MATH 3640/8645

MODERN GEOMETRY

<u>Course Description</u>:

Axiomatic systems, finite geometries, modern foundations of Euclidean geometry, hyperbolic and other non-Euclidean geometries, projective geometry. **3 credits**

<u>Prerequisites</u>:

MATH 2230, MATH 2030, or equivalent mathematical maturity.

<u>Overview of Content and Purpose of the Course</u>:

The objectives of the course are twofold: a) to introduce the student to the rich variety of geometric topics beyond those studied at the high school level. This should prove valuable to the mathematics student in broadening his horizons and specifically to the prospective high school teacher by increasing his knowledge in the area of geometry; and b) to help the student develop the skills of logical reasoning, use of the axiomatic method and careful presentation of proof. This course may help the student in the transition from the more manipulative courses at the freshman-sophomore level to abstract courses at the advanced level.

<u>Major Topics</u>:

1. Axiomatic systems, finite geometries, consistency completeness, and independence in an axiomatic system.

2. Foundations of Euclidean geometry
   a. A critique of Euclid's elements
   b. A modern set of axioms for Euclidean geometry

3. The role of parallel postulate
   a. Absolute geometry
   b. The Euclidean parallel postulate
   c. Discovery on non-Euclidean geometries

4. Hyperbolic and other non-Euclidean geometries
   a. The Hyperbolic parallel postulate
   b. Some theorems of Hyperbolic geometry
   c. Poincare's model
   d. Ecliptic geometries

5. Advanced topics in Euclidean geometry
   a. Circles and theory of inversions
   b. Verification of Poincare's model

6. Introduction to projective geometry

<u>Methods</u>:

The class will be presented in a lecture form with student questions and discussion encouraged.

<u>Textbook</u>:

Greenberg, Marvin Jay. *Euclidean & Non-Euclidean Geometries, 4th ed*. New York: W. H. Freeman and Company, 2007.

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