

**Syllabus**  
**Math 01.561 School Mathematics from an Advanced Standpoint**

**Catalog Description**

School Mathematics from an Advanced Standpoint

This course is designed to develop a deeper understanding of mathematics and a new appreciation of its beauty, its logical structure and its applicability. The course will take into account not only the many interconnections among school mathematics topics but also their relationship to higher mathematics.

**A) Objectives:**

At the end of this course, students will demonstrate the ability to:

- analyze alternative definitions, language, and algorithms for mathematical ideas and concepts
- explain why concepts arose and how they changed over time
- perform a wide range of applications
- use calculator and computer approaches to problems
- analyze common high school math problems from a deeper mathematical level
- expound on problems and proofs that can be extended and generalized
- provide connections between ideas in different branches of mathematics
- relate ideas studied in school mathematics to ideas studied later in mathematics

**B) Topical Outline**

**I. Algebra & Analysis with connections to Geometry**

- .....• Real Numbers - decimal representations of real numbers and periods of periodic decimals
- .....• Complex Numbers - the geometry of complex number arithmetic
- .....• Functions - historical evolution, problem analysis, properties, limiting behavior, fitting data
- .....• Equations - Isomorphism, algebraic structure
- .....• Integers & Polynomials - Induction, recursion, FTA, bases, division, algorithm, Euclidean algorithm
- .....• Number System Structures - Modular arithmetic, integer congruence, number fields

**II. Geometry with Connections to Algebra & Analysis**

- Congruence - Euclid's Elements, transformations, symmetry
- Distance & Similarity - Locus, distance on a sphere: similarity of graphs, polygons, and arcs: geometric means
- Trigonometry - Modeling with trigonometric functions, historical development, algebraic properties
- Area and Volume - Area formulas, area as probability, polyhedra, spheres

- Axiomatics and Euclidean Geometry - Incidence Axioms, Betweenness, Parallel Postulate, Euclid's 5th, Cartesian coordinates

### **C) Course Texts**

The following books may be used as a text for the course.

Beaumont & Pierce (1963). The Algebraic Foundations of Mathematics.  
.....Addison-Wesley

House & Coxforde (eds) (1995). Connecting Mathematics across the Curriculum,  
.....1995 Yearbook of the NCTM.NCTM.

Ifah, Georges (2000). The Universal History of Numbers. Wiley.

Nelson, Roger (2000). Proofs Without Words II: More Exercises in Visual  
.....Thinking. MAA.

Peressini, A. & Sherbert D. (1971). Topics in Modern Mathematics for Teachers.  
.....Holt, Rinehardt & Winston.

Polya, George (1954). Induction and Analogy in Mathematics. Volume I and II  
.....Wiley.

Ribenboim, Paulo (2000). My Numbers, My Friends. Springer-Verlag.

Silvester, J (2001). Geometry: Ancient and Modern. Oxford University Press.

Usiskin, Peressini, Marchisotto, & Stanley (2003). Mathematics for High School  
.....Teachers. Person Education.