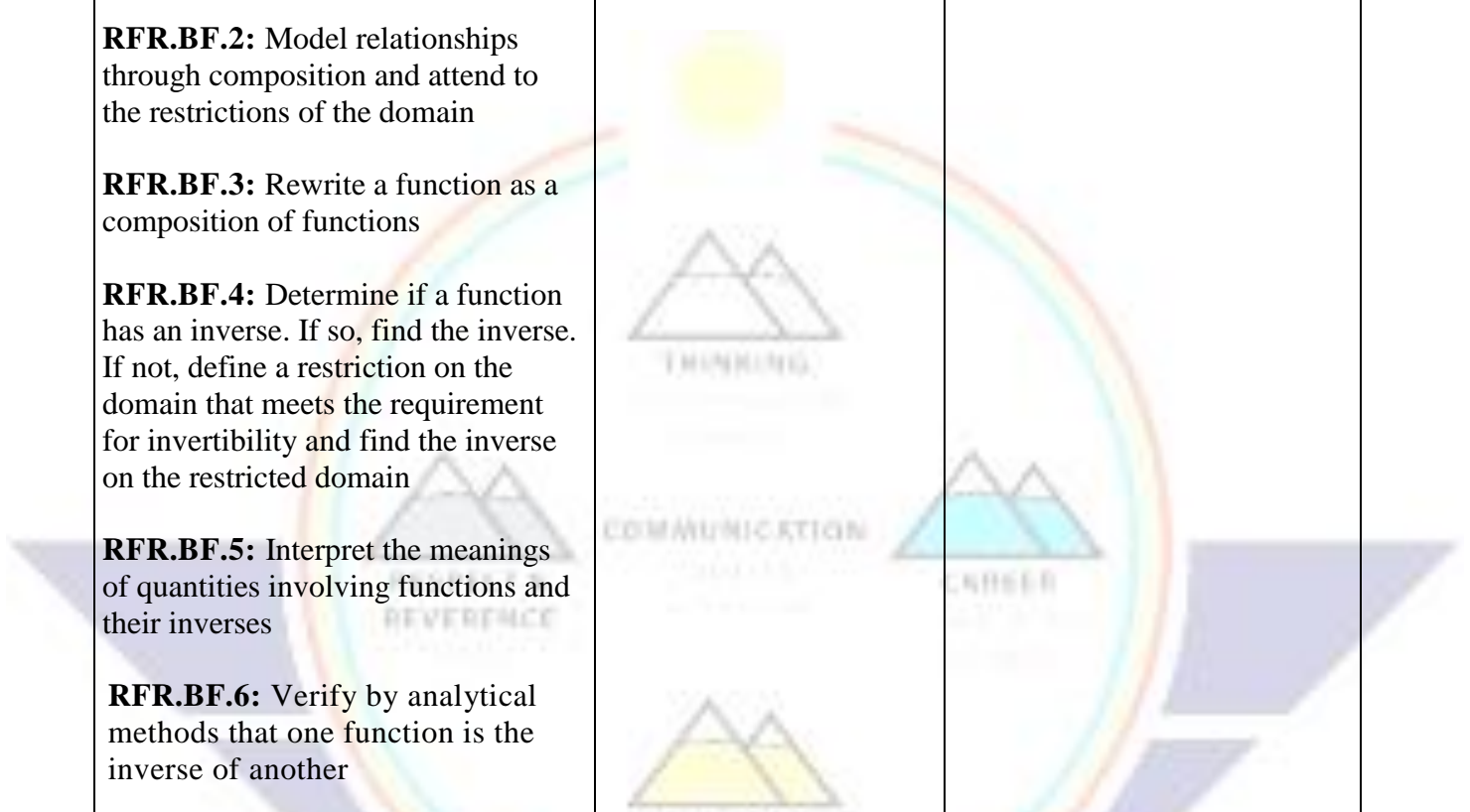


Ganado Unified School District #20

Pre-Calculus/ 11-12

PACING Guide SY 2022-2023


Time Line & Resources <small>(Identify textbook, page number or website link & etc.)</small>	Arizona Mathematics Standards	Essential Question (HESS Matrix)	Learning Goal	Vocabulary (Content/Academic)
First Quarter				
Chapter 0: Preparing for Pre-Calculus	<p>RFR.AF.1: Interpret parameters of a function defined by an expression in the context of the situation.</p> <p>RFR.AF.2: Sketch the graph of a function that models a relationship between two quantities, identifying key features.</p> <p>RFR.AF.3: Interpret key features of graphs and tables for a function that models a relationship between two quantities in terms of the quantities.</p> <p>RFR.AF.4: Use limits to describe long-range behavior, asymptotic behavior, and points of discontinuity.</p> <p>RFR.BF.1: Model relationships between quantities that require adding, subtracting, multiplying, and/or dividing functions</p>	<p>What are the different methods in solving quadratic equations?</p> <p>What is a conjugate?</p>	<p>I will be able to:</p> <ul style="list-style-type: none"> • Use set notation to denote elements, subsets, and complements. • Find the intersections and unions of sets • Perform operations with pure imaginary numbers and complex numbers • Use complex conjugates to write quotients of complex numbers in standard form • Graph quadratic functions • Solve quadratic equations 	<ul style="list-style-type: none"> - Set - Element - Subset - Universal Set - Complement - Union - Intersection - Empty Set - Imaginary Unit - Complex Number - Standard Form - Real Part - Imaginary Part - Imaginary Number - Pure Imaginary Number - Complex Conjugates

	<p>RFR.BF.2: Model relationships through composition and attend to the restrictions of the domain</p> <p>RFR.BF.3: Rewrite a function as a composition of functions</p> <p>RFR.BF.4: Determine if a function has an inverse. If so, find the inverse. If not, define a restriction on the domain that meets the requirement for invertibility and find the inverse on the restricted domain</p> <p>RFR.BF.5: Interpret the meanings of quantities involving functions and their inverses</p> <p>RFR.BF.6: Verify by analytical methods that one function is the inverse of another</p>			
