Union County Educational Services Commission
High School Course Syllabus

Title: Algebra ll

Timeline: Full Year; 5 Credits

Course Description:
Students taking Algebra 2 will continue to build upon skills learned in Algebra 1. They will review solving linear equations both algebraically and graphically. Students will solve systems of equations and inequalities using different methods. Students working in Algebra 2 will work with functions and relations, demonstrating how they can create them and apply them to real world situations. Students will be exposed to matrices, and basic arithmetic operations associated with them. This course will also work with more advanced topics working with quadratics and polynomials.

Scope and Sequence:

I. Linear Functions
II. Linear Systems
III. Laws of Exponents
IV. Polynomials
V. Factoring
VI. Quadratic Functions
VII. Rational Functions
VIII. Exponential and Logarithmic Functions
IX. Polynomial Functions
X. Matrices
XI. Complex Numbers

Refer to the attached curriculum map for a detailed outline of course objectives.

Curriculum Alignment:
New Jersey Student Learning Standards - Algebra
Standards for Mathematical Content and Practice
PARCC Evidence Tables - Algebra ll

Grading Procedures:

Do Now	10%
Participation	20%
Class Assignments	50%
Assessments	20%

Adoption Date:

Unit	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Length of Unit	3 Weeks	3 Weeks	4 Weeks	4 Weeks	3 Weeks	3 Weeks
Topics	Linear Functions	Linear Systems	Laws of Exponents	Polynomials	Factoring	Quadradic Functions
Standards for Mathematical Content	**A-CED.A.2** - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **A-REI.B.3** - Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. **F-IF.B.6** - Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. **F-IF.C.7** - Graph functions expressed symbolically and show key features of the graph, by hand in	**A-CED.A.3** - Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. **A-REI.D.11** - Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) =	**N-RN.A.1** - Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define 51/3 to be the cube root of 5 because we want (51/3) 3 = 5(1/3) 3 to hold, so (51/3) 3 must equal 5. **N-RN.A.2** - Rewrite expressions involving radicals and rational exponents using the properties of exponents. **F-IF.C.8** – Write a function defined by an expression in different but equivalent forms to reveal and explain different properties	**A-SSE.A.1** - Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r) n as the product of P and a factor not depending on P **A-SSE.A.2** - Use the	**A-SSE.A.1** - Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r) n as the product of P and a factor not depending on P **A-SSE.A.2** - Use the structure of an expression to	**F-IF.B.4** - For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. **F-IF.C.7** - Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts,

	simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations	g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.	of the function. b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)t , y = (0.97)t , y = (1.01)12t, y = (1.2)t/10, and classify them as representing exponential growth or decay	structure of an expression to identify ways to rewrite it. For example, see x4 – y4 as (x2) 2 – (y2) 2 , thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2). **A-APR.A.1** - Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.	identify ways to rewrite it. For example, see x4 – y4 as (x2) 2 – (y2) 2 , thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2).	maxima, and minima. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. **F-IF.C.8** - Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the

	are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.					graph, and interpret these in terms of a context. **A-REI.B.4** - Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form (x – p) 2 = q that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives

						complex solutions and write them as a ± bi for real numbers a and b. **A-SSE.B.3** - Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
Standards for Mathematical Practice	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments & critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.					
Content	Rate of Change Slope	One solution, No Solution, Infinitely	Properties of exponents	Standard Form Factoring	Standard Form Factoring	Quadratic equations with both real and complex

