Math 444/445 **Geometry for Teachers** **Summer 2011**

SYLLABUS

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Classes: Math 444 (June 20-July 20): Mon/Wed/Fri 10:50-1:00, Sieg 225
Math 445 (July 22-August 19): Mon/Wed/Fri 10:50-1:00, EEB042.

Web site: *www.math.washington.edu/~lee/Courses/444-5-2011*
From the Math Dept. home page, **Class Web Pages → Math 444/445**

Textbooks: The main required text will be the following draft textbook, which I've written for this course. Be sure you get the Summer 2011 edition; prior editions are not acceptable.

- John M. Lee, *Axiomatic Geometry*, Summer 2011 edition.

In addition, you'll need to get at least temporary custody of 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:

- The complete text of *Euclid's Elements* is available online, 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. This edition is less convenient than the Green Lion one, because it's cluttered with a lot of commentary by Heath, which is not as relevant for our purposes.

The books are (or soon will be) 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: Math 444 Final: Wednesday, July 20.
Math 445 Final: Friday, August 19.

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. 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—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 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; writing informally about mathematical ideas; 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;
- an introduction to the history and main results of non-Euclidean geometry.

REQUIREMENTS

Please note that this intensive summer course consists of two 3-credit courses (usually 20 weeks of classes) compressed into about 8 weeks of classes. In addition to spending six hours each week in class, you should be prepared to do an average of 4–5 hours of work before each class *in addition to class time*. This adds up to the equivalent of a half-time job, so be sure to allocate your time accordingly.

Here are the specific requirements:

Classes: Although I won't keep a formal attendance record, *class attendance is required*. Much of what I talk about in class will be designed to *supplement* the reading, not repeat it. 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 post a blog entry as soon as possible after every class—usually, my entries will be ready by about 3:00PM, sometimes sooner. Each of my blog entries will include a brief summary of what happened that day (no substitute for attending class!), and the latest reading and written assignments. Sometimes I'll expand on things that I said in class, or pose questions for you to think about before the next class. You are required to post responses to my entries at least twice a week. I might ask you to comment on the reading, or to describe one or more questions that have been raised in your mind by the reading or lectures, or to answer a specific mathematical question. You're also welcome to post comments, ask questions of your own, or respond (respectfully!) to questions or comments that were poseed by me or by others in the class. If you wish to write about specific homework problems, please confine your comments to general questions and suggestions about how to get started.

Reading: Most of my blog posts will include reading assignments. If the reading covers material that we have not yet talked about in class, I expect you to read through it quickly before the next class. Then, after we talk about it, you'll need to read it thoroughly and carefully. All reading assignments are required.

Individual Written Assignments: Most of my blog posts will also include written homework assignments for you to do on your own, usually due at the beginning of the next class meeting. Homework that is turned in after the first ten minutes of class will get a 5% deduction, and homework turned in after class is over will not be accepted except in extraordinary circumstances and (except for emergencies) with advance permission.

Group Written Assignments: On the first day of class, I will assign each of you to a study group of three or four students. Some homework problems will be designated as "group assignments." For these, you'll collaborate with your group to work out a solution, and then produce a single written solution for the entire group. It should go without saying (but I'll say it anyway) that each member of the group should make a serious effort to contribute a fair share of the work, and to encourage other members of the group to contribute their fair shares.

Collaboration: In addition to the group assignments, I strongly encourage you to work on the individual asignments together with other students. However, when you write up your solutions to individual assignments, *you must write your own solutions in your own words.* More details about how to write up homework assignments will be explained in the *Homework Expectations* handout.

Quizzes: At sporadic intervals throughout the summer, 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.

Final Exams: On the last day of each course (444 and 445), there will be a two-hour final exam in the regular classroom at the regular meeting time.

Optional W Credit: You may optionally sign up for "W" (writing intensive) credit for Math 444 and/or 445. To do so, you must let me know by email no later than the third class meeting of the course in which you want to receive W credit. For those who choose to work toward W credit, two written assignments will be designated as "Portfolio Assignments." You'll revise and rewrite your portfolio assignments after feedback from other members of the class, the TA, and/or me. After a couple of rounds of revision, you'll come up with a final version to keep in your portfolio. At the end of the quarter, you'll turn in a completed writing portfolio (together with all previous drafts and comments) for grading. If you receive a grade of 2.0 or better in the course *and* receive an overall score of 70% or better on the portfolio assignments, you will get W credit.

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

35%	Individual homework
15%	Group homework
5%	Blog posts
15%	Quizzes
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.