Course Overview

Geometry is one of the oldest and most fundamental branches of mathematics. While we commonly think of Euclid's geometry, there are many others and this course will be an exploration of geometries.

We'll start by considering axiomatic systems and finite geometries. This will give us practice proving theorems and understanding the relationship between axiomatic systems and models. Next comes a brief overview of Euclidean geometry, before moving on to hyperbolic geometry. In hyperbolic geometry, Euclids parallel postulate fails spectacularly and an amazing mathematical object appears. We'll then spend some time discussing the role that symmetry and transformations play in our understandinig of the idea of a geometry. Finally, we'll end the course studying projective geometry, a non-Euclidean geometry with connections to art that plays an important role in modern mathematics.

Essential Information

Professor	David Maxwell
Office	Chapman 308C
Email	`ffdam@uaf.edu`
Phone	474-1196
Web	`http://www.math.uaf.edu/~maxwell`
Required Text	**The Geometric Viewpoint**, *Thomas Q. Sibley*, Addison-Wesley

Optional Texts

From time to time I will use material from other texts to supplement the course. Three good texts I have in mind are

- **A Course in Modern Geometries**, *Judith N. Cederberg*
- **Experienceing Geometry**, *David W. Henderson* and *Daina Taimina*.
- **Euclidean and Non-Euclidean Geometries**, *Marvin J. Greenberg*.

I've put Greenberg on loan in the library. You are welcome to borrow my personal copies of the other two texts for a day or two if you'd like.

Prerequisites:

MATH F202 and comfort writing proofs. (MATH F215 would be an ideal course to have taken, but it is not required). We'll also use a little linear algebra in this class, but I'll teach what we need as we go along.

Class Time

We will meet three times a week for an hour each session. The classes will be a mixture of traditional lectures as well as group work some days.

During the group work sessions, you will be working in small groups of three students or so on a collaborative problem. Your group may be called upon to present a solution to the problem or to

lead a discussion concerning its solution or challenges.

Lecture Times
MWF 1:00–2:00 Gruening 413

Office Hours

I will schedule 3 hours a week of formal office hours. These times will be chosen after consulting with my classes. I will post the times on my website and outside my office door. I have an open door policy; if I'm in my office and my door is open, please feel free to drop by with questions. You are also welcome to schedule a meeting outside of my formal office hours by sending me an email.

Homework

There will be a homework assignment due roughly every week. We will decide together on the first day of class on a good day of the week for your homework to be due. Homework will be due at the end of class on the day due.

Late homework will not be accepted as this interferes with posting solutions. To compensate for this policy, your lowest two homework grades will be dropped.

Midterms

There will be two in-class midterm exams to be (*tentatively*) held on February 24 and March 31.

Final Exam

There will be a two-hour final exam on Wednesday May 10 at 1:00pm. The exam will be comprehensive.

Project

Each student will complete a project for the class delving into an aspect of geometry not directly covered in class. The project will will consists of an oral presentation and a component to be turned in.

The oral presentation will be about 15 minutes long and will be held during the last two weeks of class. We'll schedule these times later. You will also hand in, on the last day of class, a short paper concerning your topic along with any software, models, etc that are part of the project. More specific guidelines for the project will be given later in the semester.

The goal of the project is to allow you to explore an area of geometry and to report back on it to the class. Your topic should reflect your interests. You could explore a specific area of geometry I don't cover (There are lots! e.g. Möbius geometry, various forms of fractal geometry, higher dimensional hyperbolic or projective geometry, ...), expand upon an advanced problem from the required or optional texts, research an aspect of history in geometry, construct software of geometric interest, etc. I can help you with directions to explore in. You will need to schedule a short meeting to discuss your project idea and you should have it approved by Friday March 24. Please feel free to chat with me about your project at any time.

Participation

From time to time in the course we will break into groups and work on problems. Sometimes your group will be asked to present the solution or lead a discussion of the problem. There will be lots of opportunities during the formal lectures for you to stop me and ask questions. All these are forms of class participation. There is a modest part of your grade (5%) associated with class participation. This shouldn't be a part of your grade you think much about; if you are usually actively present during class you will receive the full participation grade.

Evaluation

Course grades will be determined as follows:

Homework	25%
Participation	5%
Midterm 1	20%
Midterm 2	20%
Project	10%
Final	20%

Letter grades will be assigned according to the following scale. This scale is a guarantee; I also reserve the right to lower these thresholds.

A	90–100%
B	80–89%
C	70–79%
D	60–69%
F	0–59%

Rules and Policies

Collaboration You are encouraged to work together in solving homework problems. But each student must write up his or her own solutions independently. If you receive significant help solving a problem, it is customary to make a note in your homework to give the person who helped you credit.

Makeup Exams You can make up an exam if certain extenuating circumstances prevent you from taking it and if you inform me in advance. Contact me as soon as possible if you are going to miss an exam.

Attendance Attendance is included indirectly as part of your grade in the participation category; if you are absent you can't participate! One of the best things you can do to succeed in a math class is to attend every class. If for some reason you have an unavoidable conflict and will miss a class, please send me an email to let me know that you will be away.

Cell Phones Turn off your cell phone before you come to class.

Disabilities Services I will work with the Office of Disabilities Services (203 Whitaker, 474-7043) to provide reasonable accommodation to students with disabilities.

Incomplete Grade Incomplete (I) will only be given in Computer Science, Mathematics or Statistics courses in cases where the student has completed the majority (normally all but the last three weeks) of a course with a grade of C or better, but for personal reasons beyond his/her control has been unable to complete the course during the regular term. Negligence or indifference are not acceptable reasons for the granting of an incomplete grade. (Note: this is essentially the old University policy.)

Late Withdrawals A withdrawal after the university deadline from a Department of Mathematical Sciences course will normally be granted only in cases where the student is performing satisfactorily (i.e., C or better) in a course, but has exceptional reasons, beyond his/her control, for being unable to complete the course. These exceptional reasons should be detailed in writing to the instructor, department head and dean.

Academic Dishonesty Academic dishonesty, including cheating and plagiarism, will not be tolerated. It is a violation of the Student Code of Conduct and will be punished according to UAF procedures.

Tentative Schedule

Week	Topics and Events
1/20	Axiom System and Models
1/23 – 1/27 Finite Geometry	
1/30 – 2/3	Euclidean Geometry
	Friday: Last drop day (50% refund)
2/6 – 2/10	Hyperbolic Geometry
2/13 – 2/17	Hyperbolic Geometry
2/20 – 2/24	Hyperbolic Geometry
	Friday: Midterm
2/27 – 3/3	Spherical Geometry, Review of Linear Algebra
3/6 – 3/10	Transformations
3/13 – 3/17	Spring Break
3/20 – 3/24	Transformations
	Friday: Project ideas approved
	Friday: Last day to withdraw
3/27 – 3/31	Symmetry
	Friday: Midterm
4/3 – 4/7	Projective Geometry
4/10 – 4/14	Projective Geometry
4/17 – 4/21	Projective Geometry, Start Student Presentations
5/1 – 5/5	Student Presentations
5/8 – 5/12	Exam Week
	Wednesday: Final Exam 1:00pm