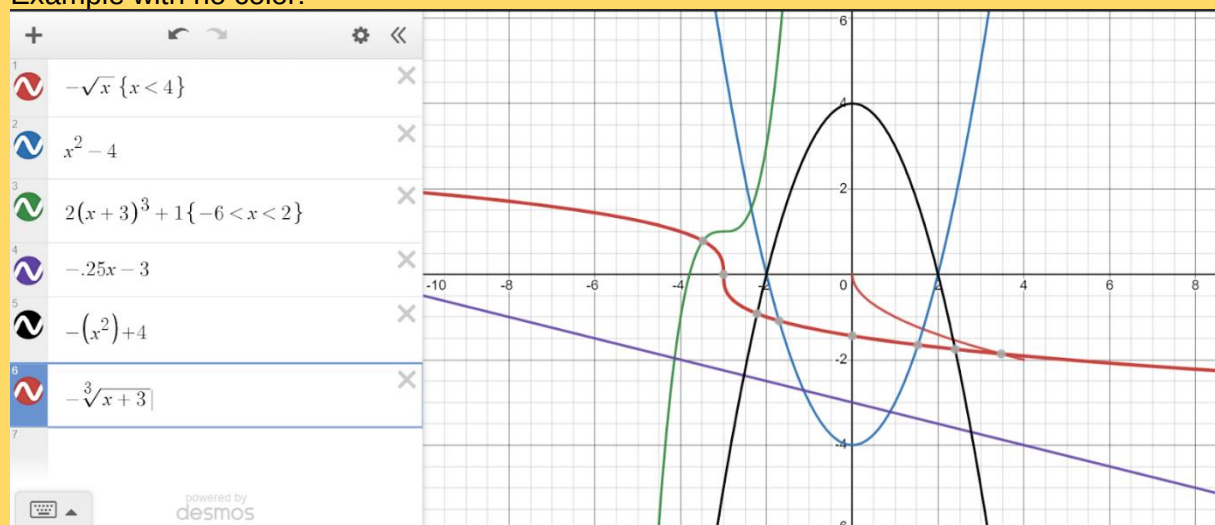
Engaging Scenario

Engaging Scenario (An Engaging Scenario is a culminating activity that includes the following components: situation, challenge, specific roles, audience, product or performance.)

Stained Glass Window - Students will create a stained-glass window using several different parent functions and their transformations with restricting domains as needed.

Exceeding	Meeting	Approaching	Initial
8-12 Functions with domain restrictions	5-7 Functions with domain restrictions	2-4 Functions	0-1 Functions
Use of h,b,a,k transformations	Use of h,k,a transformations	Use of 2 transformations	0-1 transformations used
Colored with multiple colors between function intersections	3-4 Colors used	1-2 colors used	No color

Example with no color:



Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Graphing Functions	Polygraph - Transformations	Students will complete the Polygraph - Transformations Desmos Activity linked above.	45 minutes
Combining Functions	Kahoot-Combine Function	Teacher will present the Kahoot linked above, and students will compete.	30 minutes
Inverse Functions	Inverse function partner share	The teacher will begin by writing a function on the board (for example $3x^2 + 1$) and as a class they should generate the sequence of steps needed to evaluate the function (1 - square the input, 2 - multiply by 3, 3- add 1). From here the class will divide into teams of 2. Each team of two will be given two different functions that are not inverses of each other, however another team should have functions that are inverses of another team's functions. Students should write out the sequence of steps for each of their functions and provide 3 ordered pairs which satisfy their functions. Once each team is done, they should seek out a team that mirrors their steps. Once they have found their other half, they should discuss what they notice about their functions (the steps are in the opposite order - steps are "undone", they should notice their ordered pairs are also reversed). This should lead to a class discussion of what an inverse is, the process of finding an inverse, and the domain-range relationship between functions and their inverses.	30 minutes

Unit 4: Polynomials

Subject: College Algebra

Grade: 10, 11, 12

Name of Unit: Polynomials

Length of Unit: 10 Blocks

Overview of Unit: Students will graph polynomial functions using end behavior and intercepts. Students will find all zeros of polynomial functions, including complex zeros and multiplicity of zeros. They will also solve polynomial inequalities. Lastly, students will use polynomials in real-world applications.

