

MATHEMATICS DEPARTMENT

TRIGONOMETRY/ANALYTIC GEOMETRY (H): COURSE #331

Contact Information

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The Department's Educational Philosophy

The study of mathematics will enhance the ability of all students to problem solve and to reason. Through a strong standardized departmental program that emphasizes problem solving, communicating, reasoning and proof, making connections, and using representations, students will develop self-confidence and a positive attitude towards mathematics.

Our curriculum matches that of the Massachusetts Mathematics Curriculum Framework, and we are philosophically aligned with the National Council of Teachers of Mathematics Standards.

Guiding Principles

- Mathematical ideas should be explored in ways that stimulate curiosity, create enjoyment of mathematics, and develop depth of understanding.
- Effective mathematics programs focus on problem solving and require teachers who have a deep knowledge of the discipline.
- Technology is an essential tool in a mathematics education, and all students should gain facility in using it where advantageous.
- All students should have a high-quality mathematics program.
- Assessment of student learning in mathematics should take many forms to inform instruction and learning.
- All students should understand the basic structure of mathematics.
- All students should recognize that the techniques of mathematics are reflections of its theory and structure.
- All students should gain facility in applying mathematical skills and concepts.
- All students should understand the role of inductive and deductive reasoning in mathematic and real life situations.

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Course Frequency: Full-year course; five times per week

Credits Offered: Five

Prerequisites: A final grade of at least 80 in Algebra II Honors or 90 in Algebra II AE

Background to the Curriculum

This course uses the McDougal Littell text Advanced Mathematics – Precalculus with Discrete Mathematics and Data Analysis, Brown, 2000 edition. It is the “Precalculus” course, which fits between the Algebra II program and one of the Advanced Placement Calculus classes. This text has been used since 1993; it replaced the text Advanced Mathematics by Coxford, published by Harcourt Brace Jovanovich, which had been used since 1980. The text is followed quite closely, and all material is covered except for the Data Analysis material. The text matches the 2000 edition of the Massachusetts State Frameworks for a Precalculus course and is philosophically aligned with the spirit of the National Council of Teachers of Mathematics Curriculum Standards. Teachers bring in other material where appropriate or time permits after consultation with the Regional Department Leader.

Core Topics / Questions / Concepts/ Skills

Linear, Quadratic, Polynomial Functions

The General Theory of Functions

Trigonometric Functions and Their Inverses

Graphing Theory for Trigonometric Functions

Trigonometric Identities – Pythagorean, Sums, Difference, Double Angle, Half Angle

Polar Coordinates for Points and Complex Numbers

Vectors in Two Space and Three Space

Parametric Equations

Matrices in Equation Solving and Transformations

Limit Theory

Derivatives of Polynomials and Other Simple Functions

Applications of Derivatives

Exponential and Logarithmic Functions

Analytic Geometry of the Conic Sections

Course-End Learning Objectives

<u>Learning objectives</u>	<u>Corresponding state standards, where applicable</u>
1] find the equation of a linear function, given various information	Algebra/Analytic Geometry.P.6
2] find the equation of a quadratic function, given various information	Algebra II.P.7
3] model real-world situations by linear or quadratic functions	Algebra I.P.11
4] use formulae for the distance between points and the distance from a point to a line	Geometry.G.12
5] sketch linear and quadratic functions, given various information	Algebra II.P.6
6] use the Remainder and Factor Theorem	Precalculus.P.2
7] graph polynomial functions and determine an equation for a polynomial graph	Precalculus.P.2
8] write polynomial function for a given situation and find its maximum and/or minimum values	Algebra II.P.12
9] use technology to approximate the real roots of a polynomial equation	Algebra II.P.8
10] solve polynomial equations by various methods, including the Rational Root Theorem	Precalculus.P.2
11] apply general theorems about polynomial equations	Precalculus.P.2
12] solve linear, quadratic, and polynomial inequalities, including those with variable denominators	Algebra II.P.8
13] solve certain applied problems using linear programming	Algebra II.P.8
14] determine domain, range, zeroes of a function, and graph it	Algebra II.P.6
15] perform the composition and inverse of functions	Algebra II.P.5
16] determine periodicity and amplitude from graphs, stretch and shrink graphs vertically and horizontally, and translate them	Algebra II.P.13
17] find the measure of an angle in degrees or radians	Precalculus.M.1
18] find arc length and sector area in a circle	Precalculus.M.1
19] use the definitions of cosine and sine in terms of x , y , r	Algebra II.G.1
20] find values of trig functions using the definitions, reference arcs, special angles, and a calculator	Precalculus.P.3

