



North Carolina Essential Standards Pre-Calculus

Note on Numbering: **N**–Number and Operations, **A**–Algebra, **G**–Geometry, **M**–Measurement, **S**–Statistics and Probability and **D**–Discrete Mathematics

Algebra

	Essential Standard	Clarifying Objectives	
PCL.A.1	Analyze the characteristics of exponential (including e^x), natural logarithmic and trigonometric functions.	PCL.A.1.1	Identify theoretical and practical domain and range.
		PCL.A.1.2	Calculate the zeros, extrema, and intercepts.
		PCL.A.1.3	Identify intervals for which the function is continuous and/or discontinuous, increasing and/or decreasing.
		PCL.A.1.4	Describe end behavior and any asymptotic behavior.
		PCL.A.1.5	Compare different types of functions.
		PCL.A.1.6	Describe horizontal and vertical shifts as well as the stretching and shrinking of a function in comparison to the parent function.
		PCL.A.1.7	Analyze connections among relationships represented in numeric/tabular, symbolic, graphical and verbal forms.
PCL.A.2	Use the limit of a function graphically, numerically and algebraically.	PCL.A.2.1	Evaluate the limit of a function (graphically and algebraically) as x approaches a certain value.
		PCL.A.2.2	Evaluate the limit of a function, as x approaches infinity.
		PCL.A.2.3	Identify behavior of a function associated with non-existence of a limit.
		PCL.A.2.4	Use limits to identify continuity at a point.
PCL.A.3	Use functions (polynomial, power, rational, exponential, logarithmic, logistic, piecewise-defined functions and greatest integer) to solve problems.	PCL.A.3.1	Use graphs and algebraic properties to solve problems.
		PCL.A.3.2	Understand the relationship between the exponential and logarithmic functions.
		PCL.A.3.3	Use the laws of exponents to prove the basic properties of a natural logarithm.
PCL.A.4	Use properties and attributes of rational, exponential, logarithmic and trigonometric functions to solve problems.	PCL.A.4.1	Use calculator-generated models of linear, polynomial, exponential, trigonometric, power, logistic and logarithmic functions of bivariate data to solve problems.
		PCL.A.4.2	Interpret the constants, coefficients and bases in the context of the data.
		PCL.A.4.3	Use the most appropriate model to draw conclusions and make predictions.
		PCL.A.4.4	Use composition and inverse of functions to solve problems.

	Essential Standard	Clarifying Objectives	
PCL.A.5	Use algebraic properties to solve problems involving trigonometric and inverse trigonometric functions; justify results.	PCL.A.5.1	Generate trigonometric functions on the unit circle.
		PCL.A.5.2	Analyze functions with respect to period, amplitude, and vertical and horizontal shifts, shrinks, and stretches.
		PCL.A.5.3	Apply the law of sines and the law of cosines to solve problems.
		PCL.A.5.4	Use Pythagorean, sum, difference, double angle and half-angle identities to find exact values and establish other identities.
		PCL.A.5.5	Use graphs and algebraic properties to solve and interpret the constants and coefficients of polar equations.

Geometry

	Essential Standard	Clarifying Objectives	
PCL.G.1	Use vectors in two dimensions to model and solve problems.	PCL.G.1.1	Represent vectors using addition, subtraction, and scalar multiplication.
		PCL.G.1.2	Use both position and component representations of vectors to solve problems.
		PCL.G.1.3	Use parametric equations to solve problems representing linear and non-linear motion.
		PCL.G.1.4	Use complex numbers as vectors to solve problems.
PCL.G.2	Analyze three-dimensional figures.	PCL.G.2.1	Use cross-sectional shapes of slices of three-dimensional objects to solve problems.
		PCL.G.2.2	Use three-dimensional objects traced out by rotations of two-dimensional objects, with and without dynamic software to solve problems.
PCL.G.3	Use properties of conic sections (parabola, circle, ellipse and hyperbola) to solve problems.	PCL.G.3.1	Identify conic sections and the characteristics of each, (parabola, circle, ellipse and hyperbola).
		PCL.G.3.2	Use tables, graphs and algebraic properties to solve problems.
		PCL.G.3.3	Use conic sections to model and solve real world situations.
		PCL.G.3.4	Interpret the constants and coefficients in the context of the problem.
		PCL.G.3.5	Describe the results of transformations algebraically and geometrically.

	Essential Standard	Clarifying Objectives	
		PCL.G.3.6	Use parametric equations to develop representations of conic sections.

Statistics and Probability

	Essential Standard	Clarifying Objectives	
PCL.S.1	Analyze the behavior of recursively-defined functions.	PCL.S.1.1	Calculate the sum of a finite sequence.
		PCL.S.1.2	Calculate the sum of an infinite sequence.
		PCL.S.1.3	Differentiate between the convergence or divergence of a given series.
		PCL.S.1.4	Translate between recursive and explicit representations.
PCL.S.2	Differentiate between probabilities of dependent and independent events.	PCL.S.2.1	Evaluate whether events are mutually exclusive and compute the probability of the given event.
		PCL.S.2.2	Explain how to compute the probability of an event not occurring.
		PCL.S.2.3	Use permutations and combinations to determine the number of ways events can occur and compute the probability of the event occurring.
PCL.S.3	Analyze the relationship of combinations to the Binomial Theorem and Pascal's Triangle.	PCL.S.3.1	Use the Binomial Theorem to expand powers of binomials.
		PCL.S.3.2	Explain how Pascal's triangle is related to combinations and to the Binomial Theorem.
PCL.S.4	Generate simulations for probability models.	PCL.S.4.1	Execute experiments using manipulatives, computers, calculators or geometric models in order to compute probabilities.
		PCL.S.4.2	Evaluate the reasonableness of the results and identify any misconceptions.