

Foundations of Geometry¹

Math 370 - Spring 2009

Instructor: Bruce E Shapiro
Location: JR-214
Class Time: Tuesday/Thursday 7:00 PM - 8:15 PM
Office Hours: As announced in class
Email: bruce.e.shapiro@csun.edu
Class Web Paage: <http://beshapiro.com/math370/>

Catalog Description. Pre-/Co-requisite: MATH 320. Write rigorous proofs of results of plane Euclidean geometry. Visualization and development of geometric intuition through the use of dynamic geometry software. Includes history, axiomatic structure, and theorems of plane Euclidean geometry, geometric transformations of the plane: rigid motions, similarities, and inversion, coordinate geometry, and an introduction to non-Euclidean geometries.

Course Objectives. To provide a survey of the topics in and applications of geometry pertinent to future high school geometry teachers including:

- Foundations of geometry
- Methods and applications of proof in mathematics
- Different axiomatic systems for geometry
- Relationship between geometry and algebra
- Historical development of geometry
- Euclidean and Non-Euclidean geometry
- California standards for geometry education
- Use of technology in the classroom
- Writing mathematics documents electronically
- Develop experience in collaborative learning

Topics Covered. As time permits, we will cover the following topics to meet these objectives:

- Using Latex
- Using Geogebra
- Euclid's Elements
- Axiomatic Systems
- Incidence Geometry
- Hilbert's Axioms
- Proving Theorems
- Plane Geometry
- Neutral Geometry
- Euclidean Geometry
- Pythagorean Theorem
- Trigonometry
- Hyperbolic Geometry
- Spherical Geometry
- Polygons and Circles
- Euclidean Constructions
- Transformations and Rotations
- Tessellations in the plane
- Computational Geometry

Student Learning Outcomes Upon completing this class, the student should²

- Understand the foundations of the geometry (MSMR 2)
- Be familiar with the California content standards for Secondary Geometry, and understand the concepts described in those standards.
- Develop a lesson plan for a secondary geometry class.
- Produce a mathematics document electronically.
- Map the principals and concepts of geometry to the California content standards for for secondary geometry.
- Work together effectively in groups to develop and present material others.
- Know the Parallel Postulate and its implications (MSMR 2.1a)
- Know the variants of the parallel postulate for non-Euclidean geometry. (MSMR 2.1b)
- Prove theorems and solve problems involving similarity and congruence (MSMR 2.2a)
- Understand, apply, and justify properties of triangles. (MSMR 2.2b)
- Understand, apply, and justify properties of polygons and circles. (MSMR 2.2c)
- Justify and perform the classical constructions (MSMR 2.2d)
- Perform constructions using software
- Use techniques in coordinate geometry to prove geometric theorems (MSMR 2.2e)
- Understand of parallelism and perpendicularity of lines and planes in three dimensions (MSMR 2.3a)
- Understand, apply, and justify properties of three-dimensional objects (MSMR 2.3b)
- Understand the basic properties of isometries (MSMR 2.4a)
- Understand the basic properties of dilations (MSMR 2.4b)

¹Subject to change without notices. Please check the class website for the most recent version.

²MSMR = Mathematics Subject Matter Requirements, California Commission on Teacher Credentialing.

Grading All assignments must be typeset (not handwritten) using L^AT_EX. Grades will be calculated* as follows:

40%	Homework
10%	Oral Presentations
15%	Group Midterm Project
15%	Group Final Project
20%	Final Exam

*Note that your grade can be penalized for poor attendance or lack of teamwork.

Textbook Gerard A. Venema, The Foundations of Geometry. Pearson Prentice Hall (2006).

Additional outside reading assignments will be provided in class or on the class web page.

Software We will use the following free, open-source software packages: L^AT_EX and geogebra. If you do not have access to a computer at home you are free to use the computers in the math lab in Jerome Richfield Hall.

I will discuss how to obtain, install and use these packages in class; no prior knowledge is expected. They work on all operating systems (Windows, Mac, Linux); if you want to use them in the math lab you will have to become comfortable with Linux.

Using this software is a requirement of the course and your grade will be penalized if you do not use L^AT_EX for your assignments.

Attendance is required; please sign in each class. If you miss a lot of classes your grade will be reduced.

Typical penalty: 0-3 unexcused absences: no penalty; 4-6 unexcused absences: 1/3 of a letter grade; 7-9 unexcused absences, 2/3 of a letter grade; etc.

Collaborative Learning Much of this class will involve collaborative learning. In addition to lectures, you will be expected to work together in groups of approximately 3 to 4 students on your homework and class projects.

Every student in the class will make at least one short (5 minute) presentation to the entire class, either as part of the midterm project or final project. Students who present on the midterm project will not be expected to present on the final, and vice-versa.

Each group should arrange a regular time and location to meet and discuss their homeworks and other group activities. You will be evaluated by each of your peers to determine the level of participation in the group.

Teamwork is an essential part of this class. Your grade may be reduced substantially if you do not work as part of a team. It is your responsibility to inform me if you are having issues with your group and need to be reassigned or have mitigating circumstances that prevent meeting with your group.

Student Conduct Students are expected to conduct themselves in accord with university policies on Student Conduct and Academic Dishonesty. Violation of this code could be punishable by a failing grade in the class or removal from the university, as determined by Dean of Students.

I require students to sign an affirmation that they will abide by the student conduct code (and not cheat in this class) and to reaffirm this contract at each exam. If you are uncomfortable signing this affirmation you should not enroll in this class.

The student conduct code is posted at: <http://www.csun.edu/a&r/soc/studentconduct.html> and is in the University Catalog, Appendix C.

Cookies I like them; please bring some to share with the class.