<p>Chapter 1: Function from a Calculus Perspective</p>	<p>RFR.AF.1: Interpret parameters of a function defined by an expression in the context of the situation.</p> <p>RFR.AF.2: Sketch the graph of a function that models a relationship between two quantities, identifying key features.</p> <p>RFR.AF.3: Interpret key features of graphs and tables for a function that models a relationship between two quantities in terms of the quantities.</p>	<p>How will you use data to determine functional relationships between quantities?</p>	<p>I will be able to:</p> <ul style="list-style-type: none"> • Describe subsets of real numbers • Identify and evaluate functions and state their domains • Use graphs of functions to estimate function values • Identify even and odd functions 	<ul style="list-style-type: none"> - Set-builder Notation - Interval Notation - Implied Domain - Piecewise-Defined Function - Relevant Domain - Zeros - Roots - Line Symmetry - Point Symmetry - Even Function - Odd Function

	<p>RFR.AF.4: Use limits to describe long-range behavior, asymptotic behavior, and points of discontinuity.</p> <p>RFR.BF.1: Model relationships between quantities that require adding, subtracting, multiplying, and/or dividing functions</p> <p>RFR.BF.2: Model relationships through composition and attend to the restrictions of the domain</p> <p>RFR.BF.3: Rewrite a function as a composition of functions</p> <p>RFR.BF.4: Determine if a function has an inverse. If so, find the inverse. If not, define a restriction on the domain that meets the requirement for invertibility and find the inverse on the restricted domain</p> <p>RFR.BF.5: Interpret the meanings of quantities involving functions and their inverses</p> <p>RFR.BF.6: Verify by analytical methods that one function is the inverse of another</p>		<ul style="list-style-type: none"> • Use limits to determine the continuity of a function • Use limits to describe the end behavior of functions • Find intervals on which functions are increasing, constant, or decreasing • Determine the average rate of change of a function • Identify, graph, and describe parent functions • Identify and graph transformations of functions • Perform operations with functions • Find composite of functions • Use the horizontal line test to determine whether a function has an inverse function. • Find inverse function algebraically and graphically 	<ul style="list-style-type: none"> - Continuous - Limit - Discontinuous - Infinite - Jump - Point - Removable and Nonremovable Discontinuities - End Behavior - Increasing - Decreasing - Constant - Maximum - Minimum - Extrema - Average Rate of Change - Secant Line - Transformations - Translation - Reflection - Dilation - Parent Square Root - Constant Identity - Quadratic - Cubic - Reciprocal - Absolute Value - Step - Greatest Integer Functions - Composition - Inverse Relation - Inverse Function - One-to-one
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Second Quarter

