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Learning Target	Knowledge & Processes	Student Friendly
Extend understandings to a greater depth for those relations/functions encountered in Algebra II as well as to newly introduced relations/functions such as parametric equations **The learner will develop a proficiency in working among the multiple representations of functions and relations.** **The learner will apply the concepts of composition and inverse as they relate to relations and functions with the understanding that restrictions may occur on the domain and range.** ***3126.2.4*** ***3126.3.1*** ***3126.3.4*** ***3126.3.5*** ***3126.3.6*** ***3126.3.9***	**Knowledge** • **Domain and range** • **Composition** • **Interval notation** • **Piecewise function** • **Even and odd function** • **Difference quotient** • **Inverse function** • **Parametric equations** **Skills** • **Determine domain and range for relations/functions regardless of form of representation** • **Use function operations, including composition, to find new functions** • **Determine if a function is even, odd or neither** • **Graph a piecewise function and explore its domain and range.** • **Identify whether two functions are inverses of each other with respect to composition and also as a reflection about the line y=x** • **Construct and simplify the difference quotient for a given function** • **Rewrite parametric equations as a single function by eliminating the parameter** **Concepts** • **The student recognizes the role that domain of a function plays in the combination of functions, including composition.** • **The student understands that complex functions can often be broken down as the combination of two or more simpler functions.** • **The student understands that piecewise functions are combinations of two or more functions.** • **The student understands that the difference quotient represents the average rate of change in a given function.** • **The student recognizes parametric equations as a set of functions that can be used to describe motion in terms of a single variable.**	I CAN • Determine domain and range for relations/functions regardless of form of representation • Determine if a function is even, odd or neither • Write parametric equations • Solve parametric equations
Brief review of Algebra II parent functions, their unique features, and their graphs	**Knowledge** • **Parent functions (linear, quadratic, cubic, square root, absolute value, reciprocal, greatest integer)** • **Characteristics of graphs**	I CAN • Determine unique characteristics of parent graphs of relations and functions (centers, vertices, endpoints, asymptotes, holes, gaps, maxima, minima, shape,

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The learner will graph and analyze functions, especially to develop the concepts of maximum, minimum, roots, intercepts, concavity, asymptotes, limits, continuity, and symmetry. ***3126.2.1*** ***3126.3.2*** ***3126.3.3*** ***3126.3.4*** ***3126.3.5*** ***3126.3.6***	• **General form, standard form** • **Limit definition (introduction to limits, including notation)** • **End behavior** • **Limitations of calculator** • **Real zeros, roots, x-intercepts, solutions** • **Critical point** • **Increasing, decreasing** • **Concavity** • **Relative and absolute extrema** • **Point of inflection** • **Interval notation** • **Vertical, horizontal, slant asymptotes** • **Discontinuities** • **Rational function definition** • **Even, odd, neither** **Skills** • **Find limit of f(x) as x approaches c** • **Determine domain and range for relations/functions regardless of form of representation** • **Determine unique characteristics of parent graphs of relations and functions (centers, vertices, endpoints, asymptotes, holes, gaps, maxima, minima, shape, symmetries and axes, direction, etc.)** • **Finding zeros analytically and using technology** • **Locate relative or absolute extrema** • **Determine concavity** • **Determine increasing and decreasing intervals** • **Graph rational functions and locate discontinuities** • **Use limit notation to describe the end behavior** • **Determine if a function is even, odd or neither** • **Locate critical points and points of inflection in addition to local max and min using graphing technology** **Concepts** • **The student understands that every function is based on a parent function.** • **In general, transformations for relations and functions match changes to values of constants and coefficients and their signs, regardless of parent graph.**	symmetries and axes, direction, etc.) • Finding zeros analytically and using technology • Locate relative or absolute extrema • Determine concavity • Determine increasing and decreasing intervals • Graph rational functions and locate discontinuities • Transformations of functions • Find limit of f(x) as x approaches c • Find limits as end behavior

