

MATHEMATICS

Precalculus

Curriculum

Grade 11/12

Vineland Public Schools
Vineland, New Jersey

2004-2005

Vineland Board of Education

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Vineland Public Schools Mission Statement

We believe that all Vineland Public School students can learn. We recognize that learning is the result of a strong partnership of parents, teachers, and the community, as students are challenged to become active participants in the quest for excellence. Our goal is to ensure a safe, creative, stimulating and caring environment, which promotes self-esteem, sound character, responsibility and respect for diversity. This will enable students to become knowledgeable, skillful, life-long learners who are contributing citizens in our changing society. We expect the best from our students and will give no less of ourselves.

Course Description

The Precalculus course is a precursor to a first year college Calculus course for students who expect to pursue scientific or math curriculums in college. An in-depth study of circular functions and their inverses will provide the one half-year of trigonometry that is required by many colleges. Other topics will include theory of equations, exponentials, logarithms, complex numbers, polar coordinates, limits, continuity, sequences, and series. This course provides the student with in-depth learning of mathematical skills and concepts mandated by the New Jersey Core Curriculum Content Standards. This course builds upon the NJ CCS skills obtained in the fourth and eighth grade core objectives.

Instruction will be in a combination of teacher presentations, discussions, activities, classroom exercises, and student led discovery. Recommended time lines are included with each topic allowing sufficient classroom time for the completion of supplemental activities, exercises, and projects, as well as instruction.

Course Goals

In accordance with New Jersey Core Curriculum Content Standards for Mathematics, this course will provide successful completion of all relevant Standards in section 4. All students will use mathematical applications to gather and organize information and to solve problems. All students will develop an understanding of the nature and impact of mathematical concepts as they relate to the individual, society, and the environment.

These goals are to promote:

1. Exposure to a variety of learning environments that will be conducive to our multicultural society.
2. An increase in student self-esteem and confidence in his/her mathematical ability.
3. The value of mathematics and make student aware of its use in various careers.
4. Communication of mathematical thinking to peers and teachers both orally and in writing.(NJCC4.5B1)
5. The use of reasoning to support their mathematical conclusions and problem solutions.(NJCC4.5D2)
6. Learning of Precalculus through problem solving, inquiry, and discovery.(NJCC4.5A1)
7. Understanding how mathematical ideas interconnect and build on one another to produce a coherent whole.(NJCC4.5C6)
8. Apply Precalculus mathematics in practical situations and in other disciplines. (NJCC4.5C4)
9. Use of technology as a problem solving tool and investigate properties of functions and their graphs. (NJCC4.5F3, F4)
10. Use of the theory of equations to implement a variety of techniques available for solving and graphing higher degree equations and functions.
11. Use of variety of trigonometric methodology to solve triangles. (NJCC4.2E1)
12. Use of models and algebraic formulas to represent sequences and series. (NJCC4.3A1, A2)
13. Use of logarithmic and exponential functions to model real world phenomena and solve problems that involve varying quantities. (NJCC4.3C1)

14. A variety of problem solving techniques and strategies to solve problems.(NJCC4.5A3)
15. Use of Polar representation of numbers as an alternative method to understanding the complex numbers.
16. Use of introductory Calculus and Limit theory to model real world situations.

NJ Core Content Curriculum Standards for Mathematics

Standard 4.1 Number and Numerical Operations-All students will develop number sense and will perform standard numerical operations and estimations on all types of numbers in a variety of ways.

4.1 Number and Numerical Operations

- A. Number Sense
- B. Numerical Operations
- C. Estimation

Standard 4.2 Geometry and Measurement- All students will develop spatial sense and the ability to use geometric properties, relationships, and measurement to model, describe, and analyze phenomena.

4.2 Geometry and Measurement

- A. Geometric Properties
- B. Transforming Shapes
- C. Coordinate Geometry
- D. Units of Measurement
- E. Measuring Geometric Objects

Standard 4.3 Patterns and Algebra-All students will represent and analyze relationships among variable quantities and solve problems involving patterns, functions, algebraic concepts and processes.

4.3 Patterns and Algebra

- A. Patterns and Relationships
- B. Functions
- C. Modeling
- D. Procedures

Standard 4.4 Data Analysis, Probability, and Discrete Mathematics-All students will develop an understanding of the concepts and techniques of data analysis, probability, and discrete mathematics, and will use them to model situations, solve problems, and analyze and draw appropriate inferences from data.

4.4 Data Analysis, Probability, and Discrete Mathematics

- A. Data Analysis (Statistics)
- B. Probability
- C. Discrete Mathematics-Systemic Listing and Counting
- D. Discrete Mathematics-Vertex-Edge Graph and Algorithms

Standard 4.5 Mathematical Processes-All students will use mathematical processes of problem solving, communication, connections, reasoning, representations, and technology to solve problems and communicate mathematical ideas.

