SDC Precalculus AB Pacing Guide First Nine Weeks		
Unit 1	**Tennessee State Math Standards**	
Revisiting Parent Functions and Graphing	P.F.BF.A.1	Understand how the algebraic properties of an equation transform the geometric properties of its graph. For example, given a function, describe the transformation of the graph resulting from the manipulation of the algebraic properties of the equation (i.e., translations, stretches, reflections, and changes in periodicity and amplitude).
Domain/Range	P.F.IF.A.2	Analyze qualities of exponential, polynomial, logarithmic, trigonometric, and rational functions and solve real world problems that can be modeled with these functions (by hand and with appropriate technology). ★
Even and Odd Functions	P.F.IF.A.1	Determine whether a function is even, odd, or neither.
Relative Extrema,Increasing, Decreasing, and Constant Functions	P.F.IF.A.6	Visually locate critical points on the graphs of functions and determine if each critical point is a minimum, a maximum, or point of inflection. Describe intervals where the function is increasing or decreasing and where different types of concavity occur.
Difference Quotient	P.F.BF.A.4	Construct the difference quotient for a given function and simplify the resulting expression.
Transformation of Functions and Piece-Wise Defined Functions	P.F.BF.A.1	Understand how the algebraic properties of an equation transform the geometric properties of its graph. For example, given a function, describe the transformation of the graph resulting from the manipulation of the algebraic properties of the equation (i.e., translations, stretches, reflections, and changes in periodicity and amplitude).
Analyze Real-World Models	P.F.IF.A.2	Analyze qualities of exponential, polynomial, logarithmic, trigonometric, and rational functions and solve real world problems that can be modeled with these functions (by hand and with appropriate technology).*
Developing Maximum/Minimum Models	P.F.BF.A.3	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 the 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.*
Building Models from Data	P.S.MD.A.1	Create scatter plots, analyze patterns and describe relationships for bivariate data (linear, polynomial, trigonometric or exponential) to model real-world phenomena and to make predictions.
	P.S.MD.A.2	Determine a regression equation to model a set of bivariate data. Justify why this equation best fits the data.

Building Models from Data (con.)	P.S.MD.A.3	Use a regression equation, modeling bivariate data, to make predictions. Identify possible considerations regarding the accuracy of predictions when interpolating or extrapolating.
Unit 2	**Tennessee State Math Standards**	
Analyzing Graphs of Polynomial Functions/End Behavior/Domain/Range	P.F.IF.A.2	Analyze qualities of exponential, polynomial, logarithmic, trigonometric, and rational functions and solve real world problems that can be modeled with these functions (by hand and with appropriate technology). ★
	P.F.IF.A.5	Identify characteristics of graphs based on a set of conditions or on a general equation such as $y = ax^2 + c$.
Symmetry (Y-Axis, Origin)	P.F.IF.A.1	Determine whether a function is even, odd, or neither.
Finding Zeros of a Polynomial Function/Descartes' Rule of Signs/Bound Theorems/Rational Zero Theorem	P.F.IF.A.4	Identify the real zeros of a function and explain the relationship between the real zeros and the x-intercepts of the graph of a function (exponential, polynomial, logarithmic, trigonometric, and rational).
Remainder/Factor Theorem	P.F.IF.A.2	Analyze qualities of exponential, polynomial, logarithmic, trigonometric, and rational functions and solve real world problems that can be modeled with these functions (by hand and with appropriate technology). ★
	P.F.IF.A.4	Identify the real zeros of a function and explain the relationship between the real zeros and the x-intercepts of the graph of a function (exponential, polynomial, logarithmic, trigonometric, and rational).
Intermediate Value Theorem/Bisection	P.F.IF.A.6	Visually locate critical points on the graphs of functions and determine if each critical point is a minimum, a maximum, or point of inflection. Describe intervals where the function is increasing or decreasing and where different types of concavity occur.
Complex Zeros/Fundamental Theorem of Algebra	P.N.NE.A.3	Classify real numbers and order real numbers that include transcendental expressions, including roots and fractions of pi and e.
	P.N.NE.A.4	Simplify complex radical and rational expressions, discuss and display understanding that rational numbers are dense in the real numbers and the integers are not.
	P.N.CN.B.6	Extend polynomial identities to the complex numbers. *For example, rewrite* $x^2 + 4$ *as* $(x + 2i)(x - 2i)$.
	P.N.CN.B.7	Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

