

# Math 444: Geometry for Teachers

Winter 2018

**Instructor:** Christopher Hoffman

**Lecture Time:** MWF, 12:30 - 1:20 in THO 325

**Office:** PDL C-333

**Office Hours:** M 11:30-12:30 PDL C-333

W 1:30-2:30 PDL C-333

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**TA:** Karthik Iyer

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**Office Hours:** W 3:00-4:00 PDL C-430

TH 3:00-4:00 PDL C-430

**Texts:** We will use two textbooks.

- *Axiomatic Geometry* by John M. Lee
- Book I of Euclid's Elements, available online:  
<https://mathcs.clarku.edu/~djoyce/java/elements/toc.html>

**Math 444 topics:** Chapters 1-8 of the textbook, and Appendices E through H.

- critical reading of Euclid
- comparison of different axiom systems for geometry
- introduction to axiomatic systems through careful study of a simplified system called incidence geometry
- in-depth study of neutral geometry, which is Euclidean geometry without any parallel postulate

**GRADES:** Your grade for each quarter will be based on a weighted average of the following scores:

- 10% Oral presentations
- 10% Quizzes
- 20% Homework
- 30% Midterm exam
- 30% Final exam

Individual homework and quiz scores will be recorded as percentages, and the lowest homework score and lowest quiz score will be dropped before averaging the rest.

## GENERAL DESCRIPTION

This course is designed for people who expect to be teaching geometry at the high school or middle school level, but it can be useful for many others as well.

Mathematics is the single field of human endeavor in which we are the most certain of the correctness of our knowledge. How can we be so certain? It is because mathematicians have developed a rigorous system for proving mathematical assertions, starting from simple assumptions and progressing by simple logical steps whose legitimacy virtually everyone can agree on. This system, together with the many mathematical insights that have been gained from it, is among the crowning intellectual achievements of humanity.

Geometry is the first branch of mathematics that people managed to systematize and place on a rigorous footing, and it has served as a model for rigorous logical thought for more than two millennia, as well as being one of the most practically useful branches of mathematics. In many high school curricula, geometry is the only course in which students have a significant opportunity to learn the rules and techniques of logical reasoning and proofs.

The main goal of this course is to help you acquire a deep understanding of and appreciation for geometry, and learn to think about it rigorously. This is a math course, not a course in pedagogy. I won't be teaching you "how to teach geometry"; that's something you'll have to learn from education courses and hands-on practice. But in order to be a successful teacher, you need to have what the experts call "profound understanding of fundamental mathematics." In this course, most of the mathematical topics we discuss will be rather elementary, but our approach will be far from elementary.

A secondary goal of this course is to help you become adept at mathematical communication. Opportunities to improve your communication skills on several levels will arise throughout the course (see below for details): speaking precisely about mathematical ideas in class and in discussion sessions; writing informally about mathematical ideas on the class discussion board; and writing careful mathematical arguments for homework assignments.

## REQUIREMENTS

**Classes:** Although I will not keep a formal attendance record, class attendance is required. Much of what we talk about in class will be designed to supplement the reading, not repeat it. Sometimes there will be unannounced quizzes. If you must miss a class for some unavoidable reason, it is your responsibility to find out what happened, and get your homework to me by class time (or, in case of emergency or unforeseen illness, as soon as possible thereafter).

**Reading Assignments:** Along with each homework assignment, there will be a reading assignment. In the early part of the course, this will usually be approximately one chapter from the book each week, but later assignments might include two chapters. It is a good idea to read through the next chapter quickly before class, and then read it again more carefully after we have discussed it. I really mean read it. This is not the kind of material that can be learned by looking at a homework problem and then leafing back through the book to find an example showing how to do that kind of problem. There might be quiz questions based on the reading.

**Written Assignments:** Each week, there will be a written homework assignment, with a due date to be announced. These assignments will be announced over email. Homework that is turned in after the first ten minutes of class will get a 10% deduction, and homework turned in after class is over will not be accepted except in extraordinary circumstances and (except for emergencies) with advance permission.

**Oral Presentations:** Throughout the quarter you will be asked to do three presentations on homework problems. These will either be in class, in my office hours or in the TAs office hours. At least one must be in class, one before the midterm and one after the midterm. Also The presentations will be graded credit/no credit: If you can present a complete and correct solution to a homework problem, with however much help you

need from the TA and other students, you will get credit.

**Collaboration:** I strongly encourage you to work on the written assignments together with other students. And if you attend discussion sessions, you can share your solutions with other students, or listen to other students present their solutions. You might be able to find solutions to some of the problems on the Internet, but I do not recommend it. Some of those solutions are probably wrong, and in any case, by reading someone else's polished solution instead of struggling with the ideas yourself, you deprive yourself of the most important learning experience that a course like this can provide.

When you write up your solutions to the homework assignments, you must write your own solutions in your own words. Even if you work out a solution as a group, it is not acceptable for one person to write down the solution and for others to copy it, and it is even less acceptable to copy a solution that you find on the Internet. If we receive a homework paper that contains material that has been copied, it will be treated as a case of academic dishonesty.

**Quizzes:** At sporadic intervals throughout the course, I'll give short quizzes in class. These might be simple questions about the latest reading assignment, or homework problems that you've already done, or short questions that test how well you've absorbed the concepts that have been discussed recently. Quizzes will not be announced in advance. Quizzes cannot be made up, but your lowest quiz score will be dropped, and any quiz missed due to an excused absence will not count against you.

**Final Exam:** The final exam for 444 will cover all of the material from winter quarter.