4.5 Mathematical Processes

- A. Problem Solving
- B. Communication
- C. Connections
- D. Reasoning
- E. Representations
- F. Technology

COURSE CONTENT

(Note: Chapter and Section precede Topic Title)

I. Linear and Quadratic Functions

Points and Lines
Slopes of Lines
Finding Equations of Lines
Linear Functions and Models
Complex Numbers
Solving Quadratic Equations
Quadratic Functions and their Graphs

II. Polynomial Functions

Polynomials
Synthetic Division; Remainder and Factor Theorems
Graphing Polynomial Functions
Finding Maximums and Minimums
Using Technology To Approximate Roots
Solving Polynomial Equations by Factoring
General Results for Polynomial Equations

III. Inequalities

Linear Inequalities; Absolute Value
Polynomial Inequalities in One Variable
Polynomial Inequalities in Two Variable
Linear Programming

IV. Functions

Functions
Operations on Functions
Reflecting Graphs; Symmetry
Period Functions; Stretching and Translating Graphs
Inverse Functions

V. Exponents and Logarithms

Growth and Decay: Integral Exponents
Growth and Decay: Rational Exponents
Exponential Functions
The Number e and the Function e^x
Logarithmic Functions
Laws of Logarithms
Exponential Equations; Change of Base

VI. Trigonometric Functions

7.1 Measurement of Angles
7.2 Sectors of Circles
7.3 Sine and Cosine Functions
7.4 Evaluating and Graphing Sine and Cosine
7.5 The Other Trigonometric Functions
7.6 The Inverse Trigonometric Functions

VII. Trigonometric Functions and Applications

8.1 Simple Trigonometric Equations
8.2 Sine and Cosine Curves
8.3 Modeling Periodic Behavior
8.4 Relationships among the Functions
8.5 Solving More Difficult Trigonometric Equations

VIII. Triangle Trigonometry

9.1 Solving Right Triangles
9.2 Area of a Triangle
9.3 Law of Sines
9.4 Law of Cosines
9.5 Applications of Trigonometry

IX. Trigonometric Addition Formulas

10.1 Sum and Difference Formulas: Sine and Cosine
10.2 Sum and Difference Formulas: Tangent
10.3 Double-Angle and Half-Angle Formulas
10.4 Solving Trigonometric Equations

X. Polar Coordinates

- 11.1 Polar Coordinates and Graphs
- 11.2 Geometric Representation of Complex Numbers
- 11.3 Powers of Complex Numbers
- 11.4 Roots of Complex Numbers

XI. Sequences and Series

- 13.1 Arithmetic and Geometric Sequences
- 13.2 Recursive Definitions
- 13.3 Arithmetic and Geometric Series and their Sums
- 13.4 Limits of Infinite Sequences
- 13.5 Sums of Infinite Geometric Series
- 13.6 Sigma Notation

XII. Limits

- 19.1 Limits of Functions

XIII. Introduction to Calculus

- 20.1 Slope of a Curve
- 20.2 Using Derivatives in Curve Sketching
- 20.4 Velocity and Acceleration

COURSE OBJECTIVES

I. Review of Linear and Quadratic Equations (4.3 B1, 4.2 B1, 4.4 A1, 4.3B4)

1.1 Find the intersection of two lines and use the distance and the midpoint formulas.

1.2 Find the slope of a line, and determine whether two lines are parallel, perpendicular, or neither.

1.3 Find an equation of a line given certain geometric properties of the line.

1.4 Model real world situations by means of linear functions.

1.5 Add, subtract, multiply, and divide complex numbers.

1.6 Solve quadratic equations by various methods.

1.7 Define and graph quadratic functions.

II. Polynomial Functions/Theory of Equations (4.1B, D 1-2)

2.1 Identify a polynomial function and to evaluate it by using synthetic substitution and determine zeros of a polynomial function.

2.2 Use synthetic division and apply the Remainder and Factor theorems.

2.3 Use the standard form of a linear equation to graph linear equations, and determine an equation for a polynomial graph.

2.4 Write a polynomial function for a given situation, find the maximum and minimum values of a function, and find the upper and lower bounds of a function.