Relative Extrema/Increasing and Decreasing Intervals	P.F.IF.A.6	Visually locate critical points on the graphs of functions and determine if each critical point is a minimum, a maximum, or point of inflection. Describe intervals where the function is increasing or decreasing and where different types of concavity occur.
Real-World Models and Analyzing Polynomial Functions	P.F.IF.A.2	Analyze qualities of exponential, polynomial, logarithmic, trigonometric, and rational functions and solve real world problems that can be modeled with these functions (by hand and with appropriate technology). ★
Properties and Graphs of Rational Functions	P.N.NE.A.5	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.
	P.F.IF.A.2	Analyze qualities of exponential, polynomial, logarithmic, trigonometric, and rational functions and solve real world problems that can be modeled with these functions (by hand and with appropriate technology). ★
Properties and Graphs of Rational Functions	P.F.IF.A.4	Identify the real zeros of a function and explain the relationship between the real zeros and the x-intercepts of the graph of a function (exponential, polynomial, logarithmic, trigonometric, and rational).
Points of Discontinuity and End Behavior	P.F.IF.A.6	Visually locate critical points on the graphs of functions and determine if each critical point is a minimum, a maximum, or point of inflection. Describe intervals where the function is increasing or decreasing and where different types of concavity occur.
Vertical, Horizontal, and Oblique Asymptotes with Limits	P.F.IF.A.2	Analyze qualities of exponential, polynomial, logarithmic, trigonometric, and rational functions and solve real world problems that can be modeled with these functions (by hand and with appropriate technology). ★
	P.F.IF.A.7	Graph rational functions, identifying zeros, asymptotes (including slant), and holes (when suitable factorizations are available) and showing end behavior.
Polynomial and Rational Inequalities	P.A.REI.A.3	Solve non-linear inequalities (quadratic, trigonometric, conic, exponential, logarithmic, and rational) by graphing (solutions in interval notation if one-variable), by hand and with appropriate technology.
	P.A.REI.A.4	Solve systems of nonlinear inequalities by graphing.
Unit 3	**Tennessee State Math Standards**	
Composite Functions	P.F.BF.A.2	Develop an understanding of functions as elements that can be operated upon to get new functions: addition, subtraction, multiplication, division, and composition of functions.

Composite Functions (con.)	P.F.BF.A.3	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.*
One-to-One and Inverse Functions	P.N.NE.A.1	Use the laws of exponents and logarithms to expand or collect terms in expressions; simplify expressions or modify them in order to analyze them or compare them.
	P.F.BF.A.5	Find inverse functions (including exponential, logarithmic, and trigonometric).
	P.F.BF.A.6	Explain why the graph of a function and its inverse are reflections of one another over the line y = x.
Properties of Exponential Functions and Logarithmic Functions	P.N.NE.A.1	Use the laws of exponents and logarithms to expand or collect terms in expressions; simplify expressions or modify them in order to analyze them or compare them.
	P.F.IF.A.2	Analyze qualities of exponential, polynomial, logarithmic, trigonometric, and rational functions and solve real world problems that can be modeled with these functions (by hand and with appropriate technology). ★
	P.F.IF.A.4	Identify the real zeros of a function and explain the relationship between the real zeros and the x-intercepts of the graph of a function (exponential, polynomial, logarithmic, trigonometric, and rational).
	P.N.NE.A.1	Use the laws of exponents and logarithms to expand or collect terms in expressions; simplify expressions or modify them in order to analyze them or compare them.
Applications and Analysis of Logarithmic/Exponential/Logistic	P.N.NE.A.2	Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.*
Models (Real-World Models)	P.F.IF.A.2	Analyze qualities of exponential, polynomial, logarithmic, trigonometric, and rational functions and solve real world problems that can be modeled with these functions (by hand and with appropriate technology). ★
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Unit 4	**Tennessee State Math Standards**	
Angles and Their Measure	P.F.TF.A.1	Convert from radians to degrees and degrees to radians.
Trigonometric Equations with a Unit Circle Approach	P.F.TF.A.2	Use special triangles to determine geometrically the values of sine, cosine, tangent for π/3, π/4, 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.