<p>Chapter 2: Power, Polynomials and Rational Functions</p>	<p>RFR.AF.1: Interpret parameters of a function defined by an expression in the context of the situation.</p> <p>RFR.AF.2: Sketch the graph of a function that models a relationship between two quantities, identifying key features.</p> <p>RFR.AF.3: Interpret key features of graphs and tables for a function that models a relationship between two quantities in terms of the quantities.</p> <p>RFR.AF.4: Use limits to describe long-range behavior, asymptotic behavior, and points of discontinuity.</p> <p>RFR.BF.1: Model relationships between quantities that require adding, subtracting, multiplying, and/or dividing functions</p> <p>RFR.BF.2: Model relationships through composition and attend to the restrictions of the domain</p> <p>RFR.BF.3: Rewrite a function as a composition of functions</p> <p>RFR.BF.4: Determine if a function has an inverse. If so, find the inverse. If not, define a restriction on the</p>	<p>What are the key characteristics of the graph of a power function?</p> <p>What are the key characteristics of the graph of a radical function?</p> <p>What are the key characteristics of the graph of a polynomial function?</p> <p>What are the key characteristics of the graph of a rational function?</p> <p>How do you divide polynomials using long division?</p> <p>How do you divide polynomials using synthetic division?</p> <p>How are long division and synthetic division the same?</p>	<p>I will be able to:</p> <ul style="list-style-type: none"> • Graph and Analyze power functions • Graph and Analyze radical functions and solve radical equations • Graph polynomial functions • Model real-world data with polynomial functions • Divide polynomials using long division • Use the Remainder and Factor Theorems • Find real zeros of polynomial functions • Find complex zeros of polynomial functions • Analyze and graph rational functions • Solve rational equations • Solve polynomial inequalities • Solve rational inequalities 	<ul style="list-style-type: none"> - Power Function - Monomial Function - Radical Function - Extraneous solutions - Polynomial Function - Leading coefficient - Leading-Term test - Turning point - Quadratic Form - Repeated Zero - Multiplicity - Synthetic Division - Depressed Polynomial - Synthetic Substitution - Rational Zero Theorem - Descartes' Rule of Signs - Fundamental Theorem of Algebra - Linear Factorization Theorem - Complex Conjugates - Rational Function - Asymptote - Vertical Asymptote
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	<p>domain that meets the requirement for invertibility and find the inverse on the restricted domain</p> <p>RFR.BF.5: Interpret the meanings of quantities involving functions and their inverses</p> <p>RFR.BF.6: Verify by analytical methods that one function is the inverse of another</p>			<ul style="list-style-type: none"> - Horizontal Asymptote - Oblique Asymptote - Holes - Polynomial Inequality - Sign Chart - Rational Inequality
<p>Chapter 3: Exponential and Logarithmic Functions</p>	<p>RFR.AF.1: Interpret parameters of a function defined by an expression in the context of the situation.</p> <p>RFR.AF.2: Sketch the graph of a function that models a relationship between two quantities, identifying key features.</p> <p>RFR.AF.3: Interpret key features of graphs and tables for a function that models a relationship between two quantities in terms of the quantities.</p> <p>RFR.AF.4: Use limits to describe long-range behavior, asymptotic behavior, and points of discontinuity.</p> <p>RFR.BF.1: Model relationships between quantities that require adding, subtracting, multiplying, and/or dividing functions</p>	<p>How will you identify the domains, ranges, and end behaviors of exponential functions?</p> <p>How will you identify the domains, ranges, and end behaviors of logarithm functions?</p> <p>How will you use the properties of exponents and logarithms to solve exponential and logarithmic equations?</p> <p>What are some means of collecting and organizing data?</p> <p>How do you make and interpret a scatter plot?</p> <p>What is the best line of fit for a scatter plot?</p>	<p>I will be able to:</p> <ul style="list-style-type: none"> • Evaluate, analyze, and graph exponential functions • Solve problems involving exponential growth and decay. • Evaluate expressions involving logarithms • Sketch and analyze graphs of logarithmic functions • Apply properties of logarithms. • Apply the Change of Base Formula. • Apply the One-to-One Property of Exponential Functions to solve equations. • Apply the One-to-One Property of Logarithmic Functions to solve equations. 	<ul style="list-style-type: none"> -Algebraic function -Transcendental function -Exponential function -Natural base -Continuous compound interest -Logarithmic function with base b -Logarithm -Common logarithm -Natural logarithm -Logistic growth function -Linearize

