Chariho Regional School District
MATH CURRICULUM
ALGEBRA II

Unit 1: ***Relations and Functions***

OVERVIEW

Total Number of 90-minute Days for this Unit: 8

LESSON #	LESSON TITLE	# of Days
Lesson 1-1	Functions and Continuity	1
Lesson 1-2	Linearity, Intercepts, and Symmetry	1
Lesson 1-3	Extrema and End Behavior	.5
Lesson 1-4	Sketching Graphs and Comparing Functions	.5
Lesson 1-5	Graphing Linear Functions and Inequalities	1
Lesson 1-6	Special Functions	1
Lesson 1-7	Transformations of Functions	1

ESSENTIAL CONTENT & SKILLS

The major themes of this unit are:

- Students determine if functions are one-to-one and onto.
- Students determine the linearity, intercepts, and symmetry of functions.
- Students analyze and compare graphs.
- Students graph functions and inequalities in two variables.
- Students identify and use transformations of functions.

Content to be learned:

- Identify one-to-one and onto functions.
- Identify discrete and continuous functions.
- Identify intercepts of graphs of functions.
- Identify linear and nonlinear functions.
- Identify extrema of graphs and functions.
- Identify end behavior of graphs of functions.
- Identify graphs that display line or point symmetry.
- Sketch and compare graphs of functions.
- Graph linear functions.

- Graph linear inequalities in two variables.
- Graph piecewise, step, and absolute value functions.
- Translate, dilate & reflect the graphs of functions.

Essential Question:
- How can analyzing a function help you understand the situation it models?

WRITTEN CURRICULUM		
Lesson 1.1	**FOCUS STANDARDS:** **Click on the standard to view the progression of standards.**	CCSS.MATH.CONTENT.F-IF.4 B. Interpret functions that arise in applications in terms of the context (linear, quadratic,exponential, rational, polynomial, square root, cube root, trigonometric, logarithmic). 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. CCSS.MATH.CONTENT.F-IF.5 B. Interpret functions that arise in applications in terms of the context (linear, quadratic,exponential, rational, polynomial, square root, cube root, trigonometric, logarithmic). 5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*
	STANDARDS FOR MATHEMATICAL PRACTICES:	1 - Make sense of problems and persevere in solving them. 7 - Look for and make use of structure.
Lesson 1.2	**FOCUS STANDARDS:** **Click on the standard to view the progression of standards.**	CCSS.MATH.CONTENT.F-IF.4 B. Interpret functions that arise in applications in terms of the context (linear, quadratic,exponential, rational, polynomial, square root, cube root, trigonometric, logarithmic). 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. CCSS.MATH.CONTENT.F-IF.5 B. Interpret functions that arise in applications in terms of the context (linear, quadratic,exponential, rational, polynomial, square root, cube root, trigonometric, logarithmic). 5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*
	STANDARDS FOR MATHEMATICAL PRACTICES:	3 - Construct viable arguments and critique the reasoning of others. 4 - Model with mathematics.
Lesson 1.3	**FOCUS STANDARDS:**	CCSS.MATH.CONTENT.F-IF.4 B. Interpret functions that arise in applications in terms of the context (linear, quadratic,exponential, rational, polynomial, square root, cube root, trigonometric, logarithmic). 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. CCSS.MATH.CONTENT.F-IF.7.c C. Analyze functions using different representations. 7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
	STANDARDS FOR MATHEMATICAL PRACTICES:	2 - Reason abstractly and quantitatively. 5 - Use appropriate tools strategically.
Lesson 1.4	**FOCUS STANDARDS:** **Click on the standard to view the progression of standards.**	CCSS.MATH.CONTENT.F-IF.4 B. Interpret functions that arise in applications in terms of the context (linear, quadratic,exponential, rational, polynomial, square root, cube root, trigonometric, logarithmic). 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. CCSS.MATH.CONTENT.F-IF.9 C. Analyze functions using different representations. 9. Translate among different representations of functions (algebraically, graphically, numerically intables, or by verbal descriptions). Compare properties of two functions each represented in a differentway. *For example, given a graph of one polynomial function (including quadratic functions) and an algebraic expression for another, say which has the larger/smaller relative maximum and/or* *minimum.*
	STANDARDS FOR MATHEMATICAL PRACTICES:	1 - Make sense of problems and persevere in solving them. 6 - Attend to precision.
Lesson 1.5	**FOCUS STANDARDS:** **Click on the standard to view the progression of standards.**	CCSS.MATH.CONTENT.A-CED.3 A. Create equations that describe numbers or relationships. 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non- viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* CCSS.MATH.CONTENT.F-IF.4 B. Interpret functions that arise in applications in terms of the context (linear, quadratic,exponential, rational, polynomial, square root, cube root, trigonometric, logarithmic). 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.
	STANDARDS FOR MATHEMATICAL PRACTICES:	5 - Use appropriate tools strategically. 6 - Attend to precision.
Lesson 1.6	**FOCUS STANDARDS:**	CCSS.MATH.CONTENT.F-IF.4 B. Interpret functions that arise in applications in terms of the context (linear, quadratic,exponential, rational, polynomial, square