Priority Standards for unit:

- A2.APR.A.2: Understand the Remainder Theorem and use it to solve problems.
- A2.APR.A.5: Identify zeros of polynomials when suitable factorizations are available, and use the zeros to sketch the function defined by the polynomial.
- A2.FM.A.1: Create functions and use them to solve applications of quadratic and exponential function model problems.
- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.
- A2.REI.A.1: Create and solve equations and inequalities.
- A2.APR.A.1: Extend the knowledge of factoring to include factors with complex coefficients.

Priority Standard: A2.APR.A.2: Understand the Remainder Theorem and use it to solve problems.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will divide polynomials, using long division and synthetic division, by given factors or zeros to determine other factors.	2
	Applying
Students will understand that a remainder of zero indicates the divisor is a factor of the dividend.	2
	Applying

Students will understand that a remainder other than zero indicates the divisor is not a factor of the dividend.	2
	Applying
Students will express the result as a quotient with a remainder.	2
	Applying

Priority Standard: A2.APR.A.5: Identify zeros of polynomials when suitable factorizations are available and use the zeros to sketch the function defined by the polynomial.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will factor polynomials and use the zero-product property to identify the zeros.	2
	Applying
The student will use the zeros with multiplicities and other key characteristics (end behavior, y-intercept) to sketch the function defined by the polynomial.	2
	Applying

Priority Standard: A2.FM.A.1: Create functions and use them to solve applications of quadratic and exponential function model problems.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will write functions to represent application problems.	3
	Analyzing
The student will solve equations to determine the answer to application problems.	2
	Applying

Priority Standard: A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will be able to graph quadratic functions.	2
	Applying

Priority Standard: A2.REI.A.1: Create and solve equations and inequalities.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will solve one-variable polynomial inequalities.	2
	Applying

Priority Standard: A2.APR.A.1: Extend the knowledge of factoring to include factors with complex coefficients.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will take given zeros (real and complex) and create polynomial functions from them (factored and standard forms).	2
	Applying

Essential Questions:

1. How do you find all zeros of a polynomial?
2. How do you create a polynomial function given zeros (real and complex)?
3. How do you sketch a polynomial function?
4. How do you graph a quadratic function?
5. How do you solve a one-variable polynomial inequality?
6. How do you use polynomial functions to model real-life situations?

Enduring Understanding/Big Ideas:

1. The degree of the polynomial determines the number of the solutions. Use rational root theorem, division, factoring, etc. to determine the zeros.
2. Turn each zero into a factor and multiply to standard form if needed.
3. Determine the end behavior, zeros with multiplicities, and y-intercept. Put all these together to make one graph satisfying everything.
4. Use key features, such as finding the vertex, axis of symmetry, max/min, and x- and y-intercepts.
5. Solve a polynomial inequality with various methods—sketching the polynomial function to decide solution intervals or making a sign chart with zeros.
6. Find or use various functions and their key features (max, min, x-int, etc.) for solution(s).

Unit Vocabulary:

- End behavior
- Zero
- Polynomial
- Synthetic Division
- Remainder
- Degree
- Leading Coefficient
- Quadratic
- Complex Number
- Roots
- Multiplicity
- Intercepts
- Maximum
- Minimum
- Quotient

Resources for Vocabulary Development: Textbook

Topic 1: Polynomial Graphing

Engaging Experience 1

Title: Real World Extrema Problems

Suggested Length of Time: 60 min

Standards Addressed

Priority:

- A2.FM.A.1: Create functions and use them to solve applications of quadratic and exponential function model problems.
- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.

Detailed Description/Instructions: Students will be given different scenarios that require them to write a quadratic function to represent the problem. They will then use the equation to determine the optimal solution (max profit, min fencing, etc...)

Bloom's Levels: Identify, Use, Analyze

Webb's DOK: 1, 2, 3

Rubric: To be created

Engaging Experience 2

Title: Analyze the graphs of polynomials

Suggested Length of Time: 60 min

Standards Addressed

Priority:

- A2.FM.A.1: Create functions and use them to solve applications of quadratic and exponential function model problems.
- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.

Detailed Description/Instructions: Students will use end behavior and multiplicity of zeros to graph several polynomials. The students then will use technology (graphing calculator or Desmos) to verify their answers.

