Course Description

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 will start with a brief overview of Euclidean geometry and the axiomatic method. Next stop: hyperbolic geometry, the discovery of which shocked the mathematical world. To get there, start with a description the Erlanger Program, which describes geometry from the modern perspective as the study of transformation groups, and move from there to Möbius geometry as a stepping stone to get to full-blown hyperbolic geometry. In the latter half of the course we explore other geometries, including projective and discrete geometry.

Essential Information

Professor	David Maxwell
Office	Chapman 308C
Email	`damaxwell@alaska.edu`
Phone	474-1196
Web	`http://www.math.uaf.edu/~maxwell`
Required Text	**Modern Geometries**, *Henle*, Prentice-Hall

Optional Texts

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

- **Axiomatic Geometry**, *John M. Lee*
- **Geometry**, *Brannan, Esplen, Gray*
- **Geometry: Euclid and Beyond**, *Robin Hartshorn*

Prerequisites:

Math 265/215 Proofs **or** permission of instructor.

Student Learning Outcomes

Students will:

- prove facts using the techniques from Euclid's Elements
- solve problems related to different modern geometries: Möbius, spherical, hyperbolic
- explore the relationship between Euclid's parallel postulate and hyperbolic geometry
- gain experience with and solve problems in projective geometry.

Class Time

There will be three hours of class lecture each week.

Lecture Times		
MWF	10:30–11:30	Chapman 104

Covid 19

We are still, still holding classes in unprecedented times.

- We need to be especially kind and patient with one another.
- Unforseen circumstances are going to occur. I will try to ensure that the class is taught in a way so that if you must miss a class due to illness or other reasons, you will have tools to make up the missed class. Please see the section below on Zoom and recordings.
- If circumstances routinely impact your ability to participate in the course, please get in touch with me so we can determine a best plan of action.
- Course practices or this syllabus may need to be adjusted as the semester progresses. I will announce any changes as needed; syllabus updates will be posted on the web site.
- Univesity policies related to COVID-19 are found at https://sites.google.com/alaska.edu/coronavirus/uaf. These can be expected to be updated.

Office Hours

I will schedule 3 hours a week of formal office hours after consultation with my students.

Discord

TODO

Homework

There will be a homework assignment due roughly every week, usually on Mondays. Each week's assignment and due date will be announced in class and will be posted on my web page.

Regarding late homework, I will accept from each student a single late homework with no questions asked. To take advantage of this opportunity, simply hand in a piece of paper in lieu of your homework notifying me that you are using your free late assignment. Your late homework will be due when the subsequent homework is due, or one week later, whichever comes first. Exceptions: you may not use your freebie for either of the first two, or the last homework assignments.

Subsequent late homeworks will be accepted only under extenuating circumstances to be determined at my discretion.

Midterm

There will be two in-class midterm exams with tentative dates listed in the schedule.

Final Exam

There will be a comprehensive final exam at the scheduled time for this course.

Participation

From time to time in the course I hope we will be able to 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	35%
Participation	5%
Midterm 1	15%
Midterm 2	15%
Final	30%

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

A+	97%	C+	77%	F ≤ 59
A	93%	C	70%	
A-	90%	C-	not given	
B+	87%	D+	67%	
B	83%	D	63%	
B-	80%	D-	60%	

Tentative Schedule

The following is a tentative list of the topics to be covered in this class. As we proceed in the course, the course web page will list specific sections to be read for each week.

Week	Topics and Events
1/10 – 1/14	Euclidean Geometry Refresher
1/17 – 1/21	Complex Numbers, Transformations Monday: Civil Rights Day (no classes)
1/24 – 1/28	The Erlanger Program; Möbius Geometry
1/31 – 2/4	Möbius Geometry, Steiner Circles
2/7 – 2/11	Hyperbolic Geometry
2/14 – 2/18	Hyperbolic Geometry
2/21 – 2/25	Hyperbolic Geometry
2/28 – 3/4	Spring Break (no classes). Friday: Midterm
3/7 – 3/11	Elliptic and Absolute Geometry
3/14 – 3/18	Elliptic and Absolute Geometry
3/21 – 3/25	Projective Geometry Friday: Last day to withdraw with a 'W'
3/28 – 4/1	Projective Geometry Friday: Midterm
4/4 – 4/8	Projective Geometry
4/11 – 4/15	Solid Geometry
4/18 – 4/22	Solid Geometry
4/25 – 4/29	Exam week Monday: Last day of class Thursday: Final Exam: 10:15am – 12:15pm

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 not included directly as part of your grade.

Cell Phones

Turn off your cell phone before you come to class.

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.

Official UAF Syllabus Addendum

COVID-19 statement: Students should keep up-to-date on the university's policies, practices, and mandates related to COVID-19 by regularly checking this website: https://sites.google.com/alaska.edu/coronavirus/uaf?authuser=0

Further, students are expected to adhere to the university's policies, practices, and mandates and are subject to disciplinary actions if they do not comply.

Student protections statement: UAF embraces and grows a culture of respect, diversity, inclusion, and caring. Students at this university are protected against sexual harassment and discrimination (Title IX). Faculty members are designated as responsible employees which means they are required to report sexual misconduct. Graduate teaching assistants do not share the same reporting obligations. For more information on your rights as a student and the resources available to you to resolve problems, please go to the following site: https://catalog.uaf.edu/academics-regulations/students-rights-responsibilities/.

Disability services statement: I will work with the Office of Disability Services to provide reasonable accommodation to students with disabilities.

Student Academic Support:

- Speaking Center (907-474-5470, uaf-speakingcenter@alaska.edu, Gruening 507)
- Writing Center (907-474-5314, uaf-writing-center@alaska.edu, Gruening 8th floor)
- UAF Math Services, uafmathstatlab@gmail.com, Chapman Building (for math fee paying students only)

- Developmental Math Lab, Gruening 406
- The Debbie Moses Learning Center at CTC (907-455-2860, 604 Barnette St, Room 120, https://www.ctc.uaf.edu/student-services/student-success-center/)
- For more information and resources, please see the Academic Advising Resource List (https://www.uaf.edu/advising/lr/SKM_364e19011717281.pdf)

Student Resources:

- Disability Services (907-474-5655, uaf-disability-services@alaska.edu, Whitaker 208)
- Student Health & Counseling [6 free counseling sessions] (907-474-7043, https://www.uaf.edu/chc/appointments.php, Whitaker 203)
- Center for Student Rights and Responsibilities (907-474-7317, uaf-studentrights@alaska.edu, Eielson 110)
- Associated Students of the University of Alaska Fairbanks (ASUAF) or ASUAF Student Government (907-474-7355, asuaf.office@alaska.eduasuaf.office@alaska.edu, Wood Center 119)

Nondiscrimination statement: The University of Alaska is an affirmative action/equal opportunity employer and educational institution. The University of Alaska does not discriminate on the basis of race, religion, color, national origin, citizenship, age, sex, physical or mental disability, status as a protected veteran, marital status, changes in marital status, pregnancy, childbirth or related medical conditions, parenthood, sexual orientation, gender identity, political affiliation or belief, genetic information, or other legally protected status. The University's commitment to nondiscrimination, including against sex discrimination, applies to students, employees, and applicants for admission and employment. Contact information, applicable laws, and complaint procedures are included on UA's statement of nondiscrimination available at www.alaska.edu/nondiscrimination. For more information, contact:

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