

Course Description

The Interactive Mathematics Program (IMP) is a comprehensive, problem-based mathematics curriculum that integrates traditional content, such as algebra, geometry, and trigonometry, with other topics such as statistics and probability. The program prepares students to use mathematics and problem-solving skills in further education and on the job.

The curriculum is designed to help all students develop a deep understanding of mathematical concepts and how to apply them. It challenges students to explore open-ended situations actively, in a way that resembles the inquiry method used by mathematicians and scientists in their work. Students routinely investigate specific cases, look for and articulate patterns, and make, test, and prove conjectures. Each year of the program consists of five units. Most units of the IMP curriculum begin with a central problem or theme, which students explore and/or solve over the course of the unit. Solving a particular unit problem often requires concepts from several branches of mathematics, allowing students to see how a variety of ideas relate to each other. Graphing calculators are used in all units to enhance student understanding.

The Interactive Mathematics Program elaborates concepts through all four years. Each year of the program covers fewer topics than traditional programs, but covers them in greater depth. A strength of the program is the opportunity provided to students to build understanding of mathematics as they work on fairly unstructured problems.

Assessment is an integral part of IMP. Students are provided diverse ways to demonstrate understanding, including homework, portfolios, presentations, reinforcement and extension problems, unit and semester exams, and discussion.

The student should be able to:

From Algebra

- Solve quadratic equations by factoring
- Study the number of roots of a quadratic equation and relating this number to the graph of the associated quadratic function
- Use the method of completing the square to analyze the graphs of quadratic equations and to solve quadratic equations
- Work with exponential and logarithmic functions:
 - describing their graphs
 - understanding the relationship between logarithms and exponents
 - finding that the derivative of an exponential function is proportional to the value of the function
 - developing general laws of exponents
 - understanding the meaning and significance of e
 - approximating data by an exponential function
- Develop and use the elimination method for solving systems of linear equations in

up to four variables

- Extend the concepts of dependent, inconsistent, and independent systems of linear equations to more than two variables
- Work with matrices:

- developing the operations of matrix addition and multiplication in the context of applied problems

- understanding the use of matrices in representing systems of linear equations

- developing the concepts of identity element and inverse in the context of matrices

- understanding the use of matrices and matrix inverses to solve systems of linear equations

- relating existence of matrix inverses to uniqueness of solution of corresponding systems of linear equations

- using calculators to multiply and invert matrices and to solve systems of linear equations

• Extend concepts of linear programming to problems with several variables

From Analytic and Coordinate Geometry

- Define slope and understand its relationship to rate of change and to equations for straight lines

• Develop equations for straight lines from two points and from point-slope information

• Develop and apply various formulas from coordinate geometry, including

- the distance formula

- the midpoint formula

- the equation of a circle with arbitrary center and radius

• Find the distance from a point to a line

• Develop and work with equations of planes in three-dimensional coordinate geometry

From Precalculus

• Understand and use inverse functions

• Understand the meaning of the derivative of a function at a point and its relationship to instantaneous rate of change

• Approximate the value of a derivative at a given point

From Geometry

• Develop the relationship of the area and circumference of a circle to its radius

• Understand the definition and significance of π ?

• Use regular polygons to approximate the area and circumference of a circle

• Discover and justify locus descriptions of various geometric entities, such as perpendicular bisectors and angle bisectors

• Develop properties of parallel lines

• Study the possible intersections of lines and planes in 3-space

From Trigonometry

• Apply right triangle trigonometry to real-world situations

From Probability and Statistics

- Develop and apply principles for finding the probability for a sequence of events
- Develop methods for the systematic listing of possibilities for complex problems
- Develop the meaning of combinatorial and permutation coefficients in the context of real-world situations, and understand the distinction between combinations and permutations
- Develop principles for computing combinatorial and permutation coefficients
- Understand and use Pascal's triangle
- Develop and apply the binomial distribution

From Logic

- Use "if and only if" in describing sets of points fitting given criteria
- Define and use the concept of the converse of a statement

Number Systems (IM 3) A; Patterns, Algebra & Functions (IM 3) C, D, E; Problem Solving & Reasoning (IM 3) A, C; Applications & Connections (IM 3) A; Communication (IM 3) A, B, C, D

PA STANDARDS: 2.1, 2.2, 2.7, 2.8, 2.9, 2.10, 2.11