	Click on the standard to view the progression of standards.	root, cube root, trigonometric, logarithmic). 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. CCSS.MATH.CONTENT.F-IF.7.b C. Analyze functions using different representations. 7. Graph functions expressed symbolically and 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.
	STANDARDS FOR MATHEMATICAL PRACTICES:	4 - Model with mathematics. 6 - Attend to precision.
Lesson 1.7	**FOCUS STANDARDS:** **Click on the standard to view the progression of standards.**	CCSS.MATH.CONTENT.F-IF.4 B. Interpret functions that arise in applications in terms of the context (linear, quadratic,exponential, rational, polynomial, square root, cube root, trigonometric, logarithmic). 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. CCSS.MATH.CONTENT.F-BF.3 B. Build new functions from existing functions. 3. Identify the effect on the graph of replacing *f(x)* by *f(x) + k*, *k f(x)*, *f(kx)*, and *f(x + k)* for specific values of k (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. (Include recognizing even and odd functions from their graphs and algebraic expressions for them.)
	STANDARDS FOR MATHEMATICAL PRACTICES:	2 - Reason abstractly and quantitatively. 7 - Look for and make use of structure.

Unit 2: ***Linear Equations, Inequalities, and Systems***

OVERVIEW

Number of 90-minute Instructional Days: 8.5

LESSON #	LESSON TITLE	# of Days
Lesson 2.1	Solving Linear Equations and Inequalities	.5
Lesson 2.2	Solving Absolute Value Equations and Inequalities	1
Lesson 2.3	Equations of Linear Functions	1
Lesson 2.4	Solving Systems of Equations Graphically	1
Lesson 2.5	Solving Systems of Equations Algebraically	1
Lesson 2.6	Solving Systems of Inequalities	.5
Lesson 2.7	Optimization with Linear Programming	.5
Lesson 2.8	Systems of Equations in Three Variables	.5
Lesson 2.9	Solving Absolute Value Equations and Inequalities by Graphing	.5

ESSENTIAL CONTENT & SKILLS

The major themes of this unit are:

- Students solve linear equations and inequalities in one variable.
- Students solve equations and inequalities involving absolute value algebraically.
- Students write linear equations in standard, slope-intercept, and point-slope forms.
- Students solve systems of equations by graphing.
- Students solve systems of equations by graphing, substitution or elimination.
- Students solve systems of inequalities in two variables.
- Students use linear programming to find maximum and minimum values of a function.
- Students solve systems of equations in three variables.
- Students solve equations and inequalities involving absolute value by graphing.

Content to be learned:

- Solve linear equations.
- Solve linear inequalities.

- Solve absolute value equations and inequalities
- Write equations of linear functions in standard, slope-intercept, and point-slope form.
- Solve systems of equations by graphing, by substitution, and by elimination.
- Solve systems of inequalities in two variables.
- Use linear programming to find maximum and minimum values of a function.
- Solve systems of equations in three variables.

Essential Questions:

- How are equations, inequalities, and systems of equations or inequalities best used to model real-world situations?

WRITTEN CURRICULUM		
Lesson 2.1	**FOCUS STANDARDS:** **Click on the standard to view the progression of standards.**	CCSS.MATH.CONTENT.A-CED.1 A. Create equations that describe numbers or relationships. 1. Create equations and inequalities in one variable and use them to solve problems. (Include equations arising from linear and quadratic functions, and simple rational and exponential functions.) CCSS.MATH.CONTENT.A-CED.2 A. Create equations that describe numbers or relationships. 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
	STANDARDS FOR MATHEMATICAL PRACTICES:	1 - Make sense of problems and persevere in solving them. 2 - Reason abstractly and quantitatively.
Lesson 2.2		CCSS.MATH.CONTENT.A-CED.1 A. Create equations that describe numbers or relationships. 1. Create equations and inequalities in one variable and use them to solve problems. (Include equations arising from linear and quadratic functions, and simple root and rational functions and exponential functions.) CCSS.MATH.CONTENT.A-CED.3 A. Create equations that describe numbers or relationships. 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non- viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*