21] find values of the tangent, cotangent, secant, and cosecant functions	Precalculus.P.3
22] find values of the inverse trig functions	Precalculus.P.3
23] graph the basic trig functions using concepts of domain and range	Precalculus.P.6
24] solve simple trig equations	Precalculus.P.5
25] find equations of sine and cosine curves that model periodic behavior	Precalculus.P.6
26] simplify trig expressions and prove trig identities	Precalculus.P.5
27] use trig identities or technology to solve more difficult trig equations	Precalculus.P.5
28] use right triangle trig, the Law of Sines, and the Law of Cosines to find unknown sides or angles of triangles	Precalculus.G.1
29] find areas of triangles using Trigonometry	Precalculus.G.1
30] derive and use identities for cosine, sine, and tangent involving sums, differences, double angles, and half angles	Precalculus.P.5
31] solve trig inequalities using identities or technology	Precalculus.P.5
32] use a variety of trig identities to simplify expressions and solve equations involving inverse trig functions	Precalculus.P.5
33] convert polar points and equations to Cartesian points and equations, and vice versa	Precalculus.N.1
34] graph the classical polar equations	Precalculus.N.1
35] convert complex numbers to polar form and use DeMoivre's Theorem	Precalculus.N.1
36] perform basic operations on vectors in 2 space and 3 space	Precalculus.G.2
37] use coordinates to perform vector operations in 2 space and 3 space	Precalculus.G.2
38] find norm and direction angle of a vector in 2 space	precalculus.G.2
39] use vector and parametric equations to describe motion in the plane and in space	Precalculus.G.2
40] define and apply the dot product in 2 space and 3 space	Precalculus.G.2
41] use determinants to solve algebraic and geometric problems	Precalculus.G.2
42] define and apply the cross product of vectors in 3 space	Precalculus.G.2
43] find the equation of a plane	Precalculus.G.2

44] use sequences defined by general term or recursively	Algebra II.P.1
45] use arithmetic and geometric sequences and series	Algebra II.P.2
46] find or estimate the limit of an infinite sequence	Algebra II.P.2
47] find the sum of an infinite series	Algebra II.P.2
48] write proofs using the Principle of Mathematical Induction	Precalculus.P.1
49] find the sum, difference, product of matrices	Algebra II.P.9
50] find the inverse of matrices and solve linear systems using matrices	Algebra II.P.9
51] use technology to solve systems of equations using matrices and their inverses	Algebra II.P.9
52] find the images of sets of points under different types of transformations using matrices	Geometry.G.15
53] use integral and rational exponents	Algebra II.N.2
54] use general exponential functions and the natural exponential function	Algebra II.P.4
55] define and apply logarithms and use log laws	Algebra II.P.10
56] solve exponential equations, and change logarithms from one base to another	Algebra II.P.10
57] understand the relationship between logarithmic and exponential functions	Algebra II.P.4
58] find the limit of a function as $x \rightarrow \infty$, $x \rightarrow -\infty$, $x \rightarrow a$	Precalculus.P.9
59] determine whether a function is continuous at a point	Precalculus.P.9
60] graph discontinuous functions	Precalculus.P.9
61] understand the intuitive concepts of limits of functions	Precalculus.P.9
62] graph rational and algebraic functions, including holes and asymptotes	Precalculus.P.9
63] find derivatives of functions by definition	Precalculus.P.9
64] find the derivative of a polynomial type function mentally and use it to find tangent line equations	Precalculus.P.9
65] sketch the graphs of functions using derivatives	Precalculus.P.9
66] solve maximum/minimum word problems using calculus	Precalculus.P.9
67] find instantaneous velocity and acceleration	Precalculus.P.9
68] prove theorems from geometry by using coordinates	Geometry.G.3

69] find the equations of conic sections given geometric information	Precalculus.P.8
70] graph conic sections with center at (h,k)	Precalculus.P.8
71] solve systems of second degree equations	Precalculus.P.8
72] compute the eccentricity and latus vectum of conic sections	Pecalculus.P.8
73] state and explain the equation for the general quadratic relation	Precalculus.P.8
74] graph rotated conic sections by using technology	Precalculus.P.8
75] graph rotated conic sections by eliminating the “xy term”	Precalculus.P.8

Assessment

Students are generally assessed by in-class tests and occasional quizzes, which are administered regularly throughout a marking period. The students’ attitude, effort, and quality of homework preparation will also impact their term grade to a small degree. Teachers informally assess students every day by asking pivotal questions, as well as questions involving mechanics or concepts, and the students’ term grades may be positively affected to a small degree based on their responses.

A standardized midyear examination and final examination are administered to all students in this course in order to assess their long-term retention of the course material.

Technology and Health Learning Objectives Addressed in This Course

(This section is for faculty and administrative reference; students and parents may disregard.)

<u>Course activity: skills &/or topics taught</u>	<u>Standard(s) addressed through this activity</u>
1] Graphing calculators are integrated throughout to find extreme values of functions	
2] Graphing calculators are used in the Trigonometry portion to fit data to sinusoids	
3] Graphing calculators are used to aid in Matrix computations	
4] Precalculus Plotter Plus software is used where feasible	

Materials and Resources

Teachers use other texts for supplementary ideas, such as the Harcourt Brace Jovanovich text used previously and the text Precalculus – A Graphing Approach by Demara and Waits. Review materials that match both departmental examinations are used by all teachers of the course. Some teachers may employ the software package “Precalculus Plotter Plus” in the Mac Lab.