2.5 Use technology to approximate the real roots of a polynomial equation.

2.6 Solve polynomial equations by various methods of factoring.

2.7 Apply general theorems about polynomial equations.

III. Inequalities (4.1 B3, 4.3 B)

3.1 Solve and graph linear inequalities in one variable.

3.2 Solve and graph polynomial inequalities in one variable.

3.3 Graph polynomial inequalities in two variables and graph the solution set of a system of inequalities.

3.4 Solve certain applied problems using linear programming.

IV. Functions (4.3 B-C)

4.1 Identify functions, determine the domain, range and zeros, and graph the function.

4.2 Perform operations on functions.

4.3 Reflect graphs and use symmetry to sketch graphs.

4.4 Determine periodicity and amplitude from graphs and stretch, shrink, and translate the graphs.

4.5 Find the inverse of a function, if it exists.

V. Exponential Functions (4.3 B)

5.1 Define and apply integral exponents (growth and decay).

5.2 Define and apply rational exponents (growth and decay).

5.3 Define and use exponential functions.

5.4 Define and apply the natural exponential function.

5.5 Define and apply logarithms.

5.6 Apply the laws of logarithms.

5.7 Solve exponential equations and changes logarithms from one base to another.

VI. Trigonometric Functions (4.2 A & C, 4.3 B)

7.1 Find the measure of an angle in degrees or radians, and find coterminal angles.

7.2 Find the arc length and area of a sector of a circle and solve problems involving apparent size.

7.3 Use the definitions of sine and cosine to find the values of these functions, and solve simple trigonometric equations.

7.4 Use reference angles, calculators, and special angles to find values of sine and cosine functions, and sketch the graphs of these functions.

7.5 Find the values of the other trigonometric functions and sketch the graphs of these functions.

7.6 Find the values of inverse trigonometric functions

VII. Trigonometric Functions and Applications (4.2 A & C, 4.3 B)

8.1 Solve simple trigonometric equations and apply them.

8.2 Find equations of different sine and cosine curves and apply these equations to real world situations.

8.3 Use trigonometric functions to model periodic behavior.

8.4 Simplify trigonometric functions and prove trigonometric identities.

8.5 Use trigonometric identities or technology to solve more difficult trigonometric equations.

VIII. Triangle Trigonometry (4.2 A & C, 4.3 B)

9.1 Use trigonometry to solve right triangles.

9.2 Find the area of a triangle using trigonometry.

9.3 Use the Law of Sines to find unknown parts of a triangle.

9.4 Use the Law of Cosines to find unknown parts of a triangle.

9.5 Use trigonometry to solve navigation and surveying problems.

IX. Trigonometric Addition Formulas (4.2 A & C, 4.3 B)

10.1 Apply the sum and difference formulas for sine and cosine.

10.2 Apply the sum and difference formulas for tangent.

10.3 Apply the double-angle and half-angle formulas.

10.4 Use identities to solve trigonometric equations.

X. Polar Coordinates (4.2 C)

11.1 Graph polar equations.

11.2 Write complex numbers in polar form and find products in polar form.

11.3 Find the powers of complex numbers.

11.4 Find roots of complex numbers.

XI. Sequences and Series (4.3 A1)

13.1 Identify an arithmetic or geometric sequence and find for formula for its n th term.

13.3 Find the sum of the first n terms of arithmetic or geometric series.

13.4 Find or estimate the limit of an infinite sequence or determine that the limit does not exist.

13.5 Find the sum of an infinite series.

13.6 Represent series by using sigma notation.

XII. Limits (4.3 A.1)

19.1 Find the limit of a function or the quotient of functions and determine if it is continuous

XIII. Introduction to Calculus

20.1 Find the derivatives of functions.

20.2 Sketch graphs of functions using derivatives

20.4 Find instantaneous velocities and accelerations

Proficiency

Satisfactory student achievement in each of the proficiencies listed in this curriculum shall be determined by student attainment of the 70% district passing-standard. Such proficiency shall be measured by a multiplicity of evaluation techniques and activities that include, but are not restricted to the following:

1. Teacher-made tests/quizzes
2. Class participation
3. Homework assignments
4. Reports and Projects
5. Oral reports and presentations: includes PowerPoint Presentation
6. Notebook/Journal
7. Cooperative group projects/activities

Instructional Resources

Brown, Richard; Advanced Mathematical Precalculus with Discrete Mathematics and Data Analysis, Houghton Mifflin Co., 1994,2001, and 2003

TI-83 Plus Graphing Calculator, Texas Instrument Inc.

PRECALCULUS
PACING CHART

A Pacing Chart is a Teaching Time Frame Guide

First Marking Period 10 weeks	Algebra II Review (3 weeks)	Complex Fractions (2 weeks)	Functions (Chapter 4) (4 weeks)	Exponents & Logarithms (1 week)
Second Marking Period 10 weeks	Exponents & Logarithms (cont.) (4 weeks)	Trig Functions (chapter 7) (5 weeks)	Midterm Review (1 week)	Midterm
Third Marking Period 10 weeks	Trig Equations & Applications (Chapter 8) (5 weeks)	Triangle Trig. (Chapter 9) (4 weeks)		
Fourth Marking Period 10 weeks	Trig Identities (Chapter 10) (4 weeks)	Polar and Complex Numbers (Chapter 11) (4 weeks)	Final Exam Review (1 week)	Final Exam

Number of actual instructional days will vary due to school activities, school closings, etc.