Math 444 **Geometry for Teachers** **Winter 2010**

SYLLABUS

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Classes: Monday/Wednesday/Friday 10:30-11:20, Benson 203.

Website: *www.math.washington.edu/~lee/Courses/444-2010*
From the Math Dept. home page, **Class Web Pages → Math 444**

Textbooks: The main text will be the following course notes, which will be posted on the class website as each chapter becomes available.

- John M. Lee, *Axiomatic Geometry*, course notes for Math 444/445.

In addition, you'll need to get a copy of the following high-school math textbook, which we will use briefly in Math 444:

- Harold Jacobs, *Geometry: Seeing, Doing, Understanding*, 3rd edition, Bedford, Freeman, and Worth, 2003.

You'll also need to have access to the text of Book I of *Euclid's Elements*, translated by T. L. Heath. Here are some alternatives:

- Online version, with interactive Java applets illustrating the propositions: *http://aleph0.clarku.edu/~djoyce/java/elements/toc.html*.
- All 13 books of *Euclid's Elements*, edited by Dana Densmore (Green Lion Press, 2002). This is an excellent edition, and I recommend purchasing it.
- Books 1 and 2 of *Euclid's Elements* are available in an inexpensive Dover edition. Less convenient than the Green Lion edition, because it's cluttered with a lot of commentary by Heath, which is not as relevant for our purposes.

Finally, you should have a reference book that explains set theory, functions, logic, and proof. If you don't already own one, I recommend the following book, which is sometimes used as a textbook for Math 300:

- Peter J. Eccles, *Introduction to Mathematical Reasoning*, Cambridge, 1998.

The books by Jacobs, Euclid (Densmore ed.), and Eccles are available for purchase in the U Bookstore, and are on reserve in the Math Research Library (PDL C-306).

Prerequisites: Grades of 2.0 or better in Math 126, 308, and 300 (formerly 310).

Exams: Midterm: Friday, February 12, in class.
Final: Monday, March 15, 8:30–10:20.

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 humans 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.

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—thus 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 elementary 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; writing informally about mathematical ideas on the Geometry Blog; and writing careful mathematical arguments for homework assignments.

Here are the main topics for 444/445:

- critical reading of Euclid;
- critical reading of a high-school geometry text;
- introduction to and comparison of different axiom systems for geometry;
- in-depth study of the most important results of Euclidean geometry and their proofs;
- comparison of intuitive, graphical, verbal, and axiomatic ways of understanding geometry;
- an introduction to the history and main results of non-Euclidean geometries.

REQUIREMENTS

Classes: Although I won't keep a formal attendance record, *class attendance is required*. Many things will be discussed in class in more depth than they are covered in the reading. Sometimes there will be unannounced quizzes. If you will miss a class for a religious holiday, let me know in advance and I'll help you get the information you missed. If you must miss a class for some other unavoidable reason, it's your responsibility to find out what happened, and get your homework to me by class time (or, in case of emergency, as soon as possible thereafter).

Geometry Blog: I've set up a Math 444/445 Geometry Blog, accessible from the class website. I will try to post a blog entry as soon as possible after every class—usually, my entries will be ready by about 4:00PM, sometimes sooner. Each of my blog entries will include a brief summary of what

happened that day (no substitute for attending class!), the latest reading and written assignments, and some questions for you to address in your own blog entries. Part of the requirement for this course is to post a blog entry of your own at least once a week. In order to count, your blog post must respond to one of mine *before the next class*. Your posts won't be graded for quality, but for full credit you must respond to at least one post a week, and your entries must address the questions I pose in my own posts. In addition, I encourage you to bring up any questions that have been raised in your mind by the latest reading, lecture, and/or homework, and to respond (respectfully!) to questions or comments made by other students. Please don't just repeat what others have written; instead, try to contribute something new to the conversation. If you wish to write about specific homework problems, please confine your comments to general questions and suggestions about how to get started.

Reading: Some of my blog posts will include reading assignments. I expect you to read through each assignment quickly before the next class, and then to reread it carefully after it is covered in class. All reading assignments are required.

Written Homework Assignments: Some of my blog posts will also include written homework assignments. Assignments are due on Wednesdays *at the beginning of class*. Late homework will not be accepted except in extraordinary circumstances and (except for emergencies) with advance permission. I strongly encourage you to work on the homework problems together with other students. However, when you write up your solutions to hand in, *you must write your own solutions in your own words*. More details about how to write up homework assignments will be given in an upcoming handout.

Quizzes: At sporadic intervals throughout the quarter, I will give short quizzes in class. These will often be simply homework problems that you've already done, which I will ask you to answer in a timed setting without looking at your notes. Other times, they will be short questions that test how well you've absorbed the concepts that have been discussed recently. Not all quizzes will be announced in advance. Quizzes cannot be made up, but your lowest quiz score will be dropped, and any quiz missed for religious or medical reasons (with a doctor's note) will not count against you.

GRADES: Your grade will be based on a weighted average of the following scores:

35%	Homework assignments
10%	Quizzes
20%	Midterm exam
5%	Blog posts
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.