

## Curriculum Sequence: Pre-Calculus

Conceptual Category	Domain	Standard	Sequence and Duration
<u>Number and Quantity (N)</u>	Vector and Matrix Quantities	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., $\mathbf{v}$ , $ \mathbf{v} $ , $  \mathbf{v}  $ , $v$ ).	3
		N-VM.2. (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.	3
		N-VM.3. (+) Solve problems involving velocity and other quantities that can be represented by vectors.	3
		N-VM.4. (+) Add and subtract vectors. a. 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. b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum. c. Understand vector subtraction $\mathbf{v} - \mathbf{w}$ as $\mathbf{v} + (-\mathbf{w})$ , where $-\mathbf{w}$ is the additive inverse of $\mathbf{w}$ , with the same magnitude as $\mathbf{w}$ and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.	3
		N-VM.5. (+) Multiply a vector by a scalar. a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as $c(v_x, v_y) = (cv_x, cv_y)$ . b. Compute the magnitude of a scalar multiple $c\mathbf{v}$ using $  c\mathbf{v}   =  c  \mathbf{v}  $ . Compute the direction of $c\mathbf{v}$ knowing that when $ c \mathbf{v} \neq 0$ , the direction of $c\mathbf{v}$ is either along $\mathbf{v}$ (for $c > 0$ ) or against $\mathbf{v}$ (for $c < 0$ ).	3
	The Complex Number System	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.	3
<u>Algebra (A)</u>	Reasoning with Equations and Inequalities	A-REI.1. Apply properties of mathematics to justify steps in solving equations in one variable.	1
<u>Functions (F)</u>	Interpreting Functions	F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more	1

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		complicated cases.* a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros (using technology) or algebraic methods when suitable factorizations are available, and showing end behavior. d. (+) Graph rational functions, identifying zeros and discontinuities (asymptotes/holes) using technology, and algebraic methods when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	
	Trigonometric Functions	F-TF.1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	2
		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.	2
		F-TF.3. (+) 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, cosines, and tangent for $\pi-x$ , $\pi+x$ , and $2\pi-x$ in terms of their values for $x$ , where $x$ is any real number.	2
		F-TF.4. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.	2
		F-TF.5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.*	2
		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.	2
		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.*	2
		F-TF.8. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to calculate trigonometric ratios.	2

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		F-TF.9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.	2
Geometry (G)	Similarity, Right Triangles, and 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.	3
		G-SRT.7. Explain and use the relationship between the sine and cosine of complementary angles.	3
		G-SRT.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.*	3
		G-SRT.9. (+) Derive the formula $A = \frac{1}{2} ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.	3
		G-SRT.10. (+) Prove the Laws of Sines and Cosines and use them to solve problems	3
		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).	3
<b>Standard</b>			
*Based on College Board Standards			4
Limits *			4
Derivatives *			4
Integral *			4