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	• **The student understands that roots, zeros and x-intercepts are the same values.** • **The student understands that symmetry is the relationship among f(x), -f(x), and f(-x).** • **The student understands that end behavior describes f(x) when x approaches positive and negative infinity.** • **The student understands that continuous functions have no asymptotes, jumps/gaps, or holes on their domain.**	
The learner will use multiple representations (i.e. set notation, interval notation, number lines, algebraic, and written) when writing solutions to equations and inequalities. ***3126.3.7***	**Knowledge** • **Interval and set notations** • **Union and intersection** • **Limitations of calculator** • **Solutions, x-intercepts** • **System of inequalities** **Skills** • **Solve nonlinear equations and inequalities using analytical and graphical approaches** • **Solve nonlinear systems of inequalities by graphing** **Concepts** • **The student recognizes that set notation and interval notation relay the same information in different ways.** • **The student understands how the graph of a function can be used to solve equations and inequalities.** • **The student understands that the solution to a system of inequalities is described as a graph of intersecting regions.**	I CAN: • Solve nonlinear inequalities • Solve nonlinear systems of inequalities

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Course: Pre-Calculus **Subject: Math**

Learning Target	Knowledge & Processes	Student Friendly
The learner will solve a variety of problems involving exponential and logarithmic functions. ***3126.2.1*** ***3126.2.2*** ***3126.2.3*** ***3126.2.4*** ***3126.3.2*** ***3126.3.3*** ***3126.3.4*** ***3126.3.5*** ***3126.3.6*** ***3126.3.7***	**Knowledge** • **Properties of exponents and logarithms, including change of base** • **Transcendental expression** • **Growth and decay functions, including logistic** **Skills** • **Use the inverse relationship between exponential and logarithmic functions to simplify expressions** • **Compute logarithms that are base 10, base *e* and other bases** • **Graph and describe the characteristics of exponential and logarithmic functions** • **Solve equations involving exponential and logarithmic expressions** • **Solve problems involving population growth and decay, including logistic growth** • **Solve problems involving simple interest, compound interest, and continuously compounded interest** **Concepts** • **The student recognizes that exponential and logarithmic expressions are transcendental, requiring different rules when simplifying.** • **The student understands that exponential and logarithmic functions are inverse functions of each other** • **The student understands that it is possible to find logarithms with different bases (base 10, base e, other bases)** • **The student recognizes transformations in the parent exponential and logarithmic functions** • **The student recognizes when a quantity can be described as exponential growth or decay.** • **The student understands the differences and relationships among simple, compound, and continuously compounded interest** • **The student understands that there is a difference between present and future values of an annuity**	I CAN: • Recognize the inverse relationship between exponential and logarithmic expressions • Find the inverse of a function if it exists • Graph logarithmic functions and their inverses • Solving exponential and logarithmic problems • Compute logarithms that are base 10, base *e* and other bases • Solve population problems involving growth and decay models • Solve simple interest, compound interest and continuous compound interest • Solve present and future values of annuities
Extend understandings of the unit circle trigonometry from Algebra II as it applies to the coordinate plane.	**Knowledge** • **Unit circle** • **Radian** • **Quadrantal angle** • **Rectangular coordinate definition for trigonometric functions**	I CAN: • Determine radian measure • Convert between radians and degrees • Calculate arc length of a circle with a radius

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Course: Pre-Calculus **Subject: Math** **2nd 9 weeks p.2 of 3**

The learner will solve a variety of problems using trigonometric and inverse trigonometric functions. ***3126.2.4*** ***3126.3.4*** ***3126.3.5*** ***3126.4.1*** ***3126.4.2*** ***3126.4.6***	• **Arc length** • **Sector of circle** • **Polar coordinates** **Skills** • **Determine coordinates on unit circle** • **Determine radian measure** • **Convert between radians and degrees (In Alg II)** • **Convert between rectangular and polar** • **Graph functions in polar coordinates** • **Calculate arc length of a circular segment with a radius subtended by a central angle of given measure** • **Calculate area of a circular sector with a radius subtended by a central angle of given measure** • **Use technology to look at the unwrapping of the unit circle as a pair of sinusoidal parametric equations** • **Evaluate expressions involving inverse trigonometric functions** **Concepts** • **The student understands that radian measure is defined using arc length.** • **The student understands that reference angles are used to find the trig values for angles in quadrants II, III, IV.** • **The student understands that positive and negative values are determined by the quadrant of the terminal side of the angle.** • **The student understands that there is a relationship between sin(x) and cos(x) and the pairs of coordinate on the unit circle.** • **The student understands that conversion factors in math and science work the same.**	subtended by a central angle of certain measure • Finding trig ratios for quadrantal angles • Determine coordinates on unit circle • Convert between rectangular and polar • Graph functions in polar coordinates • Find values of inverse trig functions
The learner will graph and analyze trigonometric and inverse trigonometric functions. ***3126.2.1*** ***3126.3.2*** ***3126.3.3*** ***3126.3.4*** ***3126.3.5***	**Knowledge** • **Limitations of calculator** • **Periodic function** • **Sinusoid** • **Period, amplitude, phase shift, asymptote** **Skills** • **Graph and describe the characteristics of the six trigonometric functions** • **Match a trigonometric equation to its graph, including those with transformations** • **Apply transformations to the parent graphs of the trigonometric functions**	I CAN: • Graph trig functions, inverses and reciprocals • Transform graphs of trig functions (translate, reflect, stretch, shrink, *etc*.) • Match trig equations to the graph including those with period and/or phase shift, with vertical stretch or shrink • Model real world data with trigonometric functions • Applications include any real world use of waves • Solve trig inequalities by graphing

