

High School Mathematics

Pre-Calculus

This course is designed for students who plan to study calculus. Students will first become involved with in-depth study of exponential, and logarithmic functions. Then they will study rectangular coordinates, polynomial and rational functions, trigonometry, parametric equations, polar coordinates, curve sketching and transformation of coordinates with emphasis on circles, parabolas, ellipses, and hyperbolas. Each student will be required to have a graphing calculator (TI 83 Plus) to use for the year.

Learning Opportunities

Graphing calculator applications, Calculator based labs with trig, Max and Min explorations, Unit portfolios with real life applications, group based collective problem solving, transforming function knowledge to the trigonometry unit., spatial analysis of functions.

Standards

Fields of Knowledge: Mathematics, Science, Technology
Inquiry, Experimentation, and Theory

7.2 Investigation: Students design and conduct a variety of their own investigations and projects.

Mathematical Understanding

7.8 Function and Algebra concepts: Students use function and algebra concepts.

Mathematical Problem Solving and Reasoning

7.10 Applications: Students use concrete, formal, and informal strategies to solve mathematical problems, apply the process of mathematical modeling, and extend and generalize mathematical concepts.

Content Knowledge and Skills

Semester 1:

- Preliminaries
- Functions and their graphs
- Polynomials and rational functions
- Limits and quotients
- Exponential and Logarithmic functions
- Trigonometric functions

Semester 2:

- Graphs of trigonometric functions
- Analytic trigonometry
- Applications of trigonometry
- Analytic geometry

Assessment Criteria

Students are able to....

- complete a mathematical model of a physical phenomena
- complete a historical study, tracing the development of a mathematical concept (7.2)

Preliminaries

Students demonstrate an understanding of:

- topics from Algebra and Geometry
- complex numbers
- rectangular coordinates and graphs

Functions and their graphs

Students demonstrate an understanding of:

- graphing techniques
- operations on functions; composite functions
- one-to-one versus onto functions; inverse functions

- mathematical models: construction functions

Polynomials and rational functions

Students demonstrate an understanding of:

- quadratic functions
- polynomials functions
- rational functions
- remainder and factor theorems; synthetic division
- the Zeros of a polynomial function
- approximating the Real Zeros of a polynomial function
- complex polynomials; fundamental theorem of Algebra

Limits and quotients

Students demonstrate an understanding of:

- limits at infinity
- points of discontinuity
- horizontal and oblique asymptotes
- graph the quotient of two polynomials
- vertical asymptotes

Exponential and Logarithmic Functions

Students demonstrate an understanding of:

- exponential functions
- logarithmic functions
- properties of logarithms
- logarithmic and exponential equations; change-of-base rule
- continuous compound interest
- continuous growth and radioactive decay
- logarithmic scales

Trigonometric functions

Students demonstrate an understanding of:

- angles and their measure
- trigonometric functions: unit circle approach
- properties of the trigonometric functions
- right triangle trigonometry

Graphs of Trigonometric functions

Students demonstrate an understanding of:

- graphs of the sine and cosine functions
- graphs of tangent, cotangent, secant, and cosecant
- the inverse trigonometric functions

Analytic Trigonometry

Students demonstrate an understanding of:

- trigonometric identities
- sum and difference formulas
- double-angle and half-angle formulas
- solving equations for θ

Additional applications of trigonometry

Students demonstrate an understanding of:

- Law of sines
- Law of cosines
- Area of a triangle
- Polar coordinates
- Conversion of polar to trigonometry and $a + bi$ forms
- Polar equations and graphs
- Complex plane (power and roots): DeMoivre's Theorem

Analytic Geometry

Students demonstrate an understanding of:

- the parabola
- the ellipse
- the hyperbola
- rotation of axes; general form of a conic

June 2004

- plane curves and parametric equations

Resources

Text: *Precalculus* – Michael Sullivan (Upper Saddle River, NJ: Prentice Hall)