Math 510, Introduction to the Foundations of Geometry

Spring 2009, 5:35–6:50 MW, C-10

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Prerequisites: Mathematical maturity at the level of Calculus II (Math 151 or equivalent) and a thorough understanding of K–12 math. If you earned less than a C in Calc II, this course is probably not for you.

Required text: M.J. Greenberg: Euclidean and Non-Euclidean Geometries

Course objective: This is an advanced undergraduate course in the foundations of geometry. This course will consist of two parts. The first part will be taught in the conventional, the second part will be discovery style learning.

In the first part of the course, we will cover selected topics from Euclidean and non-Euclidean geometry. You will be expected to be thoroughly familiar with the terminology introduced, be able to state definitions precisely, give examples and counterexamples to them, be able to solve all homework problems, be able to state and prove all theorems covered in class and in your textbook, and be able to solve problems and construct proofs of statements similar in content and level to these. In the second part of the course, you will build a geometric system from definitions and axioms. You will be expected to construct your own examples and proofs and maintain your own notes.

Website: www.rohan.sdsu.edu/~ituba/math510s09. I will also use Blackboard to post your grades periodically.

Class attendance: This is not distance education. You are expected to attend and participate in every class. If you skip class you will miss the chance to learn skills that will be tested on the exams. You may also miss a quiz and there are no make-ups. Finally, if you keep skipping class, I will think that you are not serious about your education and will remember that when assigning your grade at the end of the semester.

On work outside of class: Have you ever wondered why taking 12 units of classes qualifies you as a full time student? That's only 10 hours per week in class. The reason is that you are expected to do a lot of work on your own outside of class. In fact, the rule of thumb of college education is that for every hour you spend in class, you should expect to spend three hours studying outside of class. That is how 12 units makes full time: 10 hours in class and 30 hours studying outside of class each week. That means you'll need to spend about 7.5 hours a week studying outside of class for this course. That is if you are well-prepared for the course. If your math background is lacking, then you'll have to spend more time. I am not kidding.

Homework and reading will be posted on the class website regularly. You will be able to follow the progress of the course using the website. HW is an essential part of your learning. Take it very seriously. It is extremely important that you keep up with the HW. If you do not, you will quickly find yourself lost in class and at a great disadvantage during exams. Treat the HW as a learning opportunity, rather than something you need to get out of the way. Reread, revise, and polish your solutions until they are correct, concise, efficient, and elegant. This will really deepen your understanding of the material. You won't do well in a math class without doing all of the HW. Attending class and reading your textbook are necessary but not sufficient conditions for passing the course. Expecting to learn math without doing exercises on your own is like expecting to learn

to ride a bicycle without ever sitting on a bicycle.

Your performance on the homework will be tested on quizzes and exams. Every quiz and half of every exam will consist of exercises straight from the homework. You can turn in your homework to me any time for feedback. I will comment on it and turn it back to you as soon as I can. Clearly, if you don't turn in homework, I can't give you feedback on your work, no matter how much I want.

Homework will become even more important in the second part of the course, when your homework will be to write and maintain your own notes. You will use the same notes to study for quizzes and exams. If you don't do your homework, you won't have notes to study from.

There is an obvious winning strategy. Do the HW, seek feedback on it, revise it, and keep your HW notes neat and organized. The familiarity you gain with the exercises by doing this will let you do the quizzes with ease. It will also let you complete half of each exam quickly and move onto the other half of the exam. The experience you gain by keeping up with your homework will be invaluable in doing that other half of the exam. On the other hand, if you do not keep up with your HW, you will face the challenge of solving many unfamiliar problems under time pressure on the quizzes and the exams. You will likely find this an impossibly daunting task and your grade will reflect this.

Discovery notes: In the second part of the course, you will write and maintain your own notes as you build up a geometry from axioms and definitions. This will be your homework. Each exercise you submit by the deadline will earn you up to 3 points. The author of the most elegant solution will get to present his/her work in front of the class and will another 3 points for a high-quality presentation.

Collaboration on the HW: Limited collaboration with your fellow students in the class is OK. The idea is to let you discuss and critique each other's ideas and not to let you split the workload. Keep collaboration constructive and reasonable. You should fully understand the solution and write it up on your own. Remember that on the quizzes and the exams, you are on your own.