Bloom's Levels: Identify, Use, Analyze

Webb's DOK: 1, 2, 3

Topic 2: Polynomial Solving

Engaging Experience 3

Title: Finding Zeros of Polynomials

Suggested Length of Time: 90 min

Standards Addressed

Priority:

- A2.APR.A.1: Extend the knowledge of factoring to include factors with complex coefficients.
- A2.APR.A.2: Understand the Remainder Theorem and use it to solve problems.
- A2.APR.A.5: Identify zeros of polynomials when suitable factorizations are available and use the zeros to sketch the function defined by the polynomial.
- A2.REI.A.1: Create and solve equations and inequalities.

Detailed Description/Instructions: Students will be given a variety of polynomial functions and be asked to use technology and theorems (options include possible rational zeros, Descartes' Rule of signs, and bounds) to determine potential zeros of the function. They will then use synthetic or polynomial division to reduce the function and identify zeros. Some zeros will be complex.

Students will extend what they have done above with polynomial functions to like polynomial inequalities to find appropriate solution intervals.

Bloom's Levels: Analyze

Webb's DOK: 3

Engaging Scenario

Engaging Scenario (An Engaging Scenario is a culminating activity that includes the following components: situation, challenge, specific roles, audience, product or performance.)

Students will be broken into groups and given sheets of paper of various sizes. They will construct an open topped box of maximum volume. Their product will be a physical box, the equation modeling their box's volume, a screenshot of technology showing values of the maximum, and a justification of their findings.

The students will then find the two values they could have cut out to make a box of half the volume. If their solution can be found without technology, they must show the work by hand.

Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Graphing Polynomials	Real World Extrema Problems	Students will be given different scenarios that require them to write a quadratic function to represent the problem. They will then use the equation to determine the optimal solution (max profit, min fencing, etc...)	60 min
Graphing Polynomials	Analyze the graphs of polynomials	Students will use end behavior and multiplicity of zeros to graph several polynomials. The students then will use technology (graphing calculator or Desmos) to verify their answers.	60 min
Solving Polynomials	Finding Zeros of Polynomials	Students will be given a variety of polynomial functions and be asked to use technology and theorems (options include possible rational zeros, Descartes' Rule of signs, and bounds) to determine potential zeros of the function. They will then use synthetic or polynomial division to reduce the function and identify zeros. Some zeros will be complex. Students will extend what they have done above with polynomial functions to like polynomial inequalities to find appropriate solution intervals.	90 min

Unit 5: Rationals

Subject: College Algebra

Grade: 10, 11, 12

Name of Unit: Rationals

Length of Unit: 8 Blocks

Overview of Unit: Students will graph rational functions using domain, asymptotes, and intercepts. Students will solve rational equations and inequalities. Additionally, they will solve application problems involving rational equations.

Priority Standards for unit:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.
- A2.REI.A.2: Solve rational equations where numerators are polynomials and where extraneous solutions may result.
- A2.FM.A.1: Use functions to model real-world problems.
- A2.REI.A.1: Create and solve equations and inequalities.

Priority Standard: A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will graph rational functions, including intercepts, holes, domain, range, and vertical, horizontal and oblique asymptotes.	2
	Applying

Priority Standard: A2.REI.A.2: Solve rational equations where numerators are polynomials and where extraneous solutions may result.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will solve rational equations by various methods, including instances when the numerator and denominator are polynomials.	2
	Applying
The student will check solutions and identify those that are extraneous.	2
	Applying

Priority Standard: A2.FM.A.1: Use functions to model real-world problems.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will write functions to represent application problems. *Include rational work word problems.	3
	Analyzing
The student will solve equations to determine the answer to application problems. *Include rational work word problems.	2
	Applying

Priority Standard: A2.REI.A.1: Create and solve equations and inequalities.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will solve one-variable rational inequalities.	2
	Applying

Essential Questions:

1. How do you graph a rational function?
2. How do you solve rational equations?
3. How do you solve rational inequalities?

Enduring Understanding/Big Ideas:

1. Find all intercepts, holes, and asymptotes; use these to create a rough sketch, filling in other values as necessary. Then state domain and range.
2. Multiply both sides of the equation by the least common denominator for the whole equation, eliminating fractions. Solve from there using prior algebra skills.
3. Solve a rational inequality with various methods—sketching the rational function to decide solution intervals or making a sign chart with zeros and vertical asymptotes.

