Mathematics **Brunswick School Department**

Precalculus: Honors
Unit 2: Trigonometric Functions

Essential Understandings	▪ Trigonometric functions have many applications in the real world. ▪ Trigonometry is one of the oldest and most useful branches of mathematics.
Essential Questions	▪ What are the different ways of describing angles? ▪ What is a unit circle and explain its relationship to real numbers? ▪ How are trigonometric functions evaluated? ▪ When are fundamental identities used? ▪ How are trigonometric functions graphed? ▪ What are inverse trigonometric functions? ▪ What real-life problems are modeled by trigonometric functions?
Essential Knowledge	▪ One radian is the measure of a central angle that intercepts an arc equal in length to the radius of the circle. ▪ A unit circle is a circle with a radius of one unit. ▪ Trigonometric functions of a unit circle with t as a real number and (x,y) be a point on the unit circle corresponding to t.…sin t=y, cos t =x, tan t=y/x, csc t=1/y, sec t=1/x,cot t=x/y. ▪ The inverse of the sine function is y = arcsin x if and only if sin y = x.
Vocabulary	▪ Terms: o Trigonometry, negative angles, central angles, linear speed, angular speed, unit circle, sine, cosecant, cosine, secant, tangent, cotangent, periodic, period, reference angle, amplitude, phase shift, inverse functions, radian, unit circle, co-terminal angles
Essential Skills	▪ Describe an angle and convert between degree and radian measure. ▪ Identify a unit circle and its relationship to real numbers. ▪ Evaluate trigonometric functions of any angle. ▪ Use fundamental trigonometric identities. ▪ Sketch graphs of trigonometric functions. ▪ Evaluate inverse trigonometric functions. ▪ Use trigonometric functions to model and solve real-life problems. ▪ Change an angle from degree measure to radian measure. ▪ Use the unit circle to evaluate the six trigonometric functions of theta. ▪ Evaluate the six trigonometric functions at any real number. ▪ Evaluate the six trigonometric functions of any angle in radians or degrees. ▪ Sketch the graph of a trigonometric function. ▪ Sketch the graph of an inverse function. ▪ Model trigonometric relationships. ▪ Evaluate the compositions of trigonometric functions. ▪ Apply sinusoidal functions.

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Related Maine Learning Results	Mathematics A. Number Real Number A1. Students will know how to represent and use real numbers. a. Use the concept of nth root. b. Estimate the value(s) of roots and use technology to approximate them. c. Compute using laws of exponents. d. Multiply and divide numbers expressed in scientific notation. e. Understand that some quadratic equations do not have real solutions and that there exist other number systems to allow for solutions to these equations. B. Data Measurement and Approximation B1. Students understand the relationship between precision and accuracy. a. Express answers to a reasonable degree of precision in the context of a given problem. b. Represent an approximate measurement using appropriate numbers of significant figures. c. Know that most measurements are approximations and explain why it is useful to take the mean of repeated measurements. Data Analysis B2. Students understand correlation and cause and effect. a. Recognize when correlation has been confused with cause and effect. b. Create and interpret scatter plots and estimate correlation and lines of best fit. c. Recognize positive and negative correlations based on data from a table or scatter plot. d. Estimate the strength of correlation based upon a scatter plot. B3. Students understand and know how to describe distributions and find and use descriptive statistics for a set of data. a. Find and apply range, quartiles, mean absolute deviation, and standard deviation (using technology) of a set of data. b. Interpret, give examples of, and describe key differences among different types of distributions: uniform, normal, and skewed. c. For the sample mean of normal distributions, use the standard deviation for a group of observations to establish 90%, 95%, or 99% confidence intervals.

Related Maine Learning Results	B4. Students understand that the purpose of random sampling is to reduce bias when creating a representative sample for a set of data. a. Describe and account for the difference between sample statistics and statistics describing the distribution of the entire population. b. Recognize that sample statistics produce estimates for the distribution of an entire population and recognize that larger sample sizes will produce more reliable estimates. c. Apply methods of creating random samples and recognize possible sources of bias in samples. Probability B5. Students understand the relationship of probability to relative frequency and know how to find the probability of compound events. a. Find the expected frequency of an event. b. Find the expected value of events. c. Find the probability of compound events including independent and dependent events. C. Geometry Geometric Figures C1. Students justify statements about polygons and solve problems. a. Use the properties of triangles to prove theorems about figures and relationships among figures. b. Solve for missing dimensions based on congruence and similarity. c. Use the Pythagorean Theorem in situations where right triangles are created by adding segments to figures. d. Use the distance formula. C2. Students justify statements about circles and solve problems. a. Use the concepts of central and inscribed angles to solve problems and justify statements. b. Use relationships among arc length and circumference, and areas of circles and sectors to solve problems and justify statements. C3. Students understand and use basic ideas of trigonometry. a. Identify and find the value of trigonometric ratios for angles in right triangles. b. Use trigonometry to solve for missing lengths in right triangles. Use inverse trigonometric functions to find missing angles in right triangles.

Related Maine Learning Results	Geometric Measurement C4.Students find the surface area and volume of three-dimensional objects. a. Find the volume and surface area of three-dimensional figures including cones and spheres. b. Determine the effect of changes in linear dimensions on the volume and surface areas of similar and other three-dimensional figures. D. Algebra Symbols and Expressions D1.Students understand and use polynomials and expressions with rational exponents. a. Simplify expressions including those with rational numbers. b. Add, subtract, and multiply polynomials. c. Factor the common term out of polynomial expressions. d. Divide polynomials by (ax+b). Equations and Inequalities D2.Students solve families of equations and inequalities. a. Solve systems of linear equations and inequalities in two unknowns and interpret their graphs. b. Solve quadratic equations graphically, by factoring in cases where factoring is efficient, and by applying the quadratic formula. c. Solve simple rational equations. d. Solve absolute value equations and inequalities and interpret the results. e. Apply the understanding that the solution(s) to equations of the form f(x) = g(x) are x-value(s) of the point(s) of intersection of the graphs of f(x) and g(x) and common outputs in table of values. f. Explain why the coordinates of the point of intersection of the lines represented by a system of equations is its solution and apply this understanding to solving problems. D3.Students understand and apply ideas of logarithms. a. Use and interpret logarithmic scales. b. Solve equations in the form of $x + b^{y}$ using the equivalent form $y = \log_b x$.

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Sample Lessons And Activities	▪ Students convert angles (in degrees) on the map of a farmer's land into radians so that a function can be made and used to make predictions. ▪ Students take the sinusoidal graph of the local tides from the newspaper and write an equation which is then used to make predictions of the tide's height at a certain time of the day.
Sample Classroom Assessment Methods	▪ Homework, quiz and chapter exams ▪ In class data collection/analysis project ▪ Poster project
Sample Resources	▪ Publications: o Precalculus with Limits – A Graphing Approach ▪ Other Resources: o Graphing calculator o A+ learning system for remediation