



Online Courses for High School Students

1-888-972-6237

Pre-Calculus/Trigonometry

Course Description:

Pre-calculus weaves together concepts of algebra and geometry into a preparatory course for calculus. The course focuses on the mastery of critical skills and exposure to new skills necessary for success in subsequent math courses. Topics include quadratic, exponential, logarithmic, radical, polynomial, and rational functions; matrices; and conic sections in the first semester. The second semester covers an introduction to infinite series, trigonometric ratios, functions, and equations; inverse trigonometric functions; applications of trigonometry, including vectors; polar equations and polar form of complex numbers; arithmetic of complex numbers; and parametric equations.

Connections are made throughout the course to calculus and a variety of other fields related to mathematics. Purposeful concentration is placed on how the concepts covered relate to each other. Demonstrating the connection between the algebra and the geometry of concepts highlights the interwoven nature of the study of mathematics.

Prerequisites: Geometry and Algebra II

Course Length: Two Semesters

Required Text: None

Materials List: Texas Instruments TI-84 Plus Graphics Calculator, drawing Compass, rulers (standard and metric), protractor, construction paper, measuring tape, six-sided die, scissors, tape

SEMESTER I

Course Outline:

Unit 1: Introduction to Precalculus and Polynomial Functions

Students extend their understanding of quadratic, radical and rational equations to encompass inequalities of the same. Concepts and theorems of polynomial and rational equations and functions are reviewed and extended to include holes, slant asymptotes and limit notation for end behavior.

- Precalculus Introduction
- Solve Equations and Inequalities
- Divide Polynomials
- Solve Polynomial Equations
- Graph Polynomial Functions
- Graph Rational Functions
- Unit Review

Unit 2: Matrices

Students are introduced to matrices and their uses. Students learn to solve a system of equations using matrices transformed into reduced row-echelon form, through the application of Cramer’s rule, and through the formation and solving of a matrix equation. Real-world applications of matrices are demonstrated in the graded assignment in this unit.

- Matrices Introduction
- Solve Systems of Equations with Matrices
- Operations with Matrices
- Inverses of Matrices
- Unit Review

Unit 3: Polynomial and Rational Functions

Conic sections are real-life phenomena that are found in architecture, space, nature, and more. Students explore how and where they occur as they progress through this unit, learning about four conic sections—circles, ellipses, hyperbolas, and parabolas. Derivations of the standard form of these conic sections are included to help foster student appreciation for the relationship that exists between algebra and geometry.

- Conic Sections Introduction
- Conic Sections
- Circles
- Ellipses
- Hyperbolas
- Parabolas
- Solve Systems of Conics
- Unit Review

Unit 4: Exponential and Logarithmic Functions

A thorough understanding of logarithmic expressions and functions is necessary for success in higher mathematics. Students deepen their understanding of the relationship between exponential and logarithmic functions as they explore how the properties of logarithms allow for equivalent forms of logarithmic expressions, and for a variety of logarithmic and exponential equations to be solved. Concentration is on real-world application of exponential equations.

- Exponents and Logarithms Introduction
- Exponential Functions
- From Exponential to Logarithmic Functions
- Operating with Logarithms
- Solve Exponential and Logarithmic Equations
- Exponents and Logarithms Unit Review

SEMESTER II

Course Outline:

Unit 1: Discrete Mathematics

Students build on their understanding of finite arithmetic and geometric sequences and series to explore infinite sequences and series. Students learn sigma notation, and properties of limits, as well as the ratio test as a method of determining if an

infinite series converges or diverges. Students explore two different (but closely related) methods of expanding binomials.

- Discrete Mathematics Introduction
- Sequences and Series
- Infinite Series and Sigma Notation
- Convergence and Divergence
- Pascal's Triangle and Binomial Expansion
- Unit Review

Unit 2: Trigonometric Ratios

Students begin a three-unit exploration into trigonometry. In this unit, students review their understanding of the three basic trigonometric functions learned in geometry; sine, cosine and tangent; and extend this to include their reciprocal functions. Students learn radian measure and are introduced to the unit circle, the foundation of all of trigonometry.

- Trigonometric Ratios Introduction
- Angles and Angle Measures
- Right Triangles and Trigonometric Ratios
- The Unit Circle
- Unit Review

Unit 3: Graph Trigonometric Functions

Students learn the graphs of the parent functions of the six trigonometric functions, as an extension of the unit circle, and explore transformations of these graphs. Students learn about inverse trigonometric functions and restrictions placed on them. Through applications of real-world problems involving trigonometric functions, students form connections between the algebra, the graph, and the description of scenarios that can be modeled with trigonometric functions.

- Graph Trigonometric Functions Introduction
- Graph Trigonometric Functions
- Transformation of Trigonometric Functions
- Real World Applications of Trigonometric Functions
- Unit Review

Unit 4: Trigonometric Laws and Identities

The study of trigonometry provides an opportunity to investigate the algebra of trigonometry. This extends to the verification of trigonometric identities, applications of sum, difference, double, and half angle formulas, derivations and applications of the laws of sine and cosine, alternate methods of determining the area of a triangle, and an exploration into angular and linear velocities and how they are related to one another.

- Trigonometric Laws and Identities Introduction
- Trigonometric Identities
- Solve Trigonometric Equations
- Laws of Sines and Laws of Cosines
- Area of Triangles
- Angular and Linear Velocities
- Unit Review

Unit 5: Complex Numbers and Vectors

Students learn about the polar coordinate system; how to plot points in polar form, graph polar equations, and convert between polar and rectangular forms.

Understanding of these ideas is extended to highlight the advantages of the polar coordinate system such as evaluating complex numbers raised to powers.

Students learn about both algebraic and geometric representations of vectors.

Arithmetic operations and applications of vectors are presented, using both representations. Connections are made between transformations of vectors and matrices.

Lastly, students are introduced to parametric equations. Concentration is placed on conversion between parametric and rectangular forms, and real-world applications of parametric equations.

- Polar Form of Complex Numbers Introduction
- The Polar Coordinate System
- Polar and Rectangular Form
- Operations with Complex Numbers
- Polar Form of Complex Numbers
- Vectors
- Parametric Equations
- Unit Review