GSE Honors Pre-Calculus Pacing Guide 2020 – 2021

# of days	Unit	GSE Standards
	1st Semester	
20	Unit 1 – Trig Basics	***MGSE9-12.F.TF.1*** Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. ***MGSE9-12.F.TF.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. ***MGSE9-12.F.TF.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. ***MGSE9-12.F.TF.4*** Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.
21	Unit 2 – Graphing Trig Functions	***MGSE9-12.F.IF.4*** Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. ***MGSE9-12.F.IF.7*** Graph functions expressed algebraically and show key features of the graph both by hand and by using technology. ***MGSE9-12.F.IF.7e*** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. ***MGSE9-12.F.TF.5*** Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. ***MGSE9-12.F.BF.4*** Find inverse functions. ***MGSE9-12.F.BF.4d*** Produce an invertible function from a non-invertible function by restricting the domain.
30	Unit 3 – Equations and Identities	***MGSE9-12.F.TF.8*** Prove the Pythagorean identity (sin A)2+ (cos A)2= 1 and use it to find sin A, cos A, or tan A, given sin A, cos A, or tan A, and the quadrant of the angle. ***MGSE9-12.F.TF.6*** Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed. ***MGSE9-12.F.TF.7*** 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. ***MGSE9-12.F.TF.9*** Prove addition, subtraction, double and half-angle formulas for sine, cosine, and tangent and use them to solve problems.
15	Unit 4 – Trig of General Triangles	***MGSE9-12.G.SRT.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. ***MGSE9-12.G.SRT.10*** Prove the Laws of Sines and Cosines and use them to solve problems. ***MGSE9-12.G.SRT.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).

2nd Semester		
25	Unit 5 – Conic Sections	***MGSE9-12.G.GPE.2*** Derive the equation of a parabola given a focus and directrix. ***MGSE9-12.G.GPE.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. ***MGSE9-12.A.REI.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 $x^2 + y^2 = 3$.
20	Unit 6 - Matrices	***MGSE9-12.N.VM.6*** Use matrices to represent and manipulate data, e.g., transformations of vectors. ***MGSE9-12.N.VM.7*** Multiply matrices by scalars to produce new matrices. ***MGSE9-12.N.VM.8*** Add, subtract, and multiply matrices of appropriate dimensions. ***MGSE9-12.N.VM.9*** Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties. ***MGSE9-12.N.VM.10*** 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. ***MGSE9-12.N.VM.12*** Work with 2 X 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area. ***MGSE9-12.A.REI.8*** Represent a system of linear equations as a single matrix equation in a vector variable ***MGSE9-12.A.REI.9*** Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3×3 or greater).
20	Unit 7 – Vectors	***MGSE9-12.N.VM.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). ***MGSE9-12.N.VM.2*** Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. ***MGSE9-12.N.VM.3*** Solve problems involving velocity and other quantities that can be represented by vectors. ***MGSE9-12.N.VM.4*** Add and subtract vectors. ***MGSE9-12.N.VM4a*** Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes. ***MGSE9-12.N.VM4b*** Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum. ***MGSE9-12.N.VM4c*** Understand vector subtraction v – w as v + (–w), where (–w) is the additive inverse of w, with the same magnitude as w and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise. ***MGSE9-12.N.VM.5*** Multiply a vector by a scalar. ***MGSE9-12.N.VM.5a*** Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as c(vx, vy) = (cvx, cvy).

		MGSE9-12.N.VM.5b Compute the magnitude of a scalar multiple cv using ||cv|| = |c|v. Compute the direction of cv knowing that when |c|v = 0, the direction of cv is either along v (for c > 0) or against v (for c < 0). ***MGSE9-12.N.VM.11*** 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.
15	Unit 8 – Complex Numbers and Polar Form	***MGSE9-12.N.CN.3*** Find the conjugate of a complex number; use the conjugate to find the absolute value (modulus) and quotient of complex numbers. **MGSE9-12.N.CN.4** 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 number represent the same number. ***MGSE9-12.N.CN.5*** 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°. ***MGSE9-12.N.CN.6*** Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.
10	Unit 9 – Algebra Review	