M333L – Structure of Modern Geometry
Fall 2009

Unique number: 57770
Time and place: TTH, 9:30 – 11:00 AM, RLM 7.124
Course text: None required. We will provide notes and problem sets in class.

Instructor: Prof. Michael Starbird
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Prerequisites: M408D or M408L with a grade of at least C, or upper-division standing and consent of instructor.

Welcome to M333L!
Greetings! According to the UT Math Department, the goal of M333L is to develop "the geometrical concepts which relate to two and three dimensional geometry and the mathematical techniques used in the study of geometry." In this course, we will be studying both Euclidean geometry, which you were introduced to in high school, and certain non-Euclidean geometries.

"Euclidean geometry" consists of the body of geometric ideas and theorems that include and extend ideas that appear in Euler's *The Elements*. Most of the theorems you saw in high school geometry were recorded by Euclid himself in *The Elements*, which is the most used textbook in history. In this course, you will prove many of these theorems, as well as some other beautiful theorems that remained undiscovered for centuries after Euclid's *Elements* was written.

"Non-Euclidean geometry" is an umbrella term for various types of geometry that follow from certain alternatives to the Parallel Postulate. While these geometries are less familiar to us, they have remarkable properties of their own, and in some cases they represent certain parts of the physical world more accurately than Euclidean geometry can.

This course will be taught using a **modified Moore method**, meaning that you, the student, will be responsible for proving the theorems we discuss in this course. During class, you will present proofs that you have written, and see proofs that your classmates have written. In order to get the most out of this course, you must be willing to put in a sustained effort from the beginning of the semester to the end.

Grading and expectations
Your grade in this course will be determined by the following:

- Notebook – 35%
- Presentations and participation – 15%
- Two midterm exams – 15% each
- Final exam – 20%

All UT courses use a plus/minus system of grading.

Exams
We will have two midterm exams in class on October 6, 2009, and November 17, 2009, and a final exam to be given at place and time assigned by the Registrar.

Your geometry notebook
In this class, you will keep a "geometry notebook" that (together with the problem sets and notes we give you) will create your textbook for the course. For this purpose, we recommend that you buy a durable three-ring binder. Each week, we will assign problems for you to work on; please write your proofs on white or lined paper and put them in your notebook. Cody will collect your notebooks each Tuesday, grade some of your proofs, and return your notebook on Thursday.

In one sense, your notebook grade will be your "homework" grade for the course; we will grade your proofs according to how complete and correct they are. However, we also want this notebook to be a resource for you as you continue your mathematical studies, and, for those of you who will be teaching middle school or high school mathematics, as you teach geometry. Therefore, we want you to make this notebook beautiful, organize it well, and make it your own! If your work is sloppy or disorganized, your grade may suffer and you will not learn as much. It is likely that you will make some mistakes the first time you try to write a proof; this reality is why we want you to use a binder rather than a spiral notebook, so that you can add and remove pages as necessary. If a proof is ugly, rewrite it and try to make it beautiful! Conversely, if you find cool ways to organize your work or make it beautiful, you can earn extra credit on this part of your grade.

Presentations and participation
On most class days, we will ask you to present proofs of theorems you have been working on. Please come to class each day prepared to present the theorems scheduled for that day; you won't be called upon to do so every day, but we want you to be ready in case you are. If you proved one theorem that you thought was particularly interesting or difficult, you should let us know so we all can see your proof!

Keep in mind that talking to others about a proof you have done is a bit different from writing a proof. The act of talking about a proof gives you the opportunity to show people how the ideas of the proof fit together, and what issues you had to deal with when working on the problem. One thing we want you to develop in this course, besides your geometry skills, is your ability to communicate mathematics to others.

When your classmates are presenting, it is your responsibility to follow their line of reasoning. Keep in mind that their argument may be different from yours; alternative proofs are especially common in a geometry course, where there are literally dozens of ways to prove certain propositions. If you see something in a proof that you don't understand, please ask about it. If you see a possible mistake, please ask about it. If there is something about the proof that you thought was interesting or clever, feel free to comment on it! In each case, please be considerate of the person at the front of the room, and treat him/her the way you'd like to be treated when it's your turn to present.

Academic dishonesty
Most of the theorems that we will prove in this course can be readily found in any good geometry textbook or on the internet. This semester, we are going to ask you **not** to use these sources. We want you to have the experience of proving theorems on your own, because figuring things out on your own is the best way to learn mathematical ideas and techniques if you want to be able to use them a year / five years / ten years from now. You can quickly find out how to do a problem by looking it up in a book or on the internet, but we want you to experience the joy of figuring things out and being a producer, rather than a consumer, of mathematics. One of the major goals of this course is for you to become skillful at creating mathematical ideas and proofs on your own.

Therefore, for purposes of this class, turning in a solution to a homework problem that you obtained from an outside source is considered plagiarism, just like writing a report that consists entirely of quotes from other books or papers would be considered plagiarism in another course. We know that since you are not allowed to look to outside sources for help, you may get stuck from time to time and not be able to complete all of the problems we assign. This is okay, and we will take this into account when determining your notebook grade.

We **do** encourage you to work with your classmates when working on homework for this class, but please use the following method in doing so. First work on the problem on your own. If you get stuck, one source for help is to ask Cody or Dr. Starbird for a hint. Alternatively, you may work with other students who have not solved the problem. If you ask a student in the class who has solved the problem, that is OK; however, the student who knows the answer should not simply tell the answer. Instead, the person who knows should give helpful guidance so that you can solve the problem on your own. As a general rule, everything you turn in for this class should represent your own work; it should not be something that somebody else gave you without any work on your part, and it should, of course, never be copied from someone else's paper. If you do learn a substantial part of the idea of a problem from someone else, then please note that fact on your paper.

Course Schedule
We will be treating theorems in Euclidean geometry from the beginning of the course until about the end of October. We will hand out lists of theorem statements and other questions on the first day of class that treat Euclidean geometry. We will proceed at the rate determined by the students ability to prove and present the theorems in class. The last part of the course will have a separate packet of theorem statements that we will hand out then and, again, the course will respond to the success of the students.

Students with disabilities
The University of Texas provides, upon request, appropriate academic accommodations for qualified students with disabilities. For more information, contact the office of the Dean of Students at 471-6259, TTY 471-4641.

One more thing...
We are committed to doing everything we can to help you make the most of this course. If you have questions, comments, or suggestions regarding our class, please do not hesitate to contact us.