**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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