	Intercept Form Vertical and Horizontal Lines Writing Equations of Lines Point Slope Form Slope Intercept Form Standard Form Parallel Lines Perpendicular Lines	Many Solutions. Substitution Method Graphing Method Elimination Method	Scientific Notation Exponential Functions Exponential Growth Exponential Decay Division Property (Quotient of Powers Property) Division Property (Positive Power of a Quotient Property) Division Property (Negative Power of a Quotient Property)	Greatest Common Factor (GCF) Monomial Binomial Trinomial Polynomial Difference of Squares Perfect Square Trinomial	Greatest Common Factor (GCF) Monomial Binomial Trinomial Polynomial Difference of Squares Perfect Square Trinomial	solutions. Quadratics can model real world problems. Key features of quadratic functions Intercepts Intervals of increasing or decreasing Relative maximums and Minimums Role of Symmetry Factoring quadratics The Quadratic Formula Completing the Square Role technology plays
Skills	Solving Linear equations and Inequalities Graphing Linear Functions Writing Linear Functions Linear Inequalities in two variables	Solving Systems of Equations by Graphing Solving Systems of Equations by Substitution Solving Systems of Equations by Elimination Solving System of Linear Inequalities Linear Equations in Three Dimensions	Integer Exponents Multiplying Monomials Dividing Monomials	Classifying Polynomials Addition and Subtraction of Polynomials Multiplication of Polynomials by a Monomial Division of Polynomials by a Monomial Multiplication of Binomials Multiplication of Polynomials	Factoring using Common Factors Factoring Quadratic Trinomials Factoring – Difference of two squares	Graphing Quadratic Functions Solving Quadratic Functions by Graphing Solving Quadratic Functions by the Square Root Method Solving Quadratic Functions by Factoring Completing the Square

Unit	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11
Length of Unit	3 Weeks	4 Weeks	4 Weeks	3 Weeks	2 Weeks
Topics	Rational Functions	Exponential and Logarithmic Functions	Polynomials	Matrices	Complex Numbers
Standards for Mathematical Content	**N-RN.A.1** - Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define 51/3 to be the cube root of 5 because we want (51/3) 3 = 5(1/3) 3 to hold, so (51/3) 3 must equal 5. **A-APR.D.7** - Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. **A-REI.A.2** - Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. **F-IF.C.7** - Graph functions expressed symbolically and	**A-REI.D.11** - Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. **F-IF.C.7** - Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. **F-BF.A.1** - Write a function that describes a relationship between two quantities b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. **F-BF.B.4** - Find inverse functions.	**A-APR.A.1** - Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. **A-APR.B.2** - Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x). **A-APR.B.3** - Identify zeros of polynomials when suitable factorizations are available, and use the zeros to	**N-VM.C.6** - Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. **N-VM.C.8** - Add, subtract, and multiply matrices of appropriate dimensions. **A-REI.D.11** - Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.	**N.CN.A.1** - Know there is a complex number i such that i 2 = –1, and every complex number has the form a + bi with a and b real. **N.CN.A.2** - Use the relation i 2 = –1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

	show key features of the graph, by hand in simple cases and using technology for more complicated cases. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.	a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, f(x) =2 x3 or f(x) = (x+1)/(x–1) for x ≠1. **F-LE.A.4** - Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	construct a rough graph of the function defined by the polynomial.		
Standards for Mathematical Practice	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments & critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.				
Content	Rational Expressions Operations with Rational Expressions	The formulas for Exponential Growth Exponential Decay Interest Rate Compound Interest Properties of Logarithms Logarithmic Applications PH Scale Bacteria Logarithmic Equations Natural Logarithms Irrational Number “e”	Standard Form Factoring Greatest Common Factor (GCF) Monomial Binomial Trinomial Polynomial Difference of Squares Perfect Square Trinomial	Determinant Dimensions or Order of a Matrix Identity Matrix Inverse Matrix Matrix Scalar Square Matrix Zero Matrix	Simplify the square roots of negative numbers. Add, subtract, and multiply complex numbers. Find the conjugate of a complex number. Divide complex numbers,

					including rationalization of the denominator using the conjugate. Plot complex numbers on a complex plane Demonstrate the absolute value of a complex number
Skills	Simplifying Rational Expressions Multiplying Rational Expressions Dividing Rational Expressions Adding and Subtracting Rational Expressions Solving Rational Equations Graphing Rational Functions Solving Rational Equations	Exponential Growth and Decay Functions Graphing Exponential Growth and Decay Functions Inverse of relations and functions Logarithmic Functions Properties of Logarithms (expand and condense) Solving Exponential and Logarithmic Equations The Natural base e	Classification of Polynomials Operations with Polynomials Operations with Polynomials (Long Division) Factoring Polynomials Finding Real Roots of Polynomial Equations	Properties of Matrices Operations with Matrices (Addition, subtraction, scalar multiplication) Operations with Matrices (multiply 3x3 matrices) Solving systems of equations using matrices	Graphing Complex Numbers Operations with Complex Numbers Evaluate Powers of *i*