**Curriculum**

**Precalculus**

**Course Overview**

This is a full-year course designed to prepare students for advanced study in mathematics at the high school or college level. The course starts with an in-depth study of polynomial, rational, algebraic, exponential, and logarithmic functions. There is an emphasis on graphing and solving equations, including the study of systems of inequalities. This is followed by a complete study of trigonometry. Sequences and series, the binomial theorem, permutations and combinations, probability, and systems of linear and quadratic equations are also studied.

**Department Standards**

Students will be able to comprehend mathematical concepts.

Students will apply mathematical procedures accurately, efficiently, and appropriately.

Students will be able to formulate, represent, and solve mathematical problems.

Students will develop logical mathematical thought and precise mathematical communication.

**Benchmarks**:

Students will be able to:

demonstate a fundamental understanding of Algebra II;

demonstrate an understanding of Functions and their graphs;

use mathematical modelling to solve problems;

define the domain, range, and zeros of Polynomial and Rational functions;

demonstrate an understanding of Exponential and Logarithmic functions and the relationship between them;

solve Exponential and Logarithmic equations;

demonstrate a thorough understanding of Triangle Trigonometry, Analytic Trigonometry, the Unit Circle, Trigonometric Identities, and the graphs of Trigonometric functions;

use sequences, factorials, and summation notation to write the terms and sum of a sequence;

use the Binomial Theorem and Pascal’s Triangle to calculate binomial coefficients and binomial expansions; and

find the probabilities of Events and their Complements.

**Performance Indicators**

First Quarter

Students will be able to:

write polynomials in standard form;

add, subtract, and multiply polynomials;

factor polynomials using different strategies;

find domains of algebraic expressions;

simplify rational expressions;

add, subtract, multiply, and divide rational expressions;

simplify complex fractions;

solving inequalities involving absolute values;

sketch graphs of equations;

find x- and y-intercepts of graphs of equations;

use symmetry to sketch graphs of equations;

find equations and sketch graphs of circles;

use graphs of equations in solving real-life problems;

use slope to graph linear equations in two variables;

find slopes of lines;

write linear equations in two variables;

use slope to identify parallel and perpendicular lines;

use linear equations in two variables to model and solve real-life problems;

determine whether relations between two variables are functions;

use function notation and evaluate functions;

use functions to model and solve real-life problems;

use the vertical line test for functions;

find the zeros of functions;

determine intervals on which functions are increasing or decreasing;

identify even and odd functions;

identify and graph linear and squaring functions;

identify and graph cubic, square root, and reciprocal functions;

identify and graph step and other piecewise-defined functions;

recognize graphs of common functions;

use vertical and horizontal shifts to sketch graphs of functions;

use reflections to sketch graphs of functions;

use non-rigid transformations to sketch graphs of functions;

add, subtract, multiply and divide functions;

find the composition of one function with another function;

use combinations of functions to model and solve real-life problems;

find inverse functions informally and verify the two functions are inverse functions of each other;

use graphs of functions to determine if functions have inverses;

use the Horizontal Line Test to determine if a function has an inverse;

find an inverse function algebraically;

use mathematical models to approximate sets of data points; and

write mathematical models for direct, inverse and joint variations including as an nth power.

Second Quarter

Students will be able to:

use the regression feature of a graphing calculator to find the equation of at least squares regression line;

sketch and analyze graphs of quadratic functions;

write quadratic functions in standard form and use the results to sketch graphs of functions;

use quadratic functions to model and solve real-life problems;

use transformations to sketch graphs of polynomial functions;

use the Leading coefficient Test to determine the end behavior of graphs of polynomial functions;

use zeros of polynomial functions as sketching aids;

use the Intermediate Value Theorem to help locate zeros of polynomial functions;

use long division and synthetic division to divide polynomials;

use the Remainder Theorem and the Factor Theorem;

find the domains of rational functions and find asymptotes of rational functions;

sketch the graph of rational functions;

recognize and find partial fraction decompositions of rational expressions;

recognize and evaluate exponential and logarithmic functions;

graph exponential and logarithmic functions

use the change-of-base formula to re-write and evaluate logarithmic expressions; and use properties of logarithms to evaluate re-write, expand or condense logarithmic expressions.

