Unit One: (Weeks 1 - 4) **Allow for time for Pre-Test and in week 1

Big Ideas: Algebra of Functions

- **Understand solving equations as a process of reasoning and explain the reasoning (A- REI)**
- **Solve equations and inequalities in one variable (A-REI)**
- **Understand the relationship between zeros and factors of polynomials (A-APR)**
- **Create equations that describe numbers or relationships (A-CED)**
- **Represent and solve equations and inequalities graphically (A-REI)**
- **Interpret functions that arise in applications in terms of the context (F-IF)**
- **Analyze functions using different representations (F-IF)**

Topics	Assessments & Activities	Standards
Solve and graph linear equations Identify the slope and y-intercept of a linear equation from an equation or from a table Convert linear equations in a variety of formats into slope-intercept form Write equations of lines to represent a problem situation Solve Linear Inequalities of varying difficulty Graph solutions to Linear Inequalities on a number line Graph linear inequalities in 2 variables on the coordinate plane	Quizzes Tests Homework **I can…** • Solve and graph linear equations • Give linear equations in multiple representations – graph, equations, tables • Solve and graph single variable linear inequalities • Graph two-variable linear inequalities • Solve real world applications involving linear equations.	***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 justify a solution method. 2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. 3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. 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). 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-APR*** 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. ***A-CED*** 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.*

Unit Two: (Weeks 5 - 8)

Big Ideas: Geometry of Triangles

- **Define trigonometric ratios and solve problems involving right triangles (G-SRT)**
- **Apply trigonometry to general triangles (G-SRT)**

Topics	Assessments & Activities	Standards
Pythagorean Theorem in Word Problems** Definitions of Trig Functions in Triangles Finding the missing side of the triangle using trig** Finding the missing angle in a triangle using trig** **Focus on a variety of word problems to encourage students to create their own diagrams and determine the sides Applications of the Law of Sines Using Law of Sines to find the area of a non-right triangle Applications of the Law of Cosines	Quizzes Tests Homework **I can…** • Find missing sides of right triangles using Pythagorean Theorem • find missing sides and angles of triangles using trigonometry • solve real life problems using trigonometry	***G-SRT*** 6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. 7. Explain and use the relationship between the sine and cosine of complementary angles. 8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems 9. (+) Derive the formula $A = 1/2\ ab\ \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. 10. (+) Prove the Laws of Sines and Cosines and use them to solve problems. 11. (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Unit Three: (Weeks 9- 11)

Big Ideas: Geometry of Polygons

- **Explain volume formulas and use them to solve problems (G-GMD)**
- **Reason quantitatively and use units to solve problems. (N-Q)**

Topics	Assessments & Activities	Standards
Find the area and perimeter of composite shapes. Find the area and perimeter of polygons. Find the area of regular polygons Find the volume of a variety of figures	Quizzes Tests Homework **Application problems** – finding the area to fertilize and find the area to tile. **I can…** • Find the area of polygons & composite figures • Find the perimeter of polygons & composite figures • Find the volume of 3D figures • Solve real-world problems regarding area, perimeter, and volume.	***G-GMD*** 1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.* 3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems ***N - Q*** 1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. 2. Define appropriate quantities for the purpose of descriptive modeling. 3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Unit Four: (Weeks 12 - 14)

Big Ideas: Algebra of Systems and Matrices

- **Reasoning with Equations and Inequalities (A-REI)**

Topics	Assessments & Activities	Standards
Solving systems using graphing Solving systems using algebra - Substitution - Elimination Solving systems using matrices Perform basic matric operations - Addition - Subtraction - Scalar Multiplication - Multiplying two matrices	Quizzes Tests Homework **I can…** • Solve systems of equations using graphing and algebra • Perform matrix operations • Solve systems of equation using matrices. • Solve real-world problems using systems of equations	**REASONING WITH EQUATIONS AND INEQUALITIES A-REI** Solve systems of equations 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 the same solutions. 6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. 7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.

Unit Five: (Weeks 15 - 17)

Big Ideas: Algebra of Polynomials

- **Interpret the structure of expressions (A-SSE)**
- **Write expressions in equivalent forms to solve problems (A-SSE)**
- **Perform arithmetic operations on polynomials (A- APR)**
- **Rewrite rational expressions (A-APR)**

Topics	Assessments & Activities	Standards
Add polynomial expressions (relate this to combining like terms) Subtract polynomial expressions (reinforce subtracting the entire polynomial in the second parenthesis) Multiplying polynomials **Use Area Model for multiplication to connect to previous unit **Use FOIL Method for binomials **Discuss binomial times trinomial Dividing Polynomials by a Monomial Factoring using a variety of methods, including special patterns, PSN, GCF, and Split the Middle **Show how the division of Polys relates to factoring GCF	Quizzes Tests Homework **Formative Assessments**: Multiplying Polynomials Puzzle Activity **I can…** • Perform polynomial operations • Factor polynomials • Represent polynomials in equivalent forms • Use polynomials to represent real-world scenarios	***A-SSE*** 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.* 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* $(x^2 - y^2)(x^2 + y^2)$ 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 ***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 polynomials. 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

Unit Six: (2nd Semester: Weeks 1 - 3)

Big Ideas: Algebra of Quadratic Functions

- **Understand solving equations as a process of reasoning and explain the reasoning (A- REI)**
- **Solve equations and inequalities in one variable (A-REI)**
- **Represent and solve equations and inequalities graphically (A-REI)**
- **Analyze functions using different representations (F-IF)**

Topics	Assessments & Activities	Standards

Solving quadratic equations
**Square Roots
**Factoring
**Completing the square
**Quadratic Formula
 	
Show the minimums and maximums of quadratics
 	
Understand that x-intercepts of quadratics graphs represent the zeros
 	
Write equations of quadratics to represent a problem situation
 	
Give imaginary solutions for quadratic equations in complex numbers
**Show understanding of the fact that complex solutions mean there is no real solution (no x-intercept)
 	
Perform basic operations with complex numbers
Graph quadratic equations
	Quizzes
	Tests
	Homework
	
	I can…
	
	• Solve quadratic equations by:
	  ○ Using square roots
	  ○ Factoring
	  ○ Completing the Square
	  ○ Quadratic Formula
	  ○ Graphing
	
	• Use and solve quadratic equations to represent real-world scenarios
	
	• Perform basic operations with complex numbers
	
	• Give imaginary solutions for quadratic equations
		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.
		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.
		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.
		A-REI
		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 $x^2 = 49$), 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.