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3126.4.2 ***3126.4.7***	**and describe how they affect period, amplitude, and phase shift.** • **Graph and describe the characteristics of inverse trigonometric functions** • **Apply appropriate domain and range restrictions to inverse trig functions** • **Use trigonometric functions to solve real world problems, including applications involving waves**	• Apply appropriate domain and range restrictions to inverse trig functions
	Concepts	
	• **The student recognizes the differences made by choice of radians versus degrees in graphing trigonometric functions.** • **The student recognizes how the same transformations and characteristics from graphical analysis can be applied to the parent trigonometric functions.** • **The student understands that functions that are cyclic are periodic.** • **The student recognizes the relationship between the sine, cosine, and tangent graphs and the graphs of their reciprocal functions.** • **The student understands that when a trigonometric function's domain is restricted so that the function is one-to-one will have an inverse function and the relationships between function and inverse function apply.** • **The student understands that waves have sinusoidal movement.**	

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Course: Pre-Calculus **Subject: Math** **3rd Nine Weeks**

Learning Target	Knowledge & Processes	Student Friendly
The learner will use trigonometric functions and identities to solve problems. ***3126.4.2*** ***3126.4.3*** ***3126.4.4***	**Knowledge** • **Identity definition** • **Pythagorean, reciprocal, quotient, sum/difference, double angle, and negative identities** **Skills** • **Verify trigonometric identities** • **Apply trigonometric identities to rewrite expressions and solve equations** • **Solve trigonometric equations and inequalities algebraically and graphically** **Concepts** • **The student understands how algebraic properties enable one to prove two expressions in an identity are equal.** • **The student understands that both members of an identity are equivalent expressions for a quantity for any given value of the variable.** • **The student recognizes when to apply trigonometric identities correctly in a given problem.**	I CAN: • Verify trig identities • Use trig identities to solve problems • Solve real world problems using trigonometry • Finding zeros analytically and using technology
The learner will use a variety of methods to solve triangle and vector problems, including real world applications. ***3126.2.5*** ***3126.2.6*** ***3126.4.5*** ***3126.4.8*** ***3126.4.9***	**Knowledge** • **Special right triangles** • **Law of Sines** • **Law of Cosines** • **Vectors, Scalars** • **Zero vector** • **Unit vector** • **Magnitude and direction of a vector** • **Dot product** **Skills** • **Solve problems using basic right triangle trigonometry** • **Solve problems using Law of Sines and Law of Cosines** • **Solve problems involving the area of a triangle** • **Write a vector given its terminal and initial points as coordinates** • **Add vectors algebraically and graphically** • **Multiply a vector by scalar algebraically and graphically** • **Calculate magnitude and direction of a vector** • **Calculate and interpret dot product of two vectors** • **Apply vectors to real world problems involving displacement and velocity** **Concepts**	I CAN: • Solve problems using trig ratios • Solve problems using Law of Sines and Law of Cosines • Adding vectors algebraically and graphically • Multiply vectors by scalars algebraically and graphically • Calculate magnitude and direction of a vector • Calculate and interpret dot product of two vectors • Apply vectors to real world problems involving displacement

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	• **The student recognizes that trigonometry is essential in calculating indirect measures in real world application involving triangles or polygons that can be divided into triangles.** • **The student recognizes that vectors have their own for of arithmetic operations in their own system of elements.** • **The student understands the geometric interpretation of vectors and how they can be applied to problems, including those from physics and other positional relationships.**	

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Course: Pre-Calculus **Subject: Math** **4th Nine Weeks**

