AP PRECALCULUS (DCC MAT 185 – 4 credits)

Code: M661 **Full Year: 1 Credit** **Rank Weight: 1.10**

Prerequisite: Algebra 2 Honors, Algebra 2 with 95% Average

Description: This course is intended primarily for students planning to take calculus. Topics include a review of the fundamental operations; polynomial, rational, trigonometric, exponential, logarithmic, polar, and inverse functions; modeling and data analysis.

Areas of Study:

Unit 1 – Polynomial and Rational Functions

- Describe how the input and output values of a function vary together by comparing function values.
- Construct a graph representing two quantities that vary with respect to each other in a contextual scenario.
- Compare the rates of change at two points using average rates of change near the points.
- Describe how two quantities vary together at different points and over different intervals of a function.
- Determine the average rates of change for sequences and functions, including linear, quadratic, and other function types.
- Determine the change in the average rates of change for linear, quadratic, and other function types.
- Identify key characteristics of polynomial functions related to rates of change.
- Identify key characteristics of a polynomial function related to its zeros when suitable factorizations are available or with technology.
- Determine if a polynomial function is even or odd.
- Describe end behaviors of polynomial functions.
- Describe end behaviors of rational functions.
- Determine the zeros of rational functions.
- Determine vertical asymptotes of graphs of rational functions.
- Determine holes in graphs of rational functions.
- Rewrite polynomial and rational expressions in equivalent forms.
- Determine the quotient of two polynomial functions using long division.
- Rewrite the repeated product of binomials using the binomial theorem.
- Construct a function that is an additive and/or multiplicative transformation of another function.
- Identify an appropriate function type to construct a function model for a given scenario.
- Describe assumptions and restrictions related to building a function model.
- Construct a linear, quadratic, cubic, quartic, polynomial of degree n, or related piecewise-defined function model.
- Construct a rational function model based on a context.
- Apply a function model to answer questions about a data set or contextual scenario.

Unit 2 – Exponential and Logarithmic Functions

- Express arithmetic sequences found in mathematical and contextual scenarios as functions of the whole numbers.
- Express geometric sequences found in mathematical and contextual scenarios as functions of the whole numbers.
- Construct functions of the real numbers that are comparable to arithmetic and geometric sequences.
- Describe similarities and differences between linear and exponential functions.
- Identify key characteristics of exponential functions.
- Rewrite exponential expressions in equivalent forms.
- Construct a model for situations involving proportional output values over equal-length input-value intervals.
- Apply exponential models to answer questions about a data set or contextual scenario.
- Construct linear, quadratic, and exponential models based on a data set.
- Validate a model constructed from a data set.
- Evaluate the composition of two or more functions for given values.
- Construct a representation of the composition of two or more functions.
- Rewrite a given function as a composition of two or more functions.
- Determine the input-output pairs of the inverse of a function.
- Determine the inverse of a function on an invertible domain.
- Evaluate logarithmic expressions.
- Construct representations of the inverse of an exponential function with an initial value of 1.
- Identify key characteristics of logarithmic functions.
- Rewrite logarithmic expressions in equivalent forms.
- Solve exponential and logarithmic equations and inequalities.
- Construct the inverse function for exponential and logarithmic functions.
- Construct a logarithmic function model.
- Determine if an exponential model is appropriate by examining a semi-log plot of a data set.
- Construct the linearization of exponential data.

Unit 3 – Trigonometric and Polar Functions

- Construct graphs of periodic relationships based on verbal representations.
- Describe key characteristics of a periodic function based on a verbal representation.
- Determine the sine, cosine, and tangent of an angle using the unit circle.
- Determine coordinates of points on a circle centered at the origin.
- Construct representations of the sine and cosine functions using the unit circle.
- Identify key characteristics of the sine and cosine functions.
- Identify the amplitude, vertical shift, period, and phase shift of a sinusoidal function.
- Construct sinusoidal function models of periodic phenomena.
- Construct representations of the tangent function using the unit circle.
- Describe key characteristics of the tangent function. Describe additive and multiplicative transformations involving the tangent function.

- Construct analytical and graphical representations of the inverse of the sine, cosine, and tangent functions over a restricted domain.
- Solve equations and inequalities involving trigonometric functions.
- Identify key characteristics of functions that involve quotients of the sine and cosine functions.
- Rewrite trigonometric expressions in equivalent forms with the Pythagorean identity.
- Rewrite trigonometric expressions in equivalent forms with sine and cosine sum identities.
- Solve equations using equivalent analytic representations of trigonometric functions.
- Determine the location of a point in the plane using both rectangular and polar coordinates.
- Construct graphs of polar functions.
- Describe characteristics of the graph of a polar function.

Optional Areas of Study (if time allows):

Unit 4 – Functions Involving Parameters, Vectors, and Matrices (not included on AP Precalculus Exam)

- Construct a graph or table of values for a parametric function represented analytically.
- Identify key characteristics of a parametric planar motion function that are related to position.
- Identify key characteristics of a parametric planar motion function that are related to direction and rate of change.
- Express motion around a circle or along a line segment parametrically.
- Construct a graph of an equation involving two variables.
- Determine how the two quantities related in an implicitly defined function vary together.
- Represent conic sections with horizontal or vertical symmetry analytically.
- Represent a curve in the plane parametrically.
- Represent conic sections parametrically.
- Identify characteristics of a vector.
- Determine sums and products involving vectors.
- Determine a unit vector for a given vector.
- Determine angle measures between vectors and magnitudes of vectors involved in vector addition.
- Represent planar motion in terms of vector-valued functions.
- Determine the product of two matrices.
- Determine the inverse of a 2 x 2 matrix.
- Apply the value of the determinant to invertibility and vectors.
- Determine the output vectors of a linear transformation using a 2 x 2 matrix.
- Determine the association between a linear transformation and a matrix.
- Determine the composition of two linear transformations.
- Determine the inverse of a linear transformation.
- Construct a model of a scenario involving transitions between two states using matrices.
- Apply matrix models to predict future and past states for n transition steps.