Unit Vocabulary:

- Rational
- Holes
- Horizontal, Vertical, & Oblique Asymptote

Resources for Vocabulary Development: Textbook

Topic 1: Rational Graphing

Engaging Experience 1

Title: Analyze Rational Functions

Suggested Length of Time: 60 min

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.

Detailed Description/Instructions: Students will be tasked with taking a variety of rational functions and analyzing them to find domain, range, holes, asymptotes, and intercepts. They will then create graphs of these functions both by hand and with the assistance of technology.

Bloom's Levels: Analyze

Webb's DOK: 3

Topic 2: Rational Solving

Engaging Experience 1

Title: Solve and Pass

Suggested Length of Time: 60 min

Standards Addressed

Priority:

- A2.REI.A.1: Create and solve equations and inequalities.
- A2.REI.A.2: Solve rational equations where numerators are polynomials and where extraneous solutions may result.
- A2.FM.A.1: Use functions to model real-world problems.

Detailed Description/Instructions: Students will be divided into groups (ideally four per group). Each group gets one rational equation or inequality; the teacher should have a bank of several equations and inequalities. Person 1 does step one of solving and then passes to the next person. Person 2 checks person 1's work and then does the next step in solving and passes to the next person. Person 3 checks person 2's work and solves then passes to person 4. Person 4 checks person 3's work and then checks the solution against the domain. Once finished the group checks with the teacher and gets a new problem. Each group should get through at least 4 problems (2 equations and 2 inequalities).

Bloom's Levels: Analyze

Webb's DOK: 3

Engaging Scenario

Engaging Scenario (An Engaging Scenario is a culminating activity that includes the following components: situation, challenge, specific roles, audience, product or performance.)

Students will be divided into small groups. Students will research various real-world problems that involve rational equations (work, rates, speed, etc). The group will create a small presentation on how to set up and solve the problem. Each group will present to the class.

Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Rational Graphing	Analyze Rational Functions	Students will be tasked with taking a variety of rational functions and analyzing them to find domain, range, holes, asymptotes, and intercepts. They will then create graphs of these functions both by hand and with the assistance of technology.	60 min
Rational Solving	Solve and Pass	Students will be divided into groups (ideally four per group). Each group gets one rational equation or inequality; the teacher should have a bank of several equations and inequalities. Person 1 does step one of solving and then passes to the next person. Person 2 checks person 1's work and then does the next step in solving and passes to the next person. Person 3 checks person 2's work and solves then passes to person 4. Person 4 checks person 3's work and then checks the solution against the domain. Once finished the group checks with the teacher and gets a new problem. Each group should get through at least 4 problems (2 equations and 2 inequalities).	60 min

Unit 6: Exponentials and Logarithms

Subject: College Algebra

Grade: 10, 11, 12

Name of Unit: Exponentials and Logarithms

Length of Unit: 13 Blocks

Overview of Unit: Students will graph exponential and logarithmic functions using characteristics of each function. Students will solve exponential and logarithmic equations. Students will apply exponential and logarithmic functions to solve real world applications.

Priority Standards for unit:

- A2.SSE.A.1: Develop the definition of logarithms based on properties of exponents.
- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.
- A2.FM.A.1: Create functions and use them to solve applications of quadratic and exponential function model problems.
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions.
- A2.SSE.A.2: Use the inverse relationship between exponents and logarithms to solve exponential and logarithmic equations.

Priority Standard: A2.SSE.A.1: Develop the definition of logarithms based on properties of exponents.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will switch between logarithmic and exponential forms.	2
	Applying
The student will expand and condense using the laws of logarithms.	2
	Applying

Priority Standard: A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.

Learning Targets	Webb's DOK Level
	Bloom's Level
The student will state the domain and range of exponential functions, including "e."	2
	Applying
The student will state the domain and range of logarithmic functions, including the natural log.	2
	Applying

Priority Standard: A2.FM.A.1: Create functions and use them to solve applications of quadratic and exponential function model problems.

Learning Targets	Webb's DOK Level
	Bloom's Level
The student will apply exponentials to solve interest problems, including "e."	2
	Applying
The student will solve application problems involving exponential and logarithmic functions.	2
	Applying

Priority Standard: A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions.

Learning Targets	Webb's DOK Level
	Bloom's Level
The student will graph transformations of exponential functions, including "e."	2
	Applying
The student will graph transformations of logarithmic functions, including the natural log.	2
	Applying

Priority Standard: A2.SSE.A.2: Use the inverse relationship between exponents and logarithms to solve exponential and logarithmic equations.

