

**MATH**  
**Learning Expectations for Pre-Calculus**

CRLS Learning Expectations	Mass. Standard	Topic/Theme	Key Understandings	Assessments/Evidence
	PC.N.1	Number Sense & Operations	<p>Students will:</p> <p>Plot complex numbers using both rectangular and polar coordinates systems.</p> <p>Represent complex numbers using polar coordinates, i.e., <math>a + bi = r(\cos q + i \sin q)</math>.</p> <p>Apply DeMoivre's theorem to multiply, take roots, and raise complex numbers to a power.</p>	
	PC.P.1	Patterns, Relations, & Algebra	Use mathematical induction to prove theorems and verify summation formulas, e.g., verify	
PC.P.2	Relate the number of roots of a polynomial to its degree. Solve quadratic equations with complex coefficients.			
PC.P.3	Demonstrate an understanding of the trigonometric functions (sine, cosine, tangent, cosecant, secant, and cotangent). Relate the functions to their geometric definitions.			
PC.P.4	Explain the identity $\sin^2 q + \cos^2 q = 1$ . Relate the identity to the Pythagorean theorem.			
PC.P.5	Demonstrate an understanding of the formulas for the sine and cosine of the sum or the difference of two angles. Relate the formulas to DeMoivre's theorem and use them to prove other trigonometric identities. Apply to the solution of problems.			

CRLS Learning Expectations	Mass. Standard	Topic/Theme	Key Understandings	Assessments/Evidence
	PC.P.6  PC.P.7  PC.P.8  PC.P.9		<p>Students will:</p> <p>Understand, predict, and interpret the effects of the parameters <math>a</math>, <math>w</math>, <math>b</math>, and <math>c</math> on the graph of <math>y = a\sin(w(x - b)) + c</math>; similarly for the cosine and tangent. Use to model periodic processes. (12.P.13)</p> <p>Translate between geometric, algebraic, and parametric representations of curves. Apply to the solution of problems.</p> <p>Identify and discuss features of conic sections: axes, foci, asymptotes, and tangents. Convert between different algebraic representations of conic sections.</p> <p>Relate the slope of a tangent line at a specific point on a curve to the instantaneous rate of change. Explain the significance of a horizontal tangent line. Apply these concepts to the solution of problems.</p>	
	PC.G.1  PC.G.2	Geometry	<p>Demonstrate an understanding of the laws of sines and cosines. Use the laws to solve for the unknown sides or angles in triangles. Determine the area of a triangle given the length of two adjacent sides and the measure of the included angle.</p> <p>Use the notion of vectors to solve problems. Describe addition of vectors, multiplication of a vector by a scalar, and the dot product of two vectors, both symbolically and geometrically. Use vector methods to obtain geometric results.</p> <p>Apply properties of angles, parallel lines, arcs, radii, chords, tangents, and secants to solve problems.</p>	

CRLS Learning Expectations	Mass. Standard	Topic/Theme	Key Understandings	Assessments/Evidence
	PC.M.1  PC.M.2	Measurement	Students will: Describe the relationship between degree and radian measures, and use radian measure in the solution of problems, in particular problems involving angular velocity and acceleration.  Use dimensional analysis for unit conversion and to confirm that expressions and equations make sense.	
	PC.D.1  PC.D.2  PC.D.3  PC.D.4  PC.D.1	Data Analysis, Statistics, & Probability	Design surveys and apply random sampling techniques to avoid bias in the data collection.  Apply regression results and curve fitting to make predictions from data.  Apply uniform, normal, and binomial distributions to the solutions of problems.  Describe a set of frequency distribution data by spread (variance and standard deviation), skewness, symmetry, number of modes, or other characteristics. Use these concepts in everyday applications.  Compare the results of simulations (e.g., random number tables, random functions, and area models) with predicted probabilities.	