	<p>RFR.BF.2: Model relationships through composition and attend to the restrictions of the domain</p> <p>RFR.BF.3: Rewrite a function as a composition of functions</p> <p>RFR.BF.4: Determine if a function has an inverse. If so, find the inverse. If not, define a restriction on the domain that meets the requirement for invertibility and find the inverse on the restricted domain</p> <p>RFR.BF.5: Interpret the meanings of quantities involving functions and their inverses</p> <p>RFR.BF.6: Verify by analytical methods that one function is the inverse of another</p>	<p>How will you use models to predict and make decisions and critical judgements?</p> <p>What is nonlinear regression?</p> <p><u>PREPARATION FOR CALCULUS:</u> Describe parent functions symbolically and graphically?</p> <p>Determine the domain and range of functions using graphs, tables, and symbols.</p> <p>Use regression to determine the appropriateness of an exponential, logarithmic, logistic, cubic, quartic, or quadratic model.</p>	<ul style="list-style-type: none"> • Model data, using exponential, logarithmic, and logistic functions. 	
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Third Quarter

<p>Chapter 4: Trigonometric Functions</p>	<p>RFR.ETT.1: Model real-world situations involving trigonometry.</p> <p>RFR.ETT.2: Apply the Law of Sines and Law of Cosines to solve problems.</p>	<p>How would you solve triangles?</p> <p>What are the key characteristics of the graphs of trigonometric functions?</p>	<p>I will be able to:</p> <ul style="list-style-type: none"> • Find the values of trigonometric functions for acute angles of right triangles. • Solve right triangles 	<ul style="list-style-type: none"> -Trigonometric functions -Reciprocal function -Inverse trigonometric function -Angles of elevation and depression
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	<p>RFR.ETT.3: Use trigonometry to find the area of triangles.</p> <p>RFR.ETT.4: Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi-x$, $\pi+x$, and $2\pi-x$ in terms of their values for x, where x is any real number.</p> <p>RFR.ETT.5: Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.</p> <p>RFR.ETT.6: Use inverse functions to solve trigonometric equations utilizing real world context; evaluate the solution and interpret them in terms of context.</p> <p>RFR.AF.5: Sketch the graph of all six trigonometric functions, identifying key features.</p>	<p>What are the six trigonometry ratios and their relationships to each other?</p> <p>What is the difference between degree measurement and radian measurements?</p> <p>How are the six trigonometric ratios of any angle found by using the unit circle?</p> <p><u>PREPARATION FOR CALCULUS:</u></p> <p>How would you analyze related rates?</p> <p>How would you integrate trigonometric functions between a range of values?