Learning Targets	Webb's DOK Level
	Bloom's Level
The student will solve exponential equations.	2
	Applying
The student will solve logarithmic equations.	2
	Applying

Essential Questions:

1. Why do exponential functions have a horizontal asymptote?
2. How are exponential and logarithmic functions related?
3. How do we evaluate a logarithmic function? (What is a logarithm?)
4. How do we apply exponential functions to the real world?
5. How do we apply logarithmic functions to the real world?

Enduring Understanding/Big Ideas:

1. As the exponent gets closer to negative infinity, the value gets closer to 0.
2. Exponential and logarithmic functions are inverse functions.
3. You rewrite the logarithm as an exponential and find the exponent. (It is an exponent.)
4. They are used to model exponential growth and compound interest.
5. They are used to solve exponential growth and compound interest problems. They are also used to model intensity of sound, earthquakes, and acidity of liquids.

Unit Vocabulary:

- Logarithm
- Natural log
- Base
- Expand
- Condense
- Exponential
- Growth
- Decay

Resources for Vocabulary Development: Textbook

Topic 1: Exponential Functions

Engaging Experience 1

Title: Graphing Exponential Functions

Suggested Length of Time: 60 min

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions.

Detailed Description/Instructions: Students will be paired up and given several exponential functions of any base including e to graph without the aid of a graphing utility. Students will take turns presenting how to graph one of the functions to the other by using transformations and key characteristics. Characteristics such as domain, range, the horizontal asymptote, and key points.

Bloom's Levels: Understand, Apply

Webb's DOK: 2

Topic 2: Logarithmic Functions

Engaging Experience 1

Title: Understanding Logarithms Circuit

Suggested Length of Time: 45min

Standards Addressed

Priority:

- A2.SSE.A.1: Develop the definition of logarithms based on properties of exponents.
- A2.SSE.A.2: Use the inverse relationship between exponents and logarithms to solve exponential and logarithmic equations.

Detailed Description/Instructions: Students will complete a circuit with 15-20 problems converting between logarithmic expressions and exponential functions. The students will simplify using the properties of exponents and logarithms as needed.

Bloom's Levels: Understand

Webb's DOK: 4

Engaging Experience 2

Title: Graph Logarithms

Suggested Length of Time: 30 min

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.
- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions.

Detailed Description/Instructions: Students will use the graph of an exponential functions and the properties and symmetry of inverse functions to develop the graphs of logarithms of any base and state key characteristics such as domain, range, vertical asymptote, and key points. The students then will be asked to graph several logarithmic functions using transformations and then compare their graphs to a graphing utility and note the limitations of the graphing utility.

Bloom's Levels: Understand

Webb's DOK: 2

Engaging Experience 3

Title: Use Properties of Logarithms

Suggested Length of Time: 30 min

Standards Addressed

Priority:

- A2.SSE.A.1: Develop the definition of logarithms based on properties of exponents.
- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.

- A2.BF.A.3: Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions.

Detailed Description/Instructions: Students will use the properties of logarithms to expand and condense expressions. To verify their work, students will be given functions and will graph the original functions and the expanded or condensed expression in the same window of a graphing utility to verify the functions are equivalent.

Bloom's Levels: Understand

Webb's DOK: 2

Topic 3: Solve and Apply

Engaging Experience 1

Title: Solving Exponential and Logarithmic Equations using a variety of methods

Suggested Length of Time: 90 min

Standards Addressed

Priority:

- A2.SSE.A.2: Use the inverse relationship between exponents and logarithms to solve exponential and logarithmic equations.

Detailed Description/Instructions: Students will be given exponential and logarithmic functions in a variety of formats. They will be asked to use their knowledge of the inverse relationship of the functions and exponentials and logarithmic properties to solve those equations.

Bloom's Levels: Apply

Webb's DOK: 3

Engaging Experience 2

Title: Exponential Growth and Decay

Suggested Length of Time: 60 min

Standards Addressed

Priority:

- A2.FM.A.1: Create functions and use them to solve applications of quadratic and exponential function model problems.

Detailed Description/Instructions: Students will solve a variety of exponential applications. Options include population growth, radioactive decay, continuously compounded interest, and Newton's Law of Cooling.

