**PRE-CALCULUS**

**Code: M644 Full Year (12) (1 credit)**

Prerequisite: Algebra 2 & Trigonometry

(rank weight 1.00)

Note: This course is intended for students who wish to further their understanding of mathematical structure and analysis.

Areas of Study Include:

* + - * Trigonometry (*9 days)*
	+ Define and evaluate the six trigonometric ratios.
	+ Solve triangles using trigonometric ratios.
	+ Define radian measure and convert angle measures between degrees and radians.
	+ Define the trigonometric functions in terms of the unit circle.
	+ Develop basic trigonometric identities.
	+ Use trigonometric functions to model and solve real-world problems, including right triangle relations, arc length, and speed.
* Trigonometric Graphs (*7 days)*
	+ Graph the sine, cosine, and tangent functions.
	+ Identify the domain and range of a basic trigonometric function.
	+ Graph transformations of the sine, cosine, and tangent graphs.
	+ Graph the cosecant, secant, and cotangent functions and their transformations.
	+ Identify and sketch the period, amplitude (if any), and phase shift of the cosine, sine, and tangent functions.
	+ Use trigonometric graphs to model and solve real-world problems.
* Trigonometric Equations and Identities (*26 days)*
	+ Solve trigonometric equations graphically and algebraically.
	+ Define the domain and range of the inverse trigonometric functions.
	+ Write a trigonometric function to model and solve real-world problems.
	+ Apply strategies to prove identities.
	+ Use the addition and subtraction identities for sine, cosine, and tangent functions.
	+ Use the double-angle and half-angle identities.
	+ Use identities to solve trigonometric equations.
	+ Solve triangles using the Law of Cosines.
	+ Solve triangles using the Law of Sines.
	+ Applications of Laws of Cosines and Sines

 (*Not necessary to do Area.)*

* Applications of Trigonometry (20 *days)*
	+ Vectors in the Plane
		- 2 Dimentional Vectors
		- Vector Operations
		- Unit Vectors
		- Direction Angles
		- Applications of Vectors
	+ Dot Product of Vectors
		- Angle between Vectors
	+ Parametric Equations and Motion
		- Parametric Equations
		- Parametric Curves
		- Eliminating the Parameter
	+ Polar Coordinates
		- Coordinate Conversions
		- Coordinate Equations
	+ Graphs of Polar Equations
	+ DeMoivre’s Theorem and *n*th Roots
		- The Complex Plane
		- Polar Form of Complex Numbers
		- Operations on Complex Polar Numbers
* Matrices (15 *days)*
	+ Identifying Matrices
	+ Matrix Addition and Scalar Multiplication
	+ Matrix Multiplication
	+ Identity and Inverse Matrices
	+ Applying Matrices to Linear Systems
	+ Applications:
		- Communication Matrices
		- Transition Matrices
		- Transformation Matrices

*Midyear*

* Analytic Geometry (*10 days)*
	+ Eccentricity
	+ Define a circle and write its equation.
	+ Analyze and sketch the graph of a circle.
	+ Define an ellipse and write its equation.
	+ Analyze and sketch the graph of an ellipse.
	+ Define a hyperbola and write its equation.
	+ Analyze and sketch the graph of a hyperbola.
	+ Define a parabola and write its equation.
	+ Analyze and sketch the graph of a parabola.
	+ Write the equation of and graph a translated conic section.
	+ Use conic sections to model and solve real-world problems.
* Functions and Graphs (*14 days)*
	+ Determine the domain and range of a function.
	+ Evaluate piecewise-defined and greatest integer functions.
	+ Analyze graphs to determine domain and range, local maxima and minima, intercepts, and intervals where they are increasing and decreasing.
	+ Transform graphs of parent functions.
	+ Determine whether a graph is symmetric with respect to the x-axis, y-axis, and/or origin.
	+ Perform addition, subtraction, multiplication, division, and composition of functions.
	+ Define inverse relations and functions and determine whether an inverse relation is a function.
	+ Verify inverses using composition.
* Polynomial and Rational Functions (1*7 days)*
	+ Divide polynomials.
	+ Apply the Remainder and Factor Theorems.
	+ Determine the maximum number of zeros of a polynomial.
	+ Find all rational zeros of a polynomial.
	+ Simplify and perform operations on complex numbers.
	+ Solve for the complex zeros of a polynomial.
	+ Analyze and sketch polynomial functions using continuity, end behavior, intercepts, local extrema, and points of inflections.
	+ Use polynomial functions to model and solve real-world problems.
	+ Find the domain of a rational function.
	+ Identify intercepts, holes, vertical, horizontal, and slant asymptotes in order to sketch graphs of rational functions.
* Exponential and Logarithmic Functions (*21 days)*
	+ Simplify expressions containing radicals or rational exponents.
	+ Graph and identify transformations of exponential functions, including the number.
	+ Use exponential functions to model and solve real-world problems.
	+ Graph and identify transformations of logarithmic functions.
	+ Evaluate logarithms to any base with and without a calculator.
	+ Apply properties and laws of logarithms to simplify and evaluate expressions.
	+ Solve exponential and logarithmic equations.
	+ Use exponential and logarithmic models to solve real-world problems.
* Limits (*15 days)*
	+ Use the informal definition of limit.
	+ Use and apply the properties of limits to find the limit of various functions.
	+ Find one-sided limits.
	+ Determine if a function is continuous at a point or an interval.
	+ Find the limit as x approaches infinity

*8 days for review, 2 days for in-class final*

Optional Topics, if Time:

* An Introduction to Calculus
	+ The Slope of a Curve
	+ Using Derivatives in Curve Sketching
	+ Extreme Value Problems
	+ Velocity and Acceleration

Assessment: Pre-Calculus students will take a district-wide final exam in June.

Textbook: *Advanced Mathematics with Pre-Calculus*, published by McDougal Littell/Houghton-

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