</p>	<ul style="list-style-type: none"> • Convert degree measures of angles to radian measures and vice versa. • Use angle measures to solve real-world problems • Find values of trigonometric functions for any angle. • Find values of trigonometric functions using the unit circle. • Graph transformations of the sine and cosine functions • Use sinusoidal functions to solve problems. • Graph tangent and reciprocal trigonometric functions. • Graph damped trigonometric functions • Evaluate and graph inverse trigonometric functions • Find composition of trigonometric functions • Solve oblique triangles by using the Law of Sines or the Law of Cosines • Find areas of oblique triangles 	<ul style="list-style-type: none"> -Vertex -Initial side -Terminal side -Standard position -Radian -Coterminal angles -Linear speed -Angular speed -Sector -Quadrantal angles -Reference angle -Unit circle -Circular function -Periodic function -Period -Sinusoid -Amplitude -Frequency -Phase shift -Vertical shift -Midline -Damped trigonometric -Damping factor -Damped oscillation -Damped wave -Damped harmonic motion -Arcsine function -Arccosine function -Arctangent function -Oblique triangles -Law of Sines -Law of Cosines -Heron's Formula
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<p>Chapter 5: Trigonometric Identities and Equations</p>	<p>RT.RTS.1: Use the structure of a trigonometric expression to identify ways to rewrite it.</p> <p>RT.RTS.2: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.</p> <p>RT.RTS.3: Solve trigonometric equations</p>	<p>Why would you use trigonometric identities to find trigonometric values?</p> <p>What trigonometric identities would you use to simplify/rewrite trigonometric expressions?</p> <p>What trigonometric identities would you use to verify trigonometric identities?</p> <p>What trigonometric identities would you use to solve trigonometric equations?</p> <p><u>PREPARATION FOR CALCULUS:</u> How would use trigonometric identities to transform expressions into forms that are more suitable for integration and differentiation?</p> <p>How would you use trigonometric substitution for integration?</p>	<p>I will be able to:</p> <ul style="list-style-type: none"> • Identify and use basic trigonometric identities to find trigonometric values • Use basic trigonometric identities to simplify and rewrite trigonometric expressions • Verify trigonometric identities • Determine whether equations are identities • Solve trigonometric equations using algebraic techniques • Solve trigonometric equations using basic identities • Use sum and difference identities to evaluate trigonometric functions • Use sum and difference identities to solve trigonometric equations • Use double-angle, power-reducing, half-angle and product-to-sum identities to evaluate trigonometric expressions and solve trigonometric equations. 	<p>-Identity -Trigonometric identity -Cofunction -Odd-Even identities -Verify an Identity -Reduction Identity</p>
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Fourth Quarter