Bloom's Levels: Interpret

Webb's DOK: 3

Engaging Scenario

Engaging Scenario (An Engaging Scenario is a culminating activity that includes the following components: situation, challenge, specific roles, audience, product or performance.)

Students will do research to find the retail price of a car 5 years ago and then find the current trade in value. The students will use the data to find the rate of depreciation of the car annually and monthly.

Students then research to find the retail price of a brand-new car. They will then have to find a rate they will be given for a loan to buy that car. Finally, the students will calculate the accumulated amount they will owe if they had not made any payments for 5 years.

Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Exponential Functions	Graphing Exponential Functions	Students will be giving several exponential functions of any base including e to graph without the aid of a graphing utility. Students will graph these functions by using transformations and key characteristics common to all exponential functions such as domain, range, the horizontal asymptote, and key points.	60 min
Logarithmic Functions	Understanding Logarithms Circuit	Students will complete a circuit with 15-20 problems converting between logarithmic expressions and exponential functions. The students will simplify using the properties of exponents and logarithms as needed.	45 min
Logarithmic Functions	Graph Logarithms	Students will use the graph of an exponential function and the properties and symmetry of inverse functions to develop the graphs of logarithms of any base and state key characteristics such as domain, range, vertical asymptote, and key points. The students then will be asked to graph several logarithmic functions using transformations and then compare their graphs to a graphing utility and note the limitations of the graphing utility.	30 min
Logarithmic Functions	Use Properties of Logarithms	Students will use the properties of logarithms to expand and condense expressions. To verify their work, students will be given functions and will graph the original functions and the expanded or condensed expression in the same window of a graphing utility to verify the functions are equivalent.	30 min
Solve and Apply	Solving Exponential and Logarithmic	Students will be given exponential and logarithmic functions in a variety of formats. They will be asked to use their	90 min

	Equations using a variety methods	knowledge of the inverse relationship of the functions and exponentials and logarithmic properties to solve those equations.	
Solve and Apply	Exponential Growth and Decay	Students will solve a variety of exponential applications. Options include population growth, radioactive decay, continuously compounded interest, and Newton's Law of Cooling.	60 min

Unit 7: Systems of Equations and Inequalities

(Linear and Nonlinear)

Subject: College Algebra

Grade: 10, 11, 12

Name of Unit: Systems of Equations and Inequalities

Length of Unit: 10 Blocks

Overview of Unit: Students will solve systems of equations and inequalities, including nonlinear systems. Students will apply systems of equations and inequalities to solve real world applications.

Priority Standards for unit:

- A2.REI.B.3: Create and solve systems of equations that may include non-linear equations and inequalities.
- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.

Priority Standard: A2.REI.B.3: Create and solve systems of equations that may include non-linear equations and inequalities.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will write and solve linear systems of equations that involve two and three variables. <i>*Make sure to include solving application problems here (mixtures, distance, area/perimeter, ticket prices, etc.)</i>	2
	Applying
The student will solve nonlinear systems of equations.	2
	Applying
The student will solve systems of inequalities, including nonlinear systems.	2
	Applying

Priority Standard: A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will graph to solve systems of equations and inequalities.	2
	Applying
The student will graph circles to be used in the family of functions for nonlinear systems.	2
	Applying

Essential Questions:

1. How do you solve a real-world problem that has several variables?
2. Why is it important to know several methods to solve systems of equations?
3. How does a solution to a system of equations differ from a solution to a system of inequalities?

Enduring Understanding/Big Ideas:

1. Write a system that has as many equations as there are variables.
2. Some systems can only be solved graphically or only by substitution. Elimination is the only method that is used when we apply systems to matrices.
3. Solutions to systems of equations are points of intersection (sometimes lines/planes/etc. for infinitely many solutions) while solutions to systems of inequalities is the intersection of shaded regions.

Unit Vocabulary:

- System
- Parametric Form
- Substitution
- Elimination
- Intersection
- Circle
- Nonlinear

Resources for Vocabulary Development: Textbook

Topic 1: Systems of Equations

Engaging Experience 1

Title: Writing dependent systems in parametric form

Suggested Length of Time: 45 min

Standards Addressed

Priority:

- A2.REI.B.3: Create and solve systems of equations that may include non-linear equations and inequalities.

Detailed Description/Instructions: Students will solve linear systems in 3 variables that have infinitely many solutions. They will have to decide which type of dependent system they have been given and write the answer in the appropriate parametric form.

