HONORS 213
QUANTIFICATION: Foundations of Geometry

I. Introduction

A. Catalog Description

This course will present a rigorous treatment of the foundations of Euclidean geometry and an introduction to non-Euclidean geometry. The discovery of non-Euclidean geometries shattered the traditional conception of geometry as the true description of physical space. The discovery led to a revolution in geometry as scientifically profound as that of the Copernian revolution in astronomy. Students will learn the history and foundations of geometry by actually proving theorems based upon Hilbert's axioms for geometry. Emphasis will be placed on logic, the axiomatic method, and mathematical models.

B. Objectives

This course is designed specifically for the Honors program. The emphasis will be on constructing logical arguments, logic, the axiomatic method, and modeling. This will give the students a flavor of modern methods in mathematics. Students will see the birth of these ideas by examining the history and the foundations of geometry.

II. Required Topics

1. Set theory
2. Logic: truth tables, negation, quantifiers, proofs.
3. Hilbert's Axioms: incidence, betweenness, congruence, continuity, parallelism
4. Models
5. Neutral Geometry: geometry without parallel axiom, exterior,angle theorems, angle sum of a triangle
6. History of the Parallel Postulate
7. Discovery of Non-Euclidean Geometry

III. Bibliography

Greenberg Euclidean and Non-Euclidean Geometries

Hilbert Foundations of Geometry

Moise Geometry

Reid Hilbert

Lakatos Proofs and Refutations, The Logic of Mathematical Discovery