# Union County Educational Services Commission High School Course Syllabus

Title: Algebra II

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 II

#### **Grading Procedures:**

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

#### **Adoption Date:**

# Union County Educational Services Commission Curriculum Mapping Format: Algebra II

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

simple cases and using	g(x); find the	of the function.	structure of an	identify ways to	maxima, and
technology for more	solutions	b. Use the	expression to	rewrite it. For	minima.
complicated cases.	approximately,	properties of	identify ways to	example, see x4 – y4	c. Graph
a. Graph linear	e.g., using	exponents to	rewrite it. For	as (x2 ) 2 – (y2 ) 2 ,	polynomial
and quadratic	technology to	interpret	example, see x4 –	thus recognizing it as	functions,
functions and	graph the	expressions	y4 as (x2 ) 2 – (y2 ) 2	a difference of	identifying zeros
show	functions, make	for	, thus recognizing it	squares that can be	when suitable
intercepts,	tables of values,	exponential	as a difference of	factored as (x2 – y2	factorizations are
maxima, and	or find successive	functions. For	squares that can be	)(x2 + y2 ).	available, and
minima.	approximations.	example,	factored as (x2 – y2		showing end
b. Graph	Include cases	identify	)(x2 + y2 ).		behavior.
square root,	where f(x) and/or	percent rate of	A-APR.A.1 -		d. (+) Graph
cube root, and	g(x) are linear,	change in	Understand that		rational
piecewise-	polynomial,	functions such	polynomials form a		functions,
defined	rational, absolute	as y = (1.02)t ,	system analogous		identifying zeros
functions,	value,	y = (0.97)t , y =	to the integers,		and asymptotes
including step	exponential, and	(1.01)12t, y =	namely, they are		when suitable
functions and	logarithmic	(1.2)t/10, and	closed under the		factorizations are
absolute value	functions.	classify them	operations of		available, and
functions.		as	addition,		showing end
c. Graph		representing	subtraction, and		behavior.
polynomial		exponential	multiplication; add,		F-IF.C.8 - Write a function
functions,		growth or	subtract, and		defined by an expression
identifying		decay	multiply		in different but
zeros when			polynomials.		equivalent forms to
suitable					reveal and explain
factorizations					different properties of
are available,					the function.
and showing					a. Use the
end behavior.					process of
d. (+) Graph					factoring and
rational					completing the
functions,					square in a
identifying					quadratic
zeros and					function to show
asymptotes					zeros, extreme
when suitable					values, and
factorizations					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.  amplitude.  graph, and interpret these in terms of a context.  A-RELB.4 - Soive 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. Soive quadratic equation is 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 equadratic formula given	.,,, I		Т	
end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.  the form (x - p) 2 = q that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equation is y inspection (e.g., for x2 - 49), taking square roots, completing the square to the first in the form. completing from this form. completing the same solutions. Derive the quadratic formula from this form. completing the square to the first in the form. completing the square to the initial form of the formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives	· ·			
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exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.  ARELB.4 - Solve quadratic equations in one variable.  a. Use the method of completing the square to transform any quadratic functions, showing period, midline, and amplitude.  Berind amplitude.  ARELB.4 - Solve quadratic 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 x 2 + 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				
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Standards for		MP	.1 Make sense of problem	s and persevere in solv	ring them.	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.		
Mathematical Practice	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		

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

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

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					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	Exponential Growth and Decay Functions	Classification of	Properties of Matrices	Graphing
	Expressions	Graphing Exponential Growth and Decay	Polynomials	Operations with Matrices	Complex
	Multiplying Rational	Functions	Operations with	(Addition, subtraction,	Numbers
	Expressions  Dividing Patients	Inverse of relations and functions	Polynomials	scalar multiplication)	Operations with
	Dividing Rational	Logarithmic Functions	Operations with	Operations with Matrices	Complex
	Expressions	Properties of Logarithms (expand and	Polynomials (Long	(multiply 3x3 matrices)	Numbers
	Adding and Subtracting	condense)	Division)	Solving systems of	Evaluate Powers
	Rational Expressions	Solving Exponential and Logarithmic	Factoring	equations using matrices	of <i>i</i>
	Solving Rational Equations	Equations The Natural base of	Polynomials		
	Graphing Rational	The Natural base e	Finding Real Roots		
	Functions Solving Patienal Equations		of Polynomial		
	Solving Rational Equations		Equations		