Campbell County Schools
Algebra IIA
1st Nine Weeks

Mathematical Practices:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Common Core Coding Explanation:

Conceptual Category **Cluster** **Standard #**

A.SSE.A.1

Domains Examples:
SSE- Seeing Structure in Expressions
REI- Reasoning with Equations & Inequalities
CED- Creating Equations that Describe

Domain	Common Core State Standard	Tasks / Suggested Pacing	Textbook Lessons Aligned to Common Core
		15 days	
Description:	Develops the structural similarities between the system of polynomials and the system of integers. Students draw on analogies between polynomial arithmetic and base-ten computation, focusing on properties of operations, particularly the distributive property. Students connect multiplication of polynomials with multiplication of multi-digit integers, and division of polynomials with long division of integers. Students identify zeroes of polynomials, including complex zeroes of quadratic polynomials, and make connections between zeroes of polynomials and solutions of polynomial equations. The unit culminates with the fundamental theorem of algebra. Rational numbers extend the arithmetic of integers by allowing division by all numbers except 0. Similarly, rational expressions extend the arithmetic of polynomials by allowing division by all polynomials except the zero polynomial. A central theme of this unit is that the arithmetic of rational expressions is governed by the same rules as the arithmetic of rational numbers. Students will engage in high level math tasks that provide opportunities to express depths of knowledge using the Mathematical Practices.		

Algebra: Arithmetic with Polynomials and Rational Expressions	**Perform arithmetic operations on polynomials.** • 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.		
	Understand the relationship between zeros and factors of polynomials. • A.APR.A.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).		
Algebra: Arithmetic with Polynomials and Rational Expressions	**Rewrite rational expressions.** • A.APR.D.6. Rewrite simple rational expressions in different forms; write *a(x)/b(x)* in the form *q(x) + r(x)/b(x)*, where *a(x), b(x), q(x),* and *r(x)* are polynomials with the degree of *r(x)* less than the degree of *b(x)*, using inspection, long division, or, for the more complicated examples, a computer algebra system. • 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.		

Number and Quantity: The Real Number System	**Extend the properties of exponents to rational exponents. (Common Core Listed in Algebra I)** • 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 $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = (5)^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.* • N.RN.A.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.		
Algebra: Arithmetic with Polynomials and Rational Expressions	**Understand the relationship between zeros and factors of polynomials.** • A.APR.B.3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.		
Number & Quantity: The Complex Number System	**Perform arithmetic operations with complex numbers.** • 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.		

Functions: Building Functions	**Build a function that models a relationship between two quantities.** • F.BF.A.1. Write a function that describes a relationship between two quantities. ★ a) F.BF.A.1.a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b) F.BF.A.1.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.*		
Algebra: Seeing Structure in Expressions	**Interpret the structure of expressions.** • A.SSE.A.1. Interpret expressions that represent a quantity in terms of its context. ★ a) A.SSE.A.1a. Interpret parts of an expression, such as terms, factors, and coefficients. *b)* A.SSE.A.1b. 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.*		

Algebra: Seeing Structure in Expressions	**Interpret the structure of expressions.** • A.SSE.A.2. Use the structure of an expression to identify ways to rewrite it. *For example, see* $x^4 - y^4$ *as* $(x^2)^2 - (y^2)^2$*, thus recognizing it as a difference of squares that can be factored as* $(x^2 - y^2)(x^2 + y^2)$*.* • A.SSE.A.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★ c) A.SSE.3.c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%*.		
Functions: Interpreting Functions	**Analyze functions using different representations.** • 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. b) F.IF.C.8.b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)12^t$, $y = (1.2)^t/10$, and classify them as representing exponential growth or decay. • F.IF.C.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.		