Bloom's Levels: Apply

Webb's DOK: 2

Engaging Experience 2

Title: Extending Methods of solving Linear Systems to Nonlinear on White Boards

Suggested Length of Time: 45 min

Standards Addressed

Priority:

- A2.REI.B.3: Create and solve systems of equations that may include non-linear equations and inequalities.
- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.

Detailed Description/Instructions: The student will apply substitution, elimination, and graphing to systems involving nonlinear equations.

Bloom's Levels: Apply

Webb's DOK: 2

Topic 2: Systems of Inequalities

Engaging Experience 1

Title: Graphically solving systems of inequalities and applying to real world situations

Suggested Length of Time: 60 min

Standards Addressed

Priority:

- A2.IF.A.1: Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.

Detailed Description/Instructions: Students will be presented with systems of inequalities involving linear and nonlinear inequalities.

Bloom's Levels: Apply

Webb's DOK: 2

Engaging Scenario

Engaging Scenario (An Engaging Scenario is a culminating activity that includes the following components: situation, challenge, specific roles, audience, product or performance.)

Students will be put in small groups. Each group will be given a Linear Programming problem. The group will do a write up on the problem including the problem, objective function, inequalities, constraints, graph, vertices and solution.

Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Systems of Equations	Writing dependent systems in parametric form	Students will solve linear systems in 3 variables that have infinitely many solutions. They will have to decide which type of dependent system they have been given and write the answer in the appropriate parametric form.	45 min
Systems of Equations	Extending Methods of solving Linear Systems to Nonlinear on White Boards	The student will apply substitution, elimination, and graphing to systems involving nonlinear equations.	45 min
Systems of Inequalities	Graphically solving systems of inequalities and applying to real world situations	Students will be presented with systems of inequalities involving linear and nonlinear inequalities.	60 min

Unit 8: Matrices

Subject: College Algebra

Grade: 10, 11, 12

Name of Unit: Matrices

Length of Unit: 6 Blocks

Overview of Unit: Students will perform matrix operations and use matrices to solve systems of linear equations.

Priority Standards for unit:

- A2.REI.B.3: Create and solve systems of equations that may include non-linear equations and inequalities.
- ACT.N.607: Use relations involving addition, subtraction, and scalar multiplication of vectors and of matrices

Priority Standard: ACT.N.607: Use relations involving addition, subtraction, and scalar multiplication of vectors and of matrices.

Learning Targets	Webb's DOK Level
	Bloom's Level
The student will add and subtract matrices.	2
	Applying
The student will perform scalar multiplication with matrices.	2
	Applying

Priority Standard: A2.REI.B.3: Create and solve systems of equations that may include non-linear equations and inequalities.	
Learning Targets	Webb's DOK Level
	Bloom's Level
The student will solve systems of equations using matrices.	2
	Applying

Essential Questions:

1. How do you perform basic matrix operations?
2. How are matrices related to systems of linear equations?
3. Why are learning matrix solutions to systems beneficial?

Enduring Understanding/Big Ideas:

1. Add/subtract corresponding elements; multiply all elements by scalar.
2. Linear systems can be rewritten as an augmented matrix or a matrix equation to then be solved in ways other than substitution, elimination, and/or graphing.
3. Technology can be used to solve linear systems extremely quickly when written as a matrix.

Unit Vocabulary:

- Augmented
- Inverse
- Reduced Row Echelon
- Gaussian
- Rows
- Columns
- Scalar
- Order (Dimensions)
- Element
- Determinant
- Minor
- Cofactor

Resources for Vocabulary Development: Textbook

Topic 1: Matrix Operations

Engaging Experience 1

Title: Real-World Problem with Matrix Operations

Suggested Length of Time: 45 min

Standards Addressed

Priority:

- ACT.N.607: Use relations involving addition, subtraction, and scalar multiplication of vectors and of matrices

Detailed Description/Instructions: Students will model real-world data using a system of equations and will perform the operations of addition, subtraction, and scalar multiplication. The website <https://meangreenmath.files.wordpress.com/2016/01/spacemath.png> contains a sample problem. Afterwards, students will model the same process using Microsoft Excel in order to make a connection between an abstract concept in mathematics and a concrete program that students use on a weekly basis.