Show the minimums and maximums of quadratics Understand that x-intercepts of quadratics graphs represent the zeros Write equations of quadratics to represent a problem situation		

Unit Seven: (Weeks 4 - 6)

Big Ideas: Algebra of Logarithms

- **Construct and compare logarithmic and exponential models and solve problems (F-LE)**
- **Interpret expressions for functions in terms of the situation they model (F-LE)**

Topics	Assessments & Activities	Standards
Understand the definition of logs Solve logarithmic and exponential equations for a given variable Apply the properties of logarithms to solve problems	Quizzes Tests Homework **I can…** • Use logarithmic equations to solve real-life problems • Use exponential equations to model real-world situations	***F-LE*** 1. Distinguish between situations that can be modeled with linear functions and with exponential functions. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. 2. Construct exponential functions, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). 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. 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. 5. Interpret the parameters in a linear or exponential function in terms of a context

Unit Eight: (Weeks 7 - 9)

Big Ideas: Algebra of Functions

- **Understand the concept of a function and use function notation (F-IF)**
- **Build a function that models a relationship between two quantities (F-BF)**
- **Build new functions from existing functions (F-BF)**

Topics	Assessments & Activities	Standards
Understand and utilize function notation Use function notation to evaluate functions for a specific value Find the inverse of a function and understand the relationship it has to the original function Find the domain and range of a variety of functions (students should be able to find D/R from a graph and from the formula) Understand and use power functions	Quizzes Tests Homework **I can…** • Understand the concept of a function • Use function notation • Develop functions to model real-world situations • Build new functions from existing 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)*. 2. Use function notation, evaluate functions for inputs in their domains, an interpret statements that use function notation in terms of a context. ***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. 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.* c. (+) Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* 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.*

		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 x*3 *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. 5. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

****Note: The Post-Test for the course covers content through Unit 8 *(Post-Test to be given on the building scheduled days)*

The following units are meant to be an introduction to content that will be explored deeper Pre-Calculus – units can be adjusted in the interest of time at the end of the year.

Unit Nine: (Weeks 10 - 11)

Big Ideas: Pre-Calculus of Functions

- **Build new functions from existing functions (F-BF)**

Topics	Assessments & Activities	Standards
Introduction to the 12 Basic Functions Domain and range of functions Understand and apply transformations in an equation to move a graph about the coordinate plane	Quizzes Tests Homework **I can…** • Describe and graph functions and their properties • Build an equation from a graph	***F-BF*** 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.* ***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.**

Unit Ten: (Weeks 12 - 14)

Big Ideas: Pre-Calculus of Unit Circle & Trigonometry

- **Extend the domain of trigonometric functions using the unit circle (F-TF)**

Topics	Assessments & Activities	Standards
Understand that Trig Values come from the Unit Circle and that they repeat Apply properties of trigonometry to find the values of a given angle using the unit circle Utilize reference angles to find the trig value of a given angle measure	Quizzes Tests Homework **I can…** • Find angles in degrees & radians • Compute exact trigonometric values from the unit circle • Understand that angles can be written in multiple ways (coterminal angles) • Find reference angles	***F-TF*** 1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. 2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. 3. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for π/3, π/4 and π/6, and use the unit circle to express the values of sine, cosine, and tangent for π–*x*, π+*x*, and 2π–*x* in terms of their values for *x*, where *x* is any real number.

Unit Eleven: (Weeks 14 - 16)

Big Ideas: Pre-Calculus of Conics

- **Translate between the geometric description and the equation for a conic section (G-GPE)**

Topics	Assessments & Activities	Standards
Graph all 4 types conic sections (circles, ellipses, hyperbolas, and parabolas) Write equations of all 4 types of conic sections given specific information	Quizzes Tests Homework **I can…** • Graph and create the equation of the conic sections	***G-GPE*** 1. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation. 2. Derive the equation of a parabola given a focus and directrix. 3. (+) Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.

Unit Twelve: (Weeks 16 - 18)

Big Ideas: Probability & Statistics

- **Use the rules of probability to compute probabilities of compound events in a uniform probability model (S-CP)**

Topics	Assessments & Activities	Standards
Use Conditional Probability to solve problems Use the Fundamental Counting Principle to solve problems Use combinations and permutations to solve problems	Quizzes Tests Homework **I can…** • Use conditional probability • Use the Fundamental Counting Principle • Use combinations and permutations	***S-CP*** 6. Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model. 7. Apply the Addition Rule, *P*(*A* or *B*) = *P*(*A*) + *P*(*B*) - *P*(*A* and *B*), and interpret the answer in terms of the model. 8. (+) Apply the general Multiplication Rule in a uniform probability model, *P*(*A* and *B*) = *P*(*A*)*P*(*B*|*A*) = *P*(*B*)*P*(*A*|*B*), and interpret the answer in terms of the model. 9. (+) Use permutations and combinations to