Properties of Trigonometric Functions	P.F.TF.A.2	Use special triangles to determine geometrically the values of sine, cosine, tangent for π/3, π/4, 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.
	P.F.TF.A.3	Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.
	P.N.NE.A.3	Classify real numbers and order real numbers that include transcendental expressions, including roots and fractions of pi and e.
Graphs and Phase Shifts of Sine/Cosine/Other Trigonometric Functions	P.F.GT.A.1	Interpret transformations of trigonometric functions.
	P.F.GT.A.2	Determine the difference made by choice of units for angle measurement when graphing a trigonometric function.
	P.F.GT.A.3	Graph the six trigonometric functions and identify characteristics such as period, amplitude, phase shift, and asymptotes.
	P.F.TF.A.4	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
Trigonometric Identities	P.G.AT.A.1	Use the definitions of the six trigonometric ratios as ratios of sides in a right triangle to solve problems about lengths of sides and measures of angles.
Sum/Difference/Double Angle/Half-Angle Formulas	P.G.TI.A.1	Apply trigonometric identities to verify identities and solve equations. Identities include: Pythagorean, reciprocal, quotient, sum/difference, double-angle, and half-angle.
	P.G.TI.A.2	Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.
Trigonometry and Inverses	P.F.GT.A.6	Determine the appropriate domain and corresponding range for each of the inverse trigonometric functions.
	P.F.GT.A.7	Graph the inverse trigonometric functions and identify their key characteristics.
	P.F.GT.A.8	Graph the inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.
Circular Inverses	P.F.GT.A.4	Find values of inverse trigonometric expressions (including compositions), applying appropriate domain and range restrictions.
	P.F.GT.A.5	Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.

Solving Trigonometric Equations/Real-World Trigonometric Models	P.F.GT.A.8	Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.
Revisiting Right Triangle Trigonometry	P.F.TF.A.2	Use special triangles to determine geometrically the values of sine, cosine, tangent for π/3, π/4, 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.
	P.G.AT.A.1	Use the definitions of the six trigonometric ratios as ratios of sides in a right triangle to solve problems about lengths of sides and measures of angles.
Area of a Sector of a Circle	P.G.AT.A.3	Derive and apply the formulas for the area of the sector of a circle.
Arc Length of a Circle	P.G.AT.A.4	Calculate the arc length of a circle subtended by a central angle.
Law of Sines/Cosines	P.G.AT.A.5	Prove the Laws of Sines and Cosines and use them to solve problems.
Area of a Triangle	P.G.AT.A.2	Derive the formula A = 1/2absin(C) for the area of a triangle by drawing an auxilliary line from a vertex perpendicular to the opposite side.
Real-World Applications Using Law of Sines and Law of Cosines	P.G.AT.A.6	Understand and apply the Law of Sines (including the ambigous case) and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).
Unit 5	**Tennessee State Math Standards**	
Circles, Parabolas, Ellipses, Hyperbolas	P.A.C.A.1	Display all of the conic sections as portions of a cone.
	P.A.C.A.3	From an equation in standard form, graph the appropriate conic section: ellipses, hyperbolas, circles, and parabolas. Demonstrate an understanding of the relationship between their standard algebraic form and the graphical characteristics.
	P.A.C.A.4	Transform equations of conic sections to convert between general and standard form.
Ellipse/Hyperbola Derivation	P.A.C.A.2	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.
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Unit 6	**Tennessee State Math Standards**	
Graphing Parametric Equations by Hand and with Technology	P.A.PE.A.1	Graph curves parametrically (by hand and with appropriate technology).
Finding Rectangular Equations for a Curve/Parametric Equations by Rectangular Equations	P.A.PE.A.2	Eliminate parameters by rewriting parametric equations as a single equation.