Third Quarter

Students will be able to:

solve exponential and logarithmic equations;

use exponential growth models, exponential decay models, Gaussian models, logistic growth models and logarithmic growth models to solve real-life problems;

use degree and radian measure to describe angles;

evaluate trigonometric functions using the unit circle;

use the domain and period to evaluate sine and cosine functions;

use a calculator to evaluate trigonometric functions;

use the fundamental trigonometric identities;

use trigonometric functions to model and solve real-life problems;

use reference angles to evaluate trigonometric functions;

sketch the graphs of basic sine, cosine, tangent, cotangent, secant, and cosecant functions using amplitude and period;

sketch translations of the graphs of the above functions;

evaluate the inverse trigonometric functions;

solve real-life problems involving right triangles;

solve real-life problems using directional bearings;

solve real-life problems involving harmonic motion;

recognize and write the fundamental trigonometric identities;

use the fundamental trigonometric identities to evaluate trigonometric functions, simplify trigonometric expressions, and rewrite trigonometric expressions;

verify trigonometric identities;

use standard algebraic techniques to solve trigonometric equations;

use inverse trigonometric functions to solve trigonometric equations;

use sum and difference formulas to evaluate trigonometric functions, verify identities and solve trigonometric equations; and

use multiple-angle, power-reducing, half-angle, and product-to-sum and sum-to-product formulas to rewrite and evaluate trigonometric functions.

Fourth Quarter

Students will be able to:

use the Law of Sines to solve oblique triangles (AAS, ASA, or SSA);

find the areas of oblique triangles;

use the Law of Sines to model and solve real-life problems;

use the Law of Cosines to solve oblique triangles (SSS or SAS);

use the Law of Cosines to model and solve real-life problems;

use Hero's Area Formula to find the area of a triangle;

represent vectors as directed line segments;

write the component form of vectors;

perform basic vector operations and represent them graphically;

write vectors as linear combinations of unit vectors;

find the direction angles of vectors;

use vectors to model and solve real-life problems;

use sequence, factorial, and summation notation to write the terms and sums of a sequence;

recognize, write, and manipulate arithmetic sequences and geometric sequences;

be exposed to mathematical induction to prove a statement involving a positive integer n;

use the Binomial Theorem and Pascal's Triangle to calculate binomial coefficients and binomial expansions;

solve counting problems using the Fundamental Counting Principle, permutations, and combinations; and

find the probabilities of events and their complements.

**Assessments**

First Quarter

Daily assignments

Quizzes

Chapter Tests

Second Quarter

Daily assignments

Quizzes

Chapter Tests

Two hour Semester One Exam

Third Quarter

Daily assignments

Quizzes

Chapter Tests

Fourth Quarter

Daily assignments

Quizzes

Chapter Tests

Two hour Semester Two Exam

**Core Topics**

First Quarter

Review of Algebra

Functions and Their Graphs

Inverse Functions

Mathematical Modeling

Second Quarter

Polynomial and Rational Functions

Complex Numbers

Exponential and Logarithmic Functions

Third Quarter

Exponential and Logarithmic Equations

Exponential and Logarithmic Models

Trigonometric Functions

Trigonometric Identities

Right Triangle Trigonometry

Analytic Trigonometry

Fourth Quarter

Law of Sines and Cosines

Vectors in the Plane

Trigonometric Form of a Complex Number

Sequences, Series, and Probability

**Specific Content**

First Quarter

Polynomials and Factoring.

Rational Expressions.

Solving Equations and Inequalities.

Graphs of equations.

Linear equations in two variables.

Functions and their domains.

Analyzing graphs of functions.

Transformations of functions.

Combinations and compositions of functions.

Inverse functions

Mathematical Modelling.

Second Quarter

Quadratic Functions

Polynomial Functions of Higher Degree

Polynomial and Synthetic Division

Complex Numbers

Zeros of Polynomial Functions

Rational Functions

Partial Fractions

Exponential Functions and Their Graphs

Logarithmic Functions and Their Graphs

Properties of Logarithms

Exponential and Logarithmic Equations

Exponential and Logarithmic Models

Third Quarter

Radian and Degree Measure

Trigonometric Functions and the Unit Circle

Right Triangle Trigonometry

Trigonometric Functions of any Angle

Graphs of Sine and Cosine Functions

Graphs of other Trigonometric Functions

Inverse Trigonometric Functions

Applications and Models of Trigonometric Functions

Fundamental Trigonometric Identities

Solving Trigonometric Equations

Sum and Difference Formulas

Multiple-Angle and Product-to-Sum Formulas

Fourth Quarter

Law of Sines

Law of Cosines

Sequences and Series

Arithmetic Sequences and Partial Sums

Vectors in the Plane

Trigonometric Form of a Complex Number

Geometric Sequences and Series

Mathematical Induction

The Binomial Theorem

Counting Principles

Probability

**Resources**

Textbook: *Precalculus* by Larson/Hostetler published by Houghton Mifflin

TI -84 (plus) Graphic Calculator

Student Notebooks

SMART Board tools

Desmos Graphing Program

GeoGebra