Bloom's Levels: Create

Webb's DOK: 3

Topic 2: Solving Systems with Matrices

Engaging Experience 1

Title: Using Augmented Matrices to solve linear systems

Suggested Length of Time: 60 min

Standards Addressed

Priority:

- A2.REI.B.3: Create and solve systems of equations that may include non-linear equations and inequalities.

Detailed Description/Instructions:

Students will rewrite linear systems of equations as an augmented matrix and solve them using Gaussian and Gauss-Jordan Elimination. Students then will verify their answers by using a graphing calculator to put the matrix in Reduced Row Echelon Form.

Bloom's Levels: Apply

Webb's DOK: 2

Engaging Experience 2

Title: Using a Matrix Equation to solve linear systems

Suggested Length of Time: 2 blocks

Standards Addressed

Priority:

- A2.REI.B.3: Create and solve systems of equations that may include non-linear equations and inequalities.

Detailed Description/Instructions:

Students will rewrite linear systems of equations as a matrix equation and solve them using an Inverse Matrix and Cramer's Rule. Students will use a graphing utility to find the inverse and determinants of larger systems.

Bloom's Levels: Apply

Webb's DOK: 2

Engaging Scenario

Engaging Scenario (An Engaging Scenario is a culminating activity that includes the following components: situation, challenge, specific roles, audience, product or performance.)

Students will be handed a bag consisting of 4 types of coins and be told the total amount of money and number of coins. They will also be given two pieces of information that will relate the amount of the different types of coins. Students will use this information to determine how many of each type of coin is in the bag. Students will need to produce the systems of equations and matrices but may use technology to solve. To confirm their results, the students will then open the bag and count the coins.

Summary of Engaging Learning Experiences for Topics

Topic	Engaging Experience Title	Description	Suggested Length of Time
Matrix Operations	Real-World Problem with Matrix Operations	Students will model real-world data using a system of equations and will perform the operations of addition, subtraction, and scalar multiplication. The website https://meangreenmath.files.wordpress.com/2016/01/spacemath.png contains a sample problem. Afterwards, students will model the same process using Microsoft Excel in order to make a connection between an abstract concept in mathematics and a concrete program that students use on a weekly basis.	45 min
Solving Systems with Matrices	Using Augmented Matrices to solve linear systems	Students will rewrite linear systems of equations as an augmented matrix and solve them using Gaussian and Gauss-Jordan Elimination. Students then will verify their answers by using a graphing calculator to put the matrix in Reduced Row Echelon Form.	60 min
Solving Systems with Matrices	Using a Matrix Equation to solve linear systems	Students will rewrite linear systems of equations as a matrix equation and solve them using an Inverse Matrix and Cramer's Rule. Students will use a graphing utility to find the inverse and determinants of larger systems.	60 min

Unit of Study Terminology

Appendices: All Appendices and supporting material can be found in this course's shell course in the District's Learning Management System.

Assessment Leveling Guide: A tool to use when writing assessments in order to maintain the appropriate level of rigor that matches the standard.

Big Ideas/Enduring Understandings: Foundational understandings teachers want students to be able to discover and state in their own words by the end of the unit of study. These are answers to the essential questions.

Engaging Experience: Each topic is broken into a list of engaging experiences for students. These experiences are aligned to priority and supporting standards, thus stating what students should be able to do. An example of an engaging experience is provided in the description, but a teacher has the autonomy to substitute one of their own that aligns to the level of rigor stated in the standards.

Engaging Scenario: This is a culminating activity in which students are given a role, situation, challenge, audience, and a product or performance is specified. Each unit contains an example of an engaging scenario, but a teacher has the ability to substitute with the same intent in mind.

Essential Questions: Engaging, open-ended questions that teachers can use to engage students in the learning.

Priority Standards: What every student should know and be able to do. These were chosen because of their necessity for success in the next course, the state assessment, and life.

Supporting Standards: Additional standards that support the learning within the unit.

Topic: These are the main teaching points for the unit. Units can have anywhere from one topic to many, depending on the depth of the unit.

Unit of Study: Series of learning experiences/related assessments based on designated priority standards and related supporting standards.

Unit Vocabulary: Words students will encounter within the unit that are essential to understanding. Academic Cross-Curricular words (also called Tier 2 words) are those that can be found in multiple content areas, not just this one. Content/Domain Specific vocabulary words are those found specifically within the content.