

MATHEMATICS

**Integrated
Advanced Mathematics**

Curriculum

Grade 12

Vineland Public Schools
Vineland, New Jersey

2007-2008

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 Integrated Advanced Mathematics course is a fourth year mathematics course for students who are planning to pursue a college education which will require College Algebra and Trigonometry. A thorough study of linear relations, functions, and circular functions and their inverses will be included. Additional topics will include exponential functions, logarithms, conic sections, complex numbers, graphing techniques, and how it applies to polynomial functions. 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. This course will include the Accuplacer (college placement) test strategies and review in preparation for the first year of college.

Instruction will be in a combination of teacher presentations, discussions, activities, classroom exercises, and student led discovery. Cooperative learning techniques will be a component of the course. 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.

NJ Math Standards and Indicators

4.1 NUMBER AND NUMERICAL OPERATIONS

A. Number Sense

1. Extend understanding of the number system to all real numbers.
2. Compare and order rational and irrational numbers.

B. Numerical Operations

1. Extend understanding and use of operations to real numbers and algebraic procedures.
2. Perform operations on matrices.
 - 1 Additions and subtraction
 - 2 Scalar multiplication
3. Understand and apply the laws of exponents to simplify expressions involving numbers raised to powers.

4.2 GEOMETRY AND MEASUREMENT

A. Geometric Properties

1. Use geometric models to represent real-world situations and objects and to solve problems using these models.
2. Apply the properties of geometric shapes.
 - 1 Parallel lines
 - 2 Triangles
 - 3 Conditions of congruence
 - 4 Midpoint formulas
 - 5 Triangle Inequality
 - 6 Circles
 - 7 Self-similarity

B. Transforming Shapes

1. Determine, describe, and draw the effect of a transformation, or a sequence of transformations, on a geometric or algebraic object, and, conversely, determine whether and how one object can be transformed to another by a transformation or a sequence of transformations.
2. Determine whether two or more given shapes can be used to generate a tessellation.
3. Recognize three-dimensional figures obtained through transformations of two-dimensional figures, using software as an aid to visualization.
4. Generate and analyze iterative geometric patterns.
 - 1 Fractals
 - 2 Patterns in areas and perimeters of self-similar figures.
 - 3 Outcome of extending iterative process indefinitely

C. Coordinate Geometry

1. Use coordinate geometry to represent and verify properties of lines
 - 1 Distance between two points
 - 2 Midpoint and slope of a line segment
 - 3 Finding the intersection of two lines
 - 4 Lines with the same slope are parallel
 - 5 Lines that are perpendicular
2. Show position and represent motion in the coordinate plane using vectors.
 - 1 Addition and subtraction of vectors

D. Units of Measurement

1. Understand and use to concept of significant digits.

E. Measuring Geometric Objects

1. Use techniques of indirect measurement to represent and solve problems.
 - 2 Similar triangles
 - 3 Pythagorean theorem
 - 4 Right triangle trigonometry
2. Use a variety of strategies to determine perimeter and area of plane figures and surface area and volume of 3D figures.

4.3 PATTERNS AND ALGEBRA

A. Patterns

1. Use models and algebraic formulas to represent and analyze sequences and series.
 - 1 Explicit formulas for nth terms
 - 2 Sums of finite arithmetic series
 - 3 Sums of finite and infinite geometric series

B. Functions and Relationships

1. Understand relations and functions and select, convert flexibly among, and use various representations for them, including equations or inequalities, tables, and graphs.
2. Analyze and explain the general properties and behavior of functions of one variable, using appropriate technologies.
3. Understand and perform transformations on commonly-used functions.
4. Understand and compare the properties of classes of functions, including exponential, polynomial, rational, and trigonometric functions

C. Modeling

1. Use functions to model real-world phenomena and solve problems that involve varying quantities.

D. Procedures

1. Evaluate and simplify expressions.
 - 1 Add and subtract polynomials
 - 2 Multiply a polynomial by a monomial or binomial
 - 3 Divide a polynomial by a monomial
2. Select and use appropriate methods to solve equations and inequalities.
 - 1 Linear equations
 - 2 Quadratic equations

4.4 DATA ANALYSIS, PROBABILITY, AND DISCRETE MATHEMATICS

A. Data Analysis

1. Use surveys and sampling techniques to generate data and draw conclusions about large groups.
2. Evaluate the use of data in real-world contexts
3. Estimate or determine lines of best fit with technology
4. Analyze data using technology, and use statistical terminology to describe conclusions.

