Algebra 1 Scope & Sequence

Days May Vary	Unit	Standard(s)/Outcome(s)	Essential/Guiding Questions
HS 8-10 MS 18-20	Unit 1: Algebraic Structure	• N.RN.3 Use properties of rational and irrational numbers. Explain why the sum or product of two rational numbers is rational; the sum of a rational number and an irrational number is irrational; and the product of a nonzero rational number and an irrational number is irrational. • A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Recognize the difference between linear and various non-linear functions • A.REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to	• What is the difference between rational and irrational numbers? • How do you perform operations on and use properties of real numbers? • How are equations and inequalities used to solve real world problems? • How can units, the structure of expressions/equations/ inequalities, and mathematical properties help determine a solution strategy?

		justify a solution method. ● A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. ● A.CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*	
HS 9-11 MS 18-20	Unit 2: Polynomials and Factoring	● A.SSE.1 Interpret expressions that represent a quantity in terms of its context, such as terms, factors, and coefficients. ● A.APR.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 polynomial ● A.SSE.2 Use the structure of an expression to identify ways to rewrite it. *For example, see,* $4x^2 - 9y^2$ *as* $(2x)^2 - (3y)^2$*, thus*	● What is the difference between rational and irrational numbers? ● How do you perform operations on and use properties of real numbers? ● How are equations and inequalities used to solve real world problems? ● How can units, the structure of expressions/equations/ inequalities, and mathematical properties help determine a solution

		recognizing it as a difference of squares that can be factored as (2x – 3y)(2x + 3y)	strategy?
			• How are polynomials added and subtracted? • How are polynomials multiplied? • What does it mean to factor a polynomial? • What are the various methods used to factor a polynomial? • How do you completely factor a polynomial?
HS 8-10 MS 16-20	Unit 3: Equations and Inequalities	• A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. • F.BF.1 Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context.	• How can you model a linear relationship graphically? • How can you solve a system of two equations graphically? • How can you determine whether a point is a solution to a linear inequality? • How do you find a solution to a system of inequalities? • Can equations that appear

		- F.LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). - A.CED.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* - A.REI.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). - F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more	to be different be equivalent? What is the difference between a linear equation and inequality?

		complicated cases. ● a. Graph linear functions and show intercepts, maxima, and minima. ● A.REI.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. ● A.REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. ● A.REI.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.	
HS 10-12 MS 20-24	Unit 4: Introduction to Functions	• F.IF.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of *f* is the graph of the equation y = f(x). • F.IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. • A.SSE.1 Interpret expressions that represent a quantity in terms of its context, such as terms, factors, and coefficients. • A.APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under	• How do we determine if a relation is a function? • How do the key features of graphs of linear, exponential, and quadratic functions relate to their models? • How do you distinguish between linear, exponential, and quadratic functions? • How can functions be combined algebraically? • How are models interpreted? • How do you know if a model is a good fit? • What are residuals?

		the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials ● F.IF.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.* ● S.ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. ● S.ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit. ● S.ID.9 Distinguish between correlation and causation. ● S.ID.6 Represent data on two	

		quantitative variables on a scatter-plot, and describe how the variables are related. ● a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or chooses a function suggested by the context. Emphasize linear and exponential models.* ● b. Informally assess the fit of a function by plotting and analyzing residuals. ● CCSS.Math.Content.HSF.BF.B.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.	
HS 8-10	Unit 5: Graphing Functions	● F.IF.7 Graph functions expressed symbolically and	● What are the key properties of the graph of a

MS 16-20		show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and <u>quadratic</u> functions and show intercepts, <u>maxima</u>, and <u>minima.</u> **In standards that repeat across levels, <u>bold underlined</u> words indicate the portion of the statement that is emphasized at this point.* *b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.* ● <u>F.IF.8</u> Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. ● b. Use the properties of exponents tointerpret expressions for exponential functions. *For example, identify percent rate of change in functions such as, and classify them as representing exponential growth or decay.*	quadratic function? ● How do the vertex and zeros of a quadratic function relate to a quadratic model? ● What are the advantages of a quadratic function in vertex form? In standard form?

HS 12-14 MS 24- 26	Unit 6: Solving Quadratic Equations and Comparing Methods	● F.IF.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, maxima, and minima. **_*In standards that repeat across levels, bold underlined words indicate the portion of the statement that is emphasized at this point._** ● A.REI.4 Solve quadratic equations in one variable. Note: Students should learn of the existence of the complex number system, but will not solve quadratics with complex solutions until Algebra II. 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 $x^2 = 49$),	● How are the roots of a quadratic equation determined algebraically? ● How do you solve a quadratic equation? ● How does completing the square relate to vertex form? ● What does the discriminant tell you about the parabola? ● How can formulas be rewritten to reveal more information?

		taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. ● A.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ● F.IF.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 graph, and interpret these in terms of a context.	
HS 11-13 MS 22-26	Unit 7: Comparing Functions and Solving Systems	● A.REI.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with	● What are the differences between linear, quadratic, and exponential functions? ● How can you compare the growth rates of linear, exponential, and quadratic

		the same solutions. ● CCSS.Math.Content.HSA.SSE.A.2 Use the 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).* ● F.BF.2 Write arithmetic and geometric sequences both recursively and with an explicit formula use them to model situations, and translate between the two forms. ● F.LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. ● F.IF.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	functions? ● How can you solve a system of two equations? ● How do you optimize an objective function? ● What are some applications of linear programming?

		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.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.* ● F.IF.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. ● A-CED.A.3 Represent constraints by linear equations, inequalities and systems; interpret solutions as viable	

		and non-viable	
HS 8-10 MS 16-20	Unit 8: Piecewise Functions and Other Functions	• F.BF.4 Find inverse 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. b. (+) Verify by composition that one function is the inverse of another. c.(+) Read values of an inverse function from a graph or a table, given that the function has an inverse. d.(+) Produce an invertible function from a non-invertible function by restricting the domain. (+) represent items that students may or may not be able to do at this level. Composition of functions would be another topic prior to this lesson if time permits.	• How are domain restrictions related to the graph? • How are inverse functions found? • How do you distinguish between various functions?