Time and Parametric Equations	P.A.PE.A.1	Graph curves parametrically (by hand and with appropriate technology).
	P.A.PE.A.2	Eliminate parameters by rewriting parametric equations as a single equation.
Unit 7	**Tennessee State Math Standards**	
Plotting Polar Coordinates	P.N.CN.A.3	Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex represent the same number.
Converting and Graphing from Polar to Rectangular Coordinates and Rectangular to Polar Coordinates	P.G.PC.A.1	Graph functions in polar coordinates.
	P.G.PC.A.2	Convert between rectangular and polar coordinates.
Graphing Polar Equations by Plotting Points in the Complex Plane	P.G.PC.A.3	Represent situations and solve problems involving polar coordinates. ★
Converting Complex Numbers from Rectangular Form to Polar Form	P.N.CN.A.4	Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. For example, $(-1 + 3i)^3 = 8$ because (-1 + 3i) has modulus 2 and argument 120˚.
Products and Quotients of Complex Numbers in Polar Form	P.N.CN.A.1	Perform arithmetic operations with complex numbers expressing answers in a + bi form.
	P.N.CN.A.5	Calculate the distance between numbers in the complex plane as the modules of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.
DeMoivre's Theorem	P.N.CN.A.4	Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. For example, $(-1 + 3i)^3 = 8$ because (-1 + 3i) has modulus 2 and argument 120˚.
	P.N.CN.A.5	Calculate the distance between numbers in the complex plane as the modules of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.
Complex Roots	P.N.CN.A.1	Perform arithmetic operations with complex numbers expressing answers in a + bi form.
	P.N.CN.A.2	Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.
Converting and Graphing from Polar to Rectangular Coordinates and Rectangular to Polar Coordinates	P.G.PC.A.1	Graph functions in polar coordinates.
	P.G.PC.A.2	Convert between rectangular and polar coordinates.
Graphing Polar Equations by Plotting Points in the Complex Plane	P.G.PC.A.3	Represent situations and solve problems involving polar coordinates. ★

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Complex Roots	P.N.CN.A.1	Perform arithmetic operations with complex numbers expressing answers in a + bi form.
	P.N.CN.A.2	Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.
Unit 8	**Tennessee State Math Standards**	
Arranging Data	P.N.VM.C.7	Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.
Scalar Multiplication	P.N.VM.C.8	Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.
Operations with Matrices	P.N.VM.C.9	Add, subtract, and multiply matrices of appropriate dimensions.
	P.N.VM.C.10	Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.
	P.N.VM.C.11	Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.

Finding Area Using Matrices	P.N.VM.C.13	Work with 2 X 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.
Augmented/Inverse Form of a Matrix	P.A.REI.A.2	Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 X 3 or greater).
Matrix Equations and Vector Variables	P.N.VM.C.12	Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.
	P.A.REI.A.1	Represent a system of linear equations as a single matrix equation in a vector variable.
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Unit 9	**Tennessee State Math Standards**	
Vectors and Graphing	P.N.VM.A.1	Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes. (e.g., **v**, **|v|**, **||v||**, v).
	P.N.VM.A.2	Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.
Position Vectors	P.N.VM.A.1	Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes. (e.g., **v**, **|v|**, **||v||**, v).
Addition and Subtraction Properties of Vectors	P.N.VM.B.4	Add and subtract vectors.
A Scalar Multiple and Magnitude of a Vector	P.N.VM.B.5	Multiply a vector by a scalar.
A Unit Vector	P.N.VM.A.1	Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes. (e.g., **v**, **|v|**, **||v||**, v).
	P.N.VM.A.2	Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.
Vectors/Magnitude and Direction	P.N.VM.B.4	Add and subtract vectors.
	P.N.VM.B.5	Multiply a vector by a scalar.
Dot Product of Two Vectors	P.N.VM.B.6	Calculate and interpret the dot product of two vectors.
Problem Solving with Vectors	P.N.VM.A.3	Solve problems involving velocity and other quantities that can be represented by vectors.
Unit 10	**Tennessee State Math Standards**	
Recursive and Explicit Sequences	P.A.S.A.1	Demonstrate an understanding of sequences by representing them recursively and explicitly.

Recursive and Explicit Sequences (con.)	P.A.S.A.2	Use sigma notation to represent a series; expand and collect expressions in both finite and infinite settings.
	P.F.IF.A.8	Recognize that sequences are functions, sometimes defined recursively, showe 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 ≥ 1.
Summation Notation	P.A.S.A.3	Derive and use the formulas for the general term and summation of finite and infinite arithmetic and geometric series, if they exist.
Arithmetic and Geometric Sequences and Series/Convergence or Divergence of a Arithmetic or Geometric Series	P.A.S.A.3	Derive and use the formulas for the general term and summation of finite and infinite arithmetic and geometric series, if they exist.
Math Induction Proofs	P.A.S.A.4	Understand that series represent the approximation of a number when truncated; estimate truncation error in specific examples.
Binomial Theorem	P.A.S.A.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.
Permutations, Combinations, and Binomial Probability	P.A.S.A.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.
Precalculus AB Honors Future Coursework (Fourth Nine Weeks Continued)		
Limit of a Function		
Derivative of a Function		
Integral of a Function (Area Under Curve)		

★	Mathematical Modeling and tasks have a real-world context.