B. Probability

1. Calculate the expected value of a probability-based game, given the probabilities and payoffs of various outcomes, and determine whether the game is fair.
2. Use concepts and formulas of area to calculate geometric probabilities.
3. Model situations involving probability with simulations and theoretical models, and solve problems using these models.
4. Determine probabilities in complex situations.
 - 1 Conditional events
 - 2 Complementary events
 - 3 Dependent and independent events

C. Discrete Math – Systematic Listing and Counting

1. Calculate combinations with replacement and without replacement.
2. Apply the multiplication rule of counting in complex situations, recognize the difference between situations with replacement and without replacement, and recognize the difference between ordered and unordered counting situations.

D. Discrete Math – Vertex-Edge Graphs and Algorithms

1. Use vertex-edge graphs and algorithmic thinking to represent and solve practical problems.

4.5 MATHEMATICAL PROCESSES

A. Problem Solving

1. Learn mathematics through problem solving, inquiry, and discovery.
2. Solve problems that arise in mathematics and in other contexts.
 - 1 Open-ended problems
 - 2 Non-routine problems
 - 3 Problems with multiple solutions
 - 4 Problems that can be solved in several ways
3. Select and apply a variety of appropriate problem-solving strategies to solve problems.
4. Pose problems of various types and levels of difficulty.
5. Monitor their progress and reflect on the process of their problem solving activity.

C. Connections

1. Use communication to organize and clarify their mathematical thinking.
 - 1 Reading and writing
 - 2 Discussion, listening, and questioning
2. Communicate their mathematical thinking coherently and clearly.

E. Representations

1. Create and use representations to organize, record, and communicate mathematical ideas.
2. Select, apply, and translate among mathematical representations to solve problems.
3. Use representations to model and interpret physical, social, and mathematical phenomena.

F. Technology

1. Use technology to gather, analyze, and communicate mathematical information.
2. Use computer spreadsheets, software and graphing utilities.
3. Using graphing calculators and computer software to investigate properties of functions and their graphs.
4. Use calculators as problem-solving tools
5. Use computer software to make and verify conjectures about geometric objects.
6. Use computer-based technology for mathematical applications in the sciences.

Students Proficiencies

Students will be able to:

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 Integrated Advanced Mathematics 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 Integrated Advanced 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 various graphing methods to solve and graph higher degree equations.
11. Use of variety of trigonometric methodology to solve triangles. (NJCC4.2E1)
12. Use of models and algebraic formulas to represent conic sections.
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 number system.
16. Use of Combinatorics and Probability to model situations and solve problems using these models. (NJCC4.4B3, C1)
17. Use Accuplacer strategies to prepare for college placement tests.

Instructional Resources

Holliday, Berchie; Cuevas, Gilbert; McClure, Melissa; Carter, John; Marks, Daniel; Advanced Mathematical Concepts, Glencoe/McGraw-Hill, 2001

Brown, Richard G., Dolciani, Mary P., Sorgenfrey, Robert H., Kane, Robert B. Algebra and Trigonometry, Structure and Method, McDougal Littell, 1997

Coxford, Arthur, Fey, James, Hirsch, Christian, et al, Contemporary Mathematics in context, Course 2, Book B Glencoe, 2003

TI-83 Plus Graphing Calculator, Texas Instrument Inc.

A. Supplemental/Resource Materials

1. New Jersey Department of Education, Academic and Professional Standards: Curriculum and Instruction, <http://www.nj.gov/njded/aps/cccs/>.
2. NJ Department of Education, NJPEP: Virtual Academy, <http://www.njpep.org/index.html>
3. Teacher Resource Manual
4. Teacher Assessment Guide
5. RAP's – Review and Practice Manuals
6. Algebra1: Author: Larson, Boswell, Kanold, Stiff, Publisher: McDougal Littell, Copyright: 2001
8. Geometry: Author: Larson, Boswell, Stiff, Publisher: McDougal Littell, Copyright: 2001

COURSE CONTENTS

I. Linear Relations and Functions

- 1.1 Relations and Functions
- 1.2. Polynomial addition, subtraction, and multiplication
 - a. Composition of Functions
- 1.3 Graphing and solving Linear Equations
- 1.4 Writing Linear Equations
 - a. Slope
 - b. Point slope, slope intercept, and Standard form of equations
- 1.5 Writing Equations of Parallel and Perpendicular Lines
- 1.6 Modeling Real world Data with Linear Functions
- 1.7 Graphing Linear Inequalities
 - Accuplacer strategies