Algebra: Arithmetic with Polynomials and Rational Expressions	**Use polynomial identities to solve problems.** • A.APR.C.4. Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples. • A.APR.C.5 (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.		
		10 days	
Description:	Students synthesize and generalize what they have learned about functions to create and explore geometric series and sequences. They identify appropriate types of functions to model a sequence situation. They will build on their Algebra 1 knowledge of arithmetic sequences and series. Students will engage in high level math tasks that provide opportunities to express depths of knowledge using the Mathematical Practices.		
Functions: Building Functions	**Build a function that models a relationship between two quantities.** • F.BF.A.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. ★		
Algebra: Seeing Structure in Expressions	**Write expressions in equivalent forms to solve problems.** • A.SSE.B.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*★		

Functions: Linear, Quadratic, & Exponential Models	**Construct and compare linear, quadratic, and exponential models and solve problems.** • F.LE.A.1 Distinguish between situations that can be modeled with ~~linear functions~~ and with exponential functions. a) Prove that linear functions grow by equal distances over equal intervals, and that exponential functions grow by equal factors over equal intervals. c) Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.		
Functions: Linear, Quadratic, & Exponential	**Construct and compare linear, quadratic, and exponential models and solve problems.** • F.LE.A.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).		
Models	**Construct and compare linear, quadratic, and exponential models and solve problems.** • ~~F.LE.A.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.		
Functions: Interpreting Functions	**Understand the concept of a function and use function notation.** • F.IF.A.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by* $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ *for* $n \geq 1$.		

	Functions (linear, quadratic, exponential, radical, rational, systems) *Our thoughts were linear (3 days), quadratic (7 d), polynomial (5 d), radical (3 d), rational (3 d), exponential (4 d), systems and tasks (10 d).*	20 days 1st nine wks 15 days 2nd nine wks	
Description:	Students solve a variety of equations. They extend their work with linear equations to include quadratic, exponential, radical, rational, and exponential equations. They will see that rules for solving equations hold true for all types of equations. The unit culminates with systems where students will combine equations to find overlaps of two or more equations. Students will engage in high level math tasks that provide opportunities to express depths of knowledge using the Mathematical Practices.		
Functions: Interpreting Functions	**Interpret functions that arise in applications in terms of a context.** • 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.★		
Algebra: Creating Equations	**Create equations that describe numbers or relationships.** • A.CED.A.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.*		
Algebra: Reasoning with Equations & Inequalities	**Understand solving equations as a process of reasoning and explain the reasoning.** • A.REI.A.1. Explain each step in solving a simple equation as following from the equality of numbers asserted at each previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.		

Algebra: Reasoning with Equations & Inequalities	**Solve equations and inequalities in one variable.** • A.REI.B.4. Solve quadratic equations in one variable. b) A.REI.B.4.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 complex solutions and write them as $a \pm bi$ for real numbers *a* and *b*.		
Algebra: Reasoning with Equations & Inequalities	**Understand solving equations as a process of reasoning and explain the reasoning.** • A.REI.A.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.		
Number & Quantity: The Complex Number System	**Use complex numbers in polynomial identities and equations.** • N.CN.C.7. Solve quadratic equations with real coefficients that have complex solutions. • N.CN.C.8. (+) Extend polynomial identities to the complex numbers. *For example, rewrite* $x^2 + 4$ *as* $(x + 2i)(x - 2i)$. • N.CN.C.9. (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.		
Geometry: Expressing Geometric Properties with Equations	**Translate between the geometric description and the equation for a conic section** • G.GPE.A.2. Derive the equation of a parabola given a focus and directrix.		
Functions: Linear, Quadratic, & Exponential Models	**Interpret expressions for functions in terms of the situation they model.** • F.LE.B.5. Interpret the parameters in a linear or exponential function in terms of a context.		

Functions: Linear, Quadratic, & Exponential Models	**Construct and compare ~~linear, quadratic, and~~ exponential models.** • F.LE.A.4. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where *a, c,* and *d* are numbers and the base *b* is 2, 10, or *e*; evaluate the logarithm using technology.		
Algebra: Creating Equations	**Create equations that describe numbers or relationships.** • A.CED.A.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.*		*(Find other formulas from chemistry and physics)*
Algebra: Reasoning with Equations & Inequalities	**Solve systems of equations.** • A.REI.C.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.		
Functions: Building Functions	**Build new functions from existing functions.** • F.BF.B.4. Find inverse functions. a) F.BF.B.4a. 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.*		
Algebra: Reasoning with Equations & Inequalities	**Solve systems of equations.** • A.REI.C.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.		

Algebra: Creating Equations	**Create equations that describe numbers or relationships.** • 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.CED.A.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.*		