

Math 432 - Foundations of Geometry

Cristian Lenart

Overview. This course is devoted to an axiomatic development of geometry, both Euclidean and non-Euclidean; that is, we define axiom systems for various types of planes, show that they are consistent by constructing models for them, and derive theorems within those axiom systems.

The course is divided into two parts. In the first part, we study *absolute geometry*, which is the common ground between Euclidean and non-Euclidean geometries. This offers us the occasion to learn some useful facts about Euclidean geometry as well, for instance about isometries (linear transformations which preserve distances) of the Euclidean plane. The second part is devoted to non-Euclidean geometries, and in particular to the hyperbolic plane defined by Bolyai and Lobachevski (which has important applications outside mathematics, such as the relativity theory in physics).

I will attempt to cover, in more or less detail, chapters 1-9, 12-14, 16-24, 26. Sometimes, I will have to skip several topics in the book, and will only concentrate on the most important issues in a particular chapter. Only the material covered in class will be examined, but you are encouraged to do extra reading on your own.

Prerequisites. There are no prerequisites for the course except for familiarity with mathematical proofs. Mathematical logic and proofs are an **essential** part of this class.

Textbook. *The Foundations of Geometry and the Non-Euclidean Plane* by George E. Martin, Springer, 1998, ISBN 0-387-90694-0, 3-540-90694-0.

Attendance. You may miss up to 3 classes with no effect on your grade. After that, for each class you miss, your grade will drop by one “notch”, for instance from B+ to B.

Homework. I will assign homework problems (mainly from the textbook), usually 1-2 problems after each class. You are welcome to work together on them, but the solutions must be written up independently. Two solutions which are written up in an identical way (I mean identical notation, formulation etc.) will be penalized. The homework assigned on each week will be due the following week on Friday. The homework represents a bare minimum amount of work needed, so you are **strongly** encouraged to solve more problems from the book on your own, especially since most of them have solutions at the end of the book (of course, starting by reading the solution does not bring you any benefits). **Late homework** is accepted but will only receive 2/3 of the credit.

Exam. There will be a mid-term exam, covering the material presented in class from Chapters 1-20. Both the mid-term and the final exams will be open book exams.

Grading. Grading will be done according to the following percentages:

Homework 40%

Mid-term exam 25%

Final 35%.

Plagiarism will result in failing the class.

Office hours. Monday 11:25-12:20 and Wednesday 2:40-3:35 in my office, ES-116A.