II. Systems of Linear Equations and Inequalities

- 2.1 Solving Equations
 - a. Two -variable equations
 - b. Systems of two variable equations
 - 1. Graphing methods
 - 2. Algebraic method
 - 3. Using matrices (optional-Cramer's Rule)
- Accuplacer strategies

III. The Nature of Graphs

- 3.1 Symmetry and Transformations
- 3.2 Families of Graphs
 - a. Linear, Quadratic, Cubic
 - b. Functions
- Accuplacer strategies

IV. Polynomial and Rational Functions

- 4.0 Polynomial Review
 - a. Factoring
- 4.1 Polynomial Functions

- 4.2 Quadratic Equations
- 4.3 The Remainder and Factor Theorems
- 4.4 The Rational Root Theorem
- 4.5 Locating Zeros of a Polynomial Function
- 4.6 Rational Equations
- 4.7 Radical Equations
- 4.8 Modeling Real World with Polynomial Functions
Accuplacer strategies

V. The Trigonometric Functions

- 5.1 Angles and Degree Measure (Unit 6: L2 of Core Plus)
- 5.2 Trigonometric Ratios in Right Triangles
- 5.3 Trigonometric Functions on the Unit Circle
- 5.4 Applying Trigonometric Functions
- 5.5 Solving Right Triangles
Accuplacer strategies

VI. Graphs of Trigonometric Functions

- 6.1 Angles and Radian Measure (Unit 6: L3 of Core Plus)
- 6.2 Linear and Angular Velocity
- 6.3 Graphing Sine and Cosine Functions
- 6.4 Amplitude and Period of Sine and Cosine Functions (Unit
6: L3 of Core Plus)
- 6.5 Translations of Sine and Cosine Functions
- 6.6 Modeling Real World Data with Sinusoidal Functions
Accuplacer strategies

VII. Trigonometric Identities and Equations

- 7.1 Basic Trigonometric Identities
- 7.2 Verifying Trigonometric Identities
- 7.3 Sum and Difference Identities
- 7.4 Solving Trigonometric Equations using graphing calculator

VIII. Polar Coordinates

- 9.1 Polar Coordinates
- 9.2 Graphs of Polar Coordinates
- 9.3 Polar and Rectangular Coordinates

9.4 Polar Form of a Linear Equation
Accuplacer strategies

IX. Exponential and Logarithmic Functions

11.1 Real Exponents
11.2 Exponential Functions
11.3 The Number e
11.4 Logarithmic functions
11.5 Common Logarithms
11.6 Natural Logarithms

X. Combinatorics and Probability

13.1 Permutations and Combinations
13.2 Permutations with Repetitions and Circular Permutations
13.3 Probability and Odds

COURSE OBJECTIVES

I. Linear Relations and Functions (4.3 B-C)

1.1 Determine whether a given relation is a function and perform operations with functions.

1.2 Evaluate and find zeros of linear functions using functional notation.

1.3 Graph and write functions and inequalities.

1.4 Write equations of parallel and perpendicular lines.

1.5 Model data using scatter plots and write prediction equations.

II. Systems of Linear Equations and Inequalities (4.1 B3, 4.3 B)

2.1 Solve systems of equations and inequalities.

2.2 Define matrices.

2.3 Add, subtract, and multiply matrices.

III. The Nature of Graphs (4.3 B – D)

3.1 Graph functions, relations, and inverses.

3.2 Analyze families of graphs.

3.3 Investigate symmetry and transformations of graphs.

IV. Polynomial and Rational Functions (4.1B, D1-2)

4.1 Determine roots of polynomial equations.

4.2 Solve quadratic, rational, and radical equations.

4.3 Find the factors of polynomials.

4.4 Approximate real zeros of polynomial functions.

4.5 Write and interpret polynomial functions that model real world data.

V. The Trigonometric Functions (4.3B, 4.2A)

5.1 Convert decimal degree measures to degrees, minutes, and seconds and vice versa.

5.2 Identify angles that are coterminal with a given angle.

5.3 Solve right triangles.

5.4 Find the values of trigonometric functions.

5.5 Find the area of triangles.

VI. Graphs of Trigonometric Functions (4.2 E)

6.1 Change from radian measure to degree measure, and vice versa.

6.2 Find linear and angular velocity.

6.3 Use and draw graphs of sinusoidal curves.

6.4 Find the amplitude, the period, the phase shift, and the vertical shift for sinusoidal curves.

6.5 Write trigonometric equations to model a given situation.

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VII. Trigonometric Identities and Equations (4.2 A & C, 4.3 B)

