Mathematics
Precalculus: Honors
Unit 1: Polynomial and Transcendental Functions

Essential Understandings	▪ Functions can be used as models for real-life problems. ▪ Functions can be graphed, evaluated, transformed, analyzed, manipulated and combined using algebraic & graphical techniques. ▪ Functions can be used as a prediction tool. ▪ Function work can be simplified using a graphing calculator.
Essential Questions	▪ What are polynomial, rational, exponential & logarithmic functions? ▪ How are functions used as a prediction tool for real-life problems? ▪ What are the types of real-life situations where functions can be used as models and prediction tools? ▪ How does the vocabulary of functions apply to the real-life situations they model? ▪ How is a graphing calculator used to work with functions?
Essential Knowledge	▪ Linear functions describe real-life situations where a rate of change remains constant. ▪ Quadratic functions can describe real-life situations involving area, gravity and data analysis. ▪ Cubic polynomial functions can describe real-life situation involving volume and data analysis. ▪ Rational functions can be used to describe real-life situations where ratios of polynomial functions must be used. ▪ Exponential functions can be used to describe growth and decay situations. ▪ Logarithmic functions can be used to describe certain scientific phenomena. ▪ Imaginary & complex numbers can be used to model scientific situations where 2-dimensional addition & subtraction are necessary. ▪ Graphing calculators can make the tedious parts of working with functions workable. ▪ Functions can be graphed, evaluated, transformed, analyzed, manipulated, and combined using algebraic & graphical techniques. ▪ Functions can be used a prediction tool. ▪ Function work can be simplified using a graphing calculator. ▪ Gaussian Models Functions can be used to solve real0life problems. ▪ Exponential, logarithmic, power, and logistic models can be fit to sets of data.

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Vocabulary	▪ Terms: ○ function definitions, domain & range, inputs & outputs, independent & dependent variables, function notation, vertical & horizontal line tests, interval notation – increasing, decreasing & constant intervals, relative minimum & maximum points, symmetry - even & odd functions, rigid & non-rigid function transformations (translations, reflections, rotations & dilations), function operations (add, subtract, multiply, divide & compositions), function inverse, one-to-one functions, linear, quadratic, cubic, piece-wise defined, rational, exponential & logarithmic functions, asymptotes (vertical, horizontal & oblique; standard & general forms of a function, continuous & discontinuous functions (removable, jump & infinite discontinuities), factoring, quadratic formula & synthetic division, the remainder & rational root theorems, real, imaginary & complex solutions, graphing calculator
Essential Skills	▪ Evaluate and graph all types of functions. ▪ Write functions using function notation. ▪ Decide which type of function to use in a given real-life situation. ▪ Manipulate functions in order to use them as modeling and prediction tools. ▪ Use a graphing calculator appropriately to work with the various types of functions. ▪ Decide when it is appropriate to use real, imaginary and/or complex numbers. ▪ Recognize the five most common models through the use of scatter plots and modeling.
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.

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Related Maine Learning Results	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. 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.

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Related Maine Learning Results	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. c. Use inverse trigonometric functions to find missing angles in right triangles. 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).

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Related Maine Learning Results	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 $y = \log_b x$. Functions and Relations D4. Students understand and interpret the characteristics of functions using graphs, tables, and algebraic techniques. a. Recognize the graphs and sketch graphs of the basic functions. b. Apply functions from these families to problem situations. c. Use concepts such as domain, range, zeros, intercepts, and maximum and minimum values. d. Use the concepts of average rate of change (table of values) and increasing and decreasing over intervals, and use these characteristics to compare functions. D5. Students express relationships recursively and use iterative methods to solve problems. a. Express the (n+1)st term in terms of the nth term and describe relationships in terms of starting point and rule followed to transform one terms to the next. b. Use technology to perform repeated calculations to develop solutions to real life problems involving linear, exponential, and other patterns of change.
Sample Lessons And Activities	▪ Use the graphing calculator to evaluate two related sets of real-life data to decide which type of function to use as a model and a prediction tool.

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Sample Classroom Assessment Methods	▪ Homework, quiz and chapter exams ▪ Poster project
Sample Resources	▪ Publications: o Precalculus with Limits – A Graphing Approach ▪ Other Resources: o Graphing calculator o A+ learning system for remediation