<p>Chapter 6: Systems of Equations and Matrices</p> <p>Lesson 6-1 through 6-3</p>	<p>RM.UM.1 Use matrices to represent and manipulate data.</p> <p>RM.UM.2 Use matrix operations to solve problems. Add, subtract, and multiply matrices of appropriate dimensions. Multiply matrices by scalars to produce new matrices</p> <p>RM.UM.3 Find the inverse and determinant of a matrix</p> <p>RM.UM.4 Use matrices to solve systems of linear equations.</p>	<p>How you represent and manipulate data using matrices?</p> <p>What does the solution to a system represent?</p> <p>How do I recognize when there are multiple or no solutions and what does that represent?</p> <p>What strategies can I use to solve systems of equations?</p>	<p>I will be able to:</p> <ul style="list-style-type: none"> • Solve systems of linear equations using matrices and Gaussian elimination • Solve systems of linear equations using matrices and Gauss-Jordan elimination • Multiply matrices • Find determinants and inverses of 2X2 and 3X3 matrices • Solve systems of linear equations using inverse matrices • Solve systems of linear equation using Cramer's Rule 	<ul style="list-style-type: none"> - Multivariable linear system - Row-echelon form - Gaussian elimination - Augmented matrix - Coefficient matrix - Reduced row-echelon form - Gauss-Jordan elimination - Identity matrix - Inverse matrix - Inverse - Invertible - Singular matrix - Determinant - Square system - Cramer's Rule
<p>Chapter 7: Conic Sections and Parametric Equations</p> <p>Lesson 7-5 Parametric Equations</p>	<p>RV.MP.1 Model real-world contexts with parametric equations</p> <p>RV.MP.2 Use parametric equations to solve problems</p> <p>RV.MP.3 Graph parametric equations and identify orientation</p> <p>RV.MP.4 Analyze and interpret the graphs of parametric equations</p>	<p>How do I use parametric equations to model real-world situations?</p> <p>How do I solve problems using parametric equations?</p> <p>How do I graph parametric equations?</p>	<p>I will be able to:</p> <ul style="list-style-type: none"> • Graph parametric equations • Solve problems related to the motion of projectiles 	<ul style="list-style-type: none"> - Parametric equation - Parameter - Orientation - Parametric curve
<p>Chapter 8: Vectors</p>	<p>RV.EV.1 Recognize vector quantities as having both magnitude and direction</p> <p>RV.EV.2 Represent vector quantities by directed line segments,</p>	<p>How can you represent physical quantities that you cannot see?</p> <p>How do I convert points and equations from</p>	<p>I will be able to:</p> <ul style="list-style-type: none"> • Represent and operate with vectors geometrically • Solve vector problems and resolve vectors into 	<ul style="list-style-type: none"> - Vector - Initial point - Terminal point - Standard position - Direction - Magnitude

	<p>and use appropriate symbols for vectors and their magnitudes</p> <p>RV.EV.3 Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point</p> <p>RV.EV.4 Solve problems involving velocity and other quantities that can be represented by vectors</p> <p>RV.EV.5 Add and subtract vectors, and multiply a vector by a scalar</p>	<p>rectangular to polar form and vice versa?</p> <p>How do I graph a vector?</p> <p>How do I perform operations with vectors?</p>	<p>their rectangular components</p> <ul style="list-style-type: none"> • Represent and operate with vectors in the coordinate plane • Write a vector as a linear combination of unit vectors • Find the dot product of two vectors and use the dot product to find the angle between them • Find the projection of one vector onto another • Plot points and vectors in the three-dimensional coordinate system • Express algebraically and operate with vectors in space • Find dot products of and angles between vectors in space • Find cross products of vectors in space, and use cross products to find area and volume 	<ul style="list-style-type: none"> - Quadrant bearing - True bearing - Parallel vectors - Equivalent vectors - Opposite vectors - Resultant - Triangle method - Parallelogram method - Zero vector - Components - Rectangular components - Component form - Unit vector - Linear combination - Dot product - Orthogonal - Vector projection - Work - Three-dimensional coordinate system - Z-axis - Octant - Ordered triple - Cross product - Torque - Parallelepiped - Triple scalar product
<p>Chapter 9: Polar Coordinates and Complex Numbers</p> <p>Lesson 9-1 thru 9-3</p>	<p>RT.EPE.1 Graph polar equations</p> <p>RT.EPE.2 Analyze and interpret the graphs of polar equations</p>	<p>Why is it helpful to have more than one coordinate system?</p>	<p>I will be able to:</p> <ul style="list-style-type: none"> • Graph points with polar coordinates • Graph simple polar equations • Graph polar equations 	<ul style="list-style-type: none"> - Polar coordinate system - Pole - Polar axis - Polar coordinates - Polar equation

	<p>RT.EPE.3 Use polar equations to solve problems</p>	 <p>THINKING</p>	<ul style="list-style-type: none"> • Identify and graph classical curves • Convert between polar and rectangular coordinates • Convert between polar and rectangular equations • 	<ul style="list-style-type: none"> - Polar graph - Limcon - Cardoid - Rose - Leminscate - Spiral of Archimedes
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