If you are approached by another student from the class who wants to copy your HW notes, think twice before generously sharing. You will feel very bad if your crafty buddy outscores you on a quiz by exploiting your and everybody else's collective wisdom without doing work of his/her own.

Discussion sections: I strongly encourage you to organize a weekly session to work with (not copy from!) your fellow students on problems in class and on the homework. This will help you keep up with your work and get ideas and feedback from others who are grappling with the same exercises as you. You will find that the sense of companionship motivates and encourages you to work.

Quizzes: In the first part of the course, we will have a quiz about every week and a half. It will be straight from the homework. It is your responsibility to come to class, so if you miss a quiz because you are not there, you will not be allowed to make it up. Your lowest quiz score will be dropped.

Exams: There will be three in-class exams as well as a final exam. Your two highest scores on the in-class exams will be used in computing your grade. The in-class exams will be on Feb 23, Mar 23, and Apr 27. If you skip an exam, it will become the dropped exam. You will normally not be able to make it up, unless you have a compelling (e.g. medical) and documented excuse. Forgetting that there is an exam or being unprepared for it are not considered compelling excuses.

Final exam: Time and place TBA.

Problem of the fortnight: The Mathematics Department in San Diego posts interesting problem periodically. I will give you extra credit for every problem to which you submit a correct solution to the organizers of the contest. You can also win a t-shirt and, if your solution is deemed the most elegant, a book. You will find a link to these problems on the class website.

Grading scheme:

Quizzes	15 points
Discovery notes and presentations	3 points each
In-class exams (two highest scores)	15 points each
Final exam	25 points
Problem of the fortnight	3 points each

A score of 80 points or more will guarantee an A, 60 pts a B, 40 pts a C, and 20 pts a D. The curve may be adjusted somewhat lower than this. Here is what the various grades mean:

Grade	University policy	What this means in Math 510
A	outstanding achievement; available only for the highest accomplishment	You are thoroughly familiar with all definitions and examples covered, can precisely state and correctly prove all theorems from class, can do all of the homework exercises, and can use the concepts you learned in this course to solve unfamiliar problems comparable in complexity to those done in class and on the homework. Your discovery notes are nearly textbook quality.
B	praiseworthy performance; definitely above average	You are thoroughly familiar with all definitions and examples covered, can precisely state and correctly prove almost all theorems from class, can do most of the homework exercises, and can use the concepts you learned in this course to solve most unfamiliar problems of comparable complexity. Your discovery notes are free of mistakes if not entirely polished.
C	average; awarded for satisfactory performance; the most common undergraduate grade	You are familiar with all definitions and most examples covered, can state and prove without major mistakes most theorems from class, can do the majority of the homework exercises, and can use the concepts you learned in this course to solve some unfamiliar problems of comparable complexity. Your discovery notes are mostly free of gaps and mistakes.
D	minimally passing; less than the typical undergraduate achievement	You are familiar with the majority of definitions and many examples covered, can state and prove at least half of the theorems from class, can do at least half of the homework exercises, and can use the concepts you learned in this course to solve at least a few unfamiliar problems of comparable complexity. Your discovery notes have gaps and mistakes but you have at least attempted most of the problems.
F	failing	You have difficulty stating definitions and coming up with examples, do not remember statements of theorems and/or cannot prove them, can do few of the homework exercises, and lack the skills to attach unfamiliar problems of comparable complexity. Your discovery notes are lacking.

Quality of work: It is important that you work neatly on the assignments. The quality of your work will affect your grades on the exams. Quality has to do with how easy it is for someone else to read your solution to a problem. It is not enough to do the math right, you must also communicate it well.

Students with disabilities: If you need special arrangements, let me know well in advance so we can plan to accommodate your needs.

On independent work: Learning math is much like learning to ride a bicycle in that you learn by doing it and not by watching someone else do it. Attending class and reading the textbook won't be enough to do well on the exams. You should work through every example and proof in the book and in your class notes and expect to have to re-read everything several times. It's slow, but then your reading list for this class is short.