	STANDARDS FOR MATHEMATICAL PRACTICES:	4 - Model with mathematics. 7 - Look for and make use of structure.
Lesson 2.3	**FOCUS STANDARDS:** **Click on the standard to view the progression of standards.**	CCSS.MATH.CONTENT.A-CED.2 A. Create equations that describe numbers or relationships. 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. CCSS.MATH.CONTENT.F-IF.6 B. Interpret functions that arise in applications in terms of the context (linear, quadratic,exponential, rational, polynomial, square root, cube root, trigonometric, logarithmic). 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.
	STANDARDS FOR MATHEMATICAL PRACTICES:	1 - Make sense of problems and persevere in solving them. 2 - Reason abstractly and quantitatively. 4 - Model with mathematics.
Lesson 2.4	**FOCUS STANDARDS:** **Click on the standard to view the progression of standards.**	CCSS.MATH.CONTENT.A-CED.3 A. Create equations that describe numbers or relationships. 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non- viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* CCSS.MATH.CONTENT.A-REI.11 D. Represent and solve equations and inequalities graphically. 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.
	STANDARDS FOR MATHEMATICAL PRACTICES:	1 - Make sense of problems and persevere in solving them. 5 - Use appropriate tools strategically.
Lesson 2.5	**FOCUS STANDARDS:**	CCSS.MATH.CONTENT.A-CED.3 A. Create equations that describe numbers or relationships. 3. Represent constraints by equations or inequalities, and by

	Click on the standard to view the progression of standards.	systems of equations and/or inequalities, and interpret solutions as viable or non- viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*
	STANDARDS FOR MATHEMATICAL PRACTICES:	1 - Make sense of problems and persevere in solving them. 6 - Attend to precision.
Lesson 2.6	**FOCUS STANDARDS:** **Click on the standard to view the progression of standards.**	CCSS.MATH.CONTENT.A-CED.3 A. Create equations that describe numbers or relationships. 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non- viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*
	STANDARDS FOR MATHEMATICAL PRACTICES:	3 - Construct viable arguments and critique the reasoning of others. 4 - Model with mathematics.
Lesson 2.7	**FOCUS STANDARDS:** **Click on the standard to view the progression of standards.**	CCSS.MATH.CONTENT.A-CED.3 A. Create equations that describe numbers or relationships. 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non- viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*
	STANDARDS FOR MATHEMATICAL PRACTICES:	4 - Model with mathematics. 5 - Use appropriate tools strategically.
Lesson 2.8	**FOCUS STANDARDS:** **Click on the standard to view the progression of standards.**	CCSS.MATH.CONTENT.A-CED.3 A. Create equations that describe numbers or relationships. 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non- viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*
	STANDARDS FOR MATHEMATICAL	1 - Make sense of problems and persevere in solving them. 8 - Look for and express regularity in repeated reasoning.

	PRACTICES:	
Lesson 2.9	**FOCUS STANDARDS:** **Click on the standard to view the progression of standards.**	CCSS.MATH.CONTENT.A-CED.A.1 A. Create equations that describe numbers or relationships. 1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
	STANDARDS FOR MATHEMATICAL PRACTICES:	1 - Make sense of problems and persevere in solving them. 5 - Use appropriate tools strategically.

Unit 3: ***Quadratic Functions***

OVERVIEW
Number of 90-minute Instructional Days: 9

LESSON #	LESSON TITLE	# of Days
Lesson 3.1	Graphing Quadratic Functions	1
Lesson 3.2	Solving Quadratic Equations by Graphing	.5
Lesson 3.3	Complex Numbers	1
Lesson 3.4	Solving Quadratic Equations by Factoring	1
Lesson 3.5	Solving Quadratic Equations by Completing the Square	1.5
Lesson 3.6	Using the Quadratic Formula and the Discriminant	.5
Lesson 3.7	Quadratic Inequalities	.5
Lesson 3.8	Solving Linear-Nonlinear Systems	1

ESSENTIAL CONTENT & SKILLS

The major themes of this unit are:

- Students graph quadratic functions.
- Students solve quadratic equations by graphing.
- Students perform operations with pure imaginary and complex numbers.
- Students simplify quadratic expressions by using the Square Root Property and completing the square.
- Students use the quadratic formula and discriminant to solve quadratic equations and determine the number of real roots.
- Students graph and solve quadratic inequalities.
- Students solve systems of linear and quadratic equations.

