

Senior Year: Pre-Calculus

- **Textbook:** Precalculus with Limits, A Graphing Approach. 4th Edition, 2005, Larson, Hostetler & Edwards, Cengage Learning.

- **Course Description:** This course is designed to prepare students for college calculus. Topics covered include as algebra, trigonometry, vectors, matrices, and analytic geometry, and an introduction to calculus. Many of these topics have been presented in previous math courses. However, this course will cover them in greater detail and depth and/or will stress application of the concepts to real life. Graphing calculators, spreadsheets, and various other technology tools are used regularly throughout this course.

- **Calculator Policy:** A TI-84 (any version) is required for this course. During the course, students will use the calculator for investigations and to solve problems. Students will be expected to understand how to solve some problems both without the calculator and with the calculator. However, students should not expect to be able to use their calculator on every quiz, test, and homework assignment.

- **Course Goals:**
 1. Students will be become proficient with graphing algebraic, radical, rational, trigonometric, logarithmic, and exponential equations and transformations of equations.
 2. Students will develop problem-solving skills by working with and solving algebraic, rational, radical, trigonometric, logarithmic, and exponential equations.
 3. Students will be comfortable working in either degrees or radians.
 4. Students will understand how to work with vectors and matrices.
 5. Students will understand analytic geometry, including conics, parametric, and polar functions.
 6. Students will be learn the basic operations of calculus so that they are prepared to take a college calculus course.
 7. Students will become proficient at using their graphing calculator to solve problems and interpret results (i.e. to realize that graphing calculators do not always provide the correct answer).
 8. Students will be able to solve problems graphical, analytically, or numerically.
 9. Students will build experience with applying mathematics to real-world situations.
 10. Students will be better prepared for the SAT and ACT.

- **Course Objectives:**

At the end of the course, students will be able to:

 1. Graph fifteen basic equations and transformations of the graphs (including horizontal and vertical translations, horizontal and vertical stretches and shrinks, reflections, amplitude changes, period changes, or phase angle changes):

$$y = x \quad y = x^2 \quad y = x^3 \quad y = \frac{1}{x} \quad y = \sqrt{x} \quad y = |x| \quad y = \lfloor x \rfloor$$

$$y = \log_a x \quad y = a^x \quad y = \sin x \quad y = \cos x \quad y = \tan x \quad y = \sec x \quad y = \csc x \quad y = \cot x$$

2. Find the domain and range of a function. Find vertical asymptotes of a function.
 3. Understand how to use the unit circle, 30-60-90 triangle, and 45-45-90 triangle to find the sine, cosine, and tangent of 30° , 45° , and 60° angles.
 4. Quickly find (or have memorized) the sine, cosine, and tangent of the following angles: 0° , 30° , 45° , 60° , 90° , 180° , 270° (in both degree and radian form).
 5. Memorize specified trigonometric identities and be able to use them to manipulate an equation or to prove that a statement is correct.
 6. Solve equations of the following type: algebraic, rational, radical, trigonometric, logarithmic, and exponential.
 7. Understand why division by a variable can result in the loss of a solution.
 8. Solve inequalities and absolute value inequalities.
 9. Graph conic sections and identify their appropriate properties (foci, directrix, major axis, minor axis, etc.)
 10. Find the inverse of a function, understand the properties of inverse functions, and know how to restrict the domain of trig functions so that they have inverses.
 11. Understand properties of a matrix and how to solve matrices.
 12. Be able to graph equations in both parametric and polar form.
 13. Perform basic vector operations and represent vectors graphically.
 14. Evaluate a limit and determine whether or not a function is continuous on an interval.
 15. Give three ways to interpret a derivative. Find the derivative of a basic function.
 16. Use technology to solve real-life mathematics problems.
- **Course Outline/Sequence:**
 - A. Chapter 1: Functions and Their Graphs**
 - Functions
 - Graphs and Functions
 - Shifting, Reflecting, and Stretching Graphs
 - Combinations of Functions
 - Inverse Functions
 - Exploring Data: Linear Models and Scatter Plots
 - B. Chapter 2: Polynomial and Rational Functions**
 - Quadratic Functions
 - Polynomial Functions of a Higher Degree
 - Real Zeros of Polynomial Functions
 - Complex Numbers
 - The Fundamental Theorem of Algebra
 - Rational Functions of Asymptotes
 - Graphs of Rational Functions

C. Chapter 4: Trigonometric Functions

- Radian and Degree Measures
- Trigonometric Functions: 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

D. Chapter 5: Analytic Trigonometry

- Using Fundamental Identities
- Verifying Trigonometric Identities
- Solving Trigonometric Equations
- Sum and Difference Formulas
- Multiple-Angle and Product-Sum Formulas

E. Chapter 6: Additional Topics in Trigonometry

- Law of Sines
- Law of Cosines
- Vectors in the Plane
- Vectors and Dot Products
- Trigonometric Form of a Complex Number

F. Chapter 7: Linear Systems and Matrices

- Solving Systems of Equations
- Systems of Linear Equations in Two Variables
- Multivariable Linear Systems
- Matrices and Systems of Equations
- Operations with Matrices
- The Inverse of a Square Matrix

G. Chapter 8: Sequences, Series, and Probability

- Sequences and Series
- Arithmetic Sequences and Partial Sums
- Geometric Sequences and Series
- The Binomial Theorem
- Counting Principles
- Probability

H. Chapter 9: Topics in Analytic Geometry

- Parabolas
- Ellipses

- Hyperbolas
- Parametric Equations
- Polar Equations

I. Chapter 11: Limits and Introduction to Calculus

- Introduction to Limits
- Techniques for Evaluating Limits
- The Tangent Line Problem
- Limits at Infinity and Limit of Sequences
- The Area Problem

J. Outside Book: Limits

- Limits and Continuity
- Limit Definition of the Derivative

K. Outside Book: Derivatives (time permitting)

- Derivatives of Basic Functions
- Derivatives of Products and Quotients
- The Chain Rule
- Derivatives of Exponential Functions
- Derivatives of Logarithmic Functions

L. Outside Book: Integrals (time permitting)

- Antiderivatives
- Substitution
- Area and the Definite Integral
- The Fundamental Theorem of Calculus
- Area Between two Curves
- Numerical Integration

- **Evaluation:** Students are evaluated through quizzes, chapter tests, chapter projects, and homework assignments.