7.1 Use reciprocal, quotient, Pythagorean, symmetry, and opposite-angle identities.

7.2 Verify trigonometric identities.

7.3 Use the sum, difference, double-angle, and half-angle identities.

7.4. Solve trigonometric equations by using graphing calculator

VIII. Polar Coordinates (4.2 C)

9.1 Convert between polar and rectangular coordinates.

9.2 Convert between rectangular and polar forms of linear equations.

9.3 Graph relations in polar form.

IX. Exponential and Logarithmic Functions (4.3 B)

11.1 Simplify and evaluate expressions containing rational and irrational exponents.

11.2 Use and graph exponential functions.

11.3 Evaluate expressions and graph and solve equations involving logarithms.

11.4 Model real world situations and solve problems using common and natural logarithms.

X. Combinatorics and Probability (4.4 B-C)

13.1 Solve problems involving combinations and permutations.

13.2 Distinguish between independent and dependent events and between mutually exclusive and mutually inclusive events.

13.3 Find probabilities.

13.4 Find odds for the success and failure of an event.

XI. Accuplacer summary, strategies and practice test

Pacing Chart

Weeks 1 – 5:

Week 1	Diagnostic Test Administered
	Practice and review basic algebraic skills used on Test
Week 2	Linear relations, functions, graphs
Week 3	Parallel, Perpendicular, Scatter Plots
Week 4	Real World, Systems, Matrices
Week 5	Accuplacer Strategies
Throughout	Alternative Assessment(s)

Week 6-8:

Week 6	Graphing functions, relations, inverses
Week 7	Analyzing, Transforming, Investigating Graphs
Week 8	Accuplacer Strategies/ Alternative Assessment(s)

Weeks 9 – 13

Week 9	Review of Polynomials
Week 10	Solving Quadratic, Rational, and Radical Equations
Week 11	Factors/Zeros of Polynomials
Week 12	Real World Models using Polynomials
Week 13	Accuplacer Strategies/Assessment
Throughout	Alternative Assessment(s)

Weeks 14 – 30

Week 14/15	Angles and their measures, Rotations of Vectors
Week 16/17	Coterminal, Reference, Radian Measure
Week 18	Right Triangle Trigonometry
Week 19	Area of Triangles using Trigonometry/Heron's formula
Week 20	Linear and Angular Velocity
Week 21	Graphs of Sinusoidal Curves
Week 22	Transformations of Sinusoidal Curves
Week 23	Real World Trig Models
Week 24	Trig Identities
Week 25	Verifying Trig Identities
Week 26	Sum, Difference of Identities
Week 27	Half angle and Double Angle Identities
Week 28	Graphing Calculator Activities-Trig Equations

Week 29	Accuplacer strategies/Assessment
Week 30	Projects/Reports/Alternative Assessments due

Weeks 31 – 35

Week 31	Properties of Exponents
Week 32	Exponential functions
Week 33	Real World Growth and Decay
Week 34	Logarithms/Compound Interest
Week 35	Accuplacer Strategies/Assessment
Throughout	Alternative Assessment(s)

Weeks 36 – 37

Week 36	Combinations and Permutations
Week 37	Probability and Odds
Throughout	Accuplacer strategies

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
8. Standardized tests

1. The following guidelines shall be implemented beginning in September 2007.
 - 30% -- Tests
 - 25% -- Quizzes
 - 25% -- Alternative Assessments
 - Projects
 - Portfolios
 - Reports
 - Presentations
 - 20% -- Homework/Class Performance
2. A minimum of two (2) test grades, two (2) quiz grades and two (2) alternative assessments, presentations, portfolios, projects, reports per marking period.
3. No single assessment shall be counted as more than one grade.
4. Homework should always serve a valid learning purpose; it should never be used as a punitive measure.
5. Classroom performance, group work, attitude and effort should consist of being present, being prepared, following classroom rules, staying on task and giving your best effort.
6. Provide a syllabus which is thoroughly explained to students as well as explaining these Grading Guidelines to all students at the beginning of each course. Please provide a copy for parents as well.
7. For year long courses each marking period grade equals 2/9ths of final average and the final exam equals 1/9th. For semester courses each marking period grade equals 4/9ths of final average and final exam equals 1/9th.