Content to be learned:

- Find and interpret average rate of change of a quadratic function.
- Estimate solutions of quadratic equations by graphing.
- Perform operations with complex numbers.
- Solve quadratic equations by factoring.
- Solve quadratic equations by completing the square.
- Use the discriminant to determine the number and type of roots of a quadratic equation.
- Solve quadratic inequalities in two variables by graphing.
- Solve systems of two quadratic equations.
- Solve systems of nonlinear relations.

Essential Questions:

- What are important characteristics of a quadratic function, and what real-world situations can be modeled by quadratic functions and equations?

WRITTEN CURRICULUM		
Lesson 3.1	**FOCUS STANDARDS:** **Click on the standard to view the progression of standards.**	CCSS.MATH.CONTENT.F-IF.4 B. Interpret functions that arise in applications in terms of the context (linear, quadratic,exponential, rational, polynomial, square root, cube root, trigonometric, logarithmic). 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. CCSS.MATH.CONTENT.F-IF.6 B. Interpret functions that arise in applications in terms of the context (linear, quadratic,exponential, rational, polynomial, square root, cube root, trigonometric, logarithmic). 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.
	STANDARDS FOR MATHEMATICAL PRACTICES:	1 - Make sense of problems and persevere in solving them. 2 - Reason abstractly and quantitatively.
Lesson 3.2	**FOCUS STANDARDS:**	CCSS.MATH.CONTENT.A-CED.2 A. Create equations that describe numbers or relationships. 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. CCSS.MATH.CONTENT.F-IF.4 B. Interpret functions that arise in applications in terms of the context (linear, quadratic,exponential, rational, polynomial, square root, cube root, trigonometric, logarithmic). 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.
	STANDARDS FOR MATHEMATICAL PRACTICES:	4 - Model with mathematics. 5 - Use appropriate tools strategically.
Lesson 3.3	**FOCUS STANDARDS:** **Click on the standard to view the progression of standards.**	CCSS.MATH.CONTENT.N-CN.1 A. Perform arithmetic operations with complex numbers. 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. CCSS.MATH.CONTENT.N-CN.2 A. Perform arithmetic operations with complex numbers. 2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
	STANDARDS FOR MATHEMATICAL PRACTICES:	3 - Construct viable arguments and critique the reasoning of others. 7 - Look for and make use of structure. 8 - Look for and express regularity in repeated reasoning.
Lesson 3.4	**FOCUS STANDARDS:**	CCSS.MATH.CONTENT.N-CN.7 C. Use complex numbers in polynomial identities and equations. 7. Solve quadratic equations with real coefficients that have

	Click on the standard to view the progression of standards.	complex solutions. CCSS.MATH.CONTENT.N-CN.8 C. Use complex numbers in polynomial identities and equations. 8. (+) Extend polynomial identities to the complex numbers. *For example, rewrite* $x^2 + 4$ *as* $(x + 2i)(x – 2i)$. CCSS.MATH.CONTENT.F-IF.8a C. Analyze functions using different representations. 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/or completing the square in quadratic and polynomial functions, where appropriate, to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
	STANDARDS FOR MATHEMATICAL PRACTICES:	1 - Make sense of problems and persevere in solving them. 7 - Look for and make use of structure.
Lesson 3.5	**FOCUS STANDARDS:** **Click on the standard to view the progression of standards.**	CCSS.MATH.CONTENT.N-CN.7 C. Use complex numbers in polynomial identities and equations. 7. Solve quadratic equations with real coefficients that have complex solutions. CCSS.MATH.CONTENT.F-IF.8a C. Analyze functions using different representations. 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/or completing the square in quadratic and polynomial functions, where appropriate, to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
	STANDARDS FOR MATHEMATICAL PRACTICES:	1 - Make sense of problems and persevere in solving them. 7 - Look for and make use of structure.
Lesson 3.6	**FOCUS STANDARDS:** **Click on the standard to view the progression of**	CCSS.MATH.CONTENT.N-CN.7 C. Use complex numbers in polynomial identities and equations. 7. Solve quadratic equations with real coefficients that have complex solutions. CCSS.MATH.CONTENT.N-CN.8

	standards.	C. Use complex numbers in polynomial identities and equations. 8. (+) Extend polynomial identities to the complex numbers. *For example, rewrite* $x^2 + 4$ *as* $(x + 2i)(x – 2i)$. CCSS.MATH.CONTENT.A.SSE.1b A. Interpret the structure of linear, quadratic, exponential, polynomial, and rational expressions. 1. Interpret expressions that represent a quantity in terms of its context. 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.*
	STANDARDS FOR MATHEMATICAL PRACTICES:	1 - Make sense of problems and persevere in solving them. 4 - Model with mathematics.