

## Pre-Calculus

5 credits – Level I

Grades: 11

Prerequisite: Minimum grade of 70 in Algebra II Level 1 (or a minimum of 90 in Algebra II Topics and Trigonometry)

This course should be selected by above-average students who plan to take Calculus in 12<sup>th</sup> grade. Units of study include polynomial functions and inequalities, inverse functions, logarithms, circular functions, and trigonometry.

### PROFICIENCIES

#### POLYNOMIAL FUNCTIONS

- identify a polynomial function, evaluate it using synthetic substitution and determine its zeros
- use synthetic division and apply the remainder and factor theorems
- graph a polynomial function and determine an equation for a polynomial graph
- write a polynomial function for a given situation and find the maximum or minimum value of the function
- use technology to approximate the real roots of a polynomial equation
- solve polynomial equations by various methods of factoring, including the use of the rational root theorem
- apply general theorems about polynomial equations

#### INEQUALITIES

- solve and graph linear inequalities in one variable
- solve and graph polynomial inequalities in one variable
- graph polynomial inequalities in two variables and graph the solution set of a system of inequalities

#### FUNCTIONS

- identify a function, determine the domain, range and zeros of a function, and graph a function
- perform operations on functions and determine the domains of the resulting functions
- reflect graphs and use symmetry to sketch graphs
- determine periodicity and amplitude from graphs, stretch and shrink graphs both vertically and horizontally, and translate graphs
- find the inverse of a function, if the inverse exists
- graph functions of two variables in a two-dimensional coordinate system and read such graphs
- form a function of one variable from a verbal description and, when appropriate, determine the minimum or maximum value of the function

#### EXPONENTS AND LOGARITHMS

- define and apply integral exponents
- define and apply rational exponents
- define and use exponential functions
- define and apply the natural exponential function
- define and apply logarithms
- prove and apply laws of logarithms
- solve exponential equations and to change logarithms from one base to another

#### TRIGONOMETRIC FUNCTIONS

- find the measure of an angle in either degrees or radians and find coterminal angles
- find the arc length and area of a sector of a circle and solve problems involving apparent size
- use the definitions of sine and cosine to find values of these functions and solve simple trigonometric equations
- use reference angles, calculators or tables and special angles to find values of the sine and cosine functions and to sketch the graphs of these functions
- find values of the tangent, cotangent, secant and cosecant functions and sketch the functions' graphs
- find values of the inverse trigonometric functions

### **TRIGONOMETRIC EQUATIONS AND APPLICATIONS**

- solve simple trigonometric equations and apply them
- find equations of different sine and cosine curves and apply these equations
- use trigonometric functions to model periodic behavior
- simplify trigonometric expressions and prove trigonometric identities
- use trigonometric identities or technology to solve more difficult trigonometric equations

### **TRIANGLE TRIGONOMETRY**

- use trigonometry to find unknown sides or angles of a right triangle
- find the area of a triangle given the lengths of two sides and the measure of the included angle
- use the law of sines to find unknown parts of a triangle
- use the law of cosines to find unknown parts of a triangle

### **TRIGONOMETRIC ADDITION FORMULAS**

- derive and apply formulas for  $\cos(\alpha \pm \beta)$  and for  $\sin(\alpha \pm \beta)$
- derive and apply formulas for  $\tan(\alpha \pm \beta)$
- derive and apply double-angle and half-angle formulas
- use identities to solve trigonometric equations

### **LIMITS OF FUNCTIONS**

- intuitively find the limit of a function from its graph
- find the limit of functions using computational techniques
- find the derivative of a function using the formal definition (limit)