Learning Target	Knowledge & Processes	Student Friendly
The learner will represent conics with equations, and use them to model real world applications. ***3126.3.7*** ***3126.3.8***	**Knowledge** • **Conic section definitions for parabola, ellipse, circle, and hyperbola** • **Standard form equation far each conic section** • **Degenerate conic sections** **Skills** • **Graph each conic section given its equation standard form** • **Where applicable, find vertices, co-vertices, foci, and axis length, for each conic section** • **Write the equation of a conic section in standard form given information about that conic.** • **Solve real world problems modeled by the properties of conic sections, including those involving inequalities** **Concepts** • **The student understands that conic sections may be recognized by equation and appearance.** • **The student understands that each conic section possesses a unique set of geometric properties.**	I CAN: • Graph ellipses and hyperbolas • Find vertices, co-vertices, foci, axis length, for ellipses and hyperbolas • Graph conic sections given equation in standard form • Solve real world problems modeled by conic equations
Presentation of topics could be integrated throughout the course **The learner will analyze a set of paired data both numerically and graphically, making predictions based on that data.** ***3126.2.1*** ***3126.5.1*** ***3126.5.2*** ***3126.5.3***	**Knowledge** • **Scatter plot, direction of association, strength of association** • **Residual, residual patterns** • **Regression equations** • **Correlation coefficient** • **Interpolation , extrapolation** **Skills** • **Construct scatter plot of paired data** • **Recognize outliers** • **Determine LSRL** • **Calculate residuals and check for a pattern** • **Using appropriate technology, calculate polynomial and transcendental regression equations to model data trends** • **Use regression equations to make predictions between and outside given data points, and identify potential errors in using those equations** **Concepts** • **The student understands the mathematical implications of the correlation**	I CAN: • Construct scatter plots of paired data • Analyze a set of data both numerically and graphically (for the purpose of modeling) • Recognize outliers • Use appropriate technology to calculate regression equations when appropriate • Use regression equations to make predictions between and outside given data points • Use appropriate technology to model data, to predict points that fit the trend and to identify potential errors

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	coefficient. • **The student understands that predictions may be hypothesized from the regression equation, and recognizes there is a margin of error in doing so.** • **The student recognizes there is a relationship among paired data, equations, and graphs.** • **The student understands that the appropriate type of regression equation may be chosen from the scatter plot or data.**	
The learner will develop an understanding of explicit and recursive series, convergence and divergence, sum of a series, and summation notation. ***3126.2.7*** ***3126.3.10*** ***3126.3.11***	**Knowledge** • **Continuous and discrete definitions** • **Converge and diverge definitions** • **Arithmetic and geometric series definitions** • **Sigma notation** • **Recursive, explicit** • **Use calculator to find sums of series, including its limitations** **Skills** • **Determine if a series converges or diverges** • **Use Sigma notation to represent series** • **Represent sequences recursively and explicitly** • **Find sum of arithmetic series** • **Find the sum of geometric series (finite and infinite)** **Concepts** • **The student understands that there is a difference between the explicit and recursive formulas, and recognizes when each is preferred.** • **The student recognizes a series is a summation of the terms in a sequence.** • **The student understands the difference between arithmetic and geometric sequences and series.** • **The student understands that a series can be represented using Sigma notation or as a summation of the terms in a sequence.** • **The student understands that there is a difference between finite and infinite geometric series and can articulate it.** **The student understands that there is a difference between converging and diverging series and articulate it.**	I CAN: • Determine if a series converges or diverges • Use sigma notation to represent series • Represent sequences recursively and explicitly • Find sum of arithmetic series • Find the sum of geometric series (finite and infinite) • Solve problems using sequences and series
The learner will understand how the concept of a limit can be used to calculate	**Knowledge** • **Limit concept and notation** • **Difference quotient**	I CAN: •

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geometric quantities of irregular shapes. ***3126.2.7***	**Skills**	
	• **Approximate the slope of a curve at a point using the slope of a secant line in the form of the difference quotient.** • **Define the slope of a curve at a point using limits.** • **Approximate the area between a curve with a finite number of rectangles** • **Compare area under a curve approximations using different numbers of rectangles** • **Define the exact area under a curve using limits** • **Approximate the length of a curve *using* a finite number of secant segments** • **Compare length of a curve approximations using different numbers of secant segments** • **Define the exact length of a curve using limits**	
	Concepts	
	• **The student understands how the concept of limits can be used to find the slope of curve at a point, area under a curve, and length of a curve.**	