

Math 4803: Low-Dimensional Geometry
Georgia Institute of Technology
Spring 2024

Meeting Information

Instructor: Austin Christian (he/him)
Office: Skiles 022
Meeting location: Skiles 169

Email: austin.christian@math.gatech.edu
Office Hours: See website, and by request.
Meeting time: MW 12:30pm-1:45pm

Course goals and learning outcomes

At the conclusion of this course, the student should be able to:

- (1) construct proofs of mathematical claims, and constructively critique the proofs of others;
- (2) identify the features which distinguish Euclidean, spherical, and hyperbolic geometries;
- (3) explain examples of surfaces obtained via gluing;
- (4) articulate the relationship between a transformation group and a fundamental domain;
- (5) produce visualizations for the geometric and topological phenomena encountered in this course;
- (6) compose an expository narrative focused on a topic in geometry or topology.

Course Requirements and Grading

There will be 7 homework assignments, 1 midterm (in class), and a term paper. These components are described in more detail below. Your course average will be computed as follows:

$$40\% \text{ homework} + 10\% \text{ participation} + 20\% \text{ midterm} + 30\% \text{ term paper}$$

Your final grade will be assigned as a letter grade. The scale will be **no more harsh than**:

A	B	C	D	F
≥ 90	$[80, 90)$	$[70, 80)$	$[60, 70)$	< 60

Note that this scale does not imply any rounding.

Homework

There will be 7 homework assignments, typically due at class time on Mondays. Each assignment covers approximately two weeks' worth of material, so **do not leave your homework to the last minute**. You are encouraged to review the assignment after each class meeting, and to discuss with me which exercises you are prepared to complete.

Some homework problems will be checked in detail, while others are checked for completion. Those which are checked for accuracy will be judged on both their presentation and their logical soundness, using a rubric to be distributed via Canvas. **If 85% of enrolled students complete the CIOS, one homework score will be dropped.**

Participation

From time to time we will have group activities during class meetings — ranging from brief discussions to short problem sets. You are expected to be present and to actively participate in your group. Absences or failure to participate in group discussions will take away from your participation score for the class.

It is assumed that you are taking this class because of a genuine interest in the topic, and will therefore participate. This should make full participation points easy to accomplish. Students who are not on track to earn full participation points will be notified during the semester.

Midterm

There will be one in-class midterm on **Monday, March 4**. Contact me as soon as possible if you have a conflict with this date.

Term paper

In lieu of a final exam, our course will culminate with a term paper, written individually or in pairs. The 6–8 page expository paper will report on some topic related to our course and will be graded both on its mathematical content and its exposition. A more detailed rubric, as well as topic suggestions, will be provided in class and through the course webpage.

You will choose between two grading schemes for your paper. The schemes are given below, and you must make your selection by **March 25**. Once you select your scheme, it can only be changed under extraordinary circumstances.

Requirement	Scheme 1	Scheme 2
proposal by Mar 1	5%	5%
draft submitted by Apr 15	15%	15%
constructive feedback by Apr 19	20%	20%
final paper by Apr 26	60%	55%
art submission by Apr 26	N/A	10%

Notice that Scheme 2 allows you to earn 105%. In this scheme, you would create a work of art (broadly construed) corresponding to the topic of your paper. The requirements for this submission are as follows.

- You must submit an artwork plan for my approval by midnight on **April 1**. More details on plan submission will be available through Canvas.
- By midnight on **April 21** you should submit a mathematical description of your artwork, about half a page long. This will describe the inspiration for your artwork using technical jargon (e.g., ‘geodesics’).
- Also by midnight on **April 21** you will submit a 1-2 paragraph description of your artwork for a broad audience, avoiding technical jargon.
- On **April 24**, you will present your artwork at the Low-Dimensional Geometry Art Exhibition, 12pm-1pm, in the School of Mathematics. This will be a come-and-go event open to all. If too few students participate for the exhibition to be feasible, this requirement will be waived.

Submitting a work of art which satisfies the above requirements will earn the full 10 points available for this component of Scheme 2. **Please note that this is the only opportunity for extra credit in this course.**

In both schemes, you will need to submit a proposal for your paper by February 26 so that I can approve your topic. You will also provide constructive feedback on other papers, and your feedback will be graded. More details will be available in class and through the course webpage.

Collaborations

You are encouraged to collaborate on homework, active learning, and your term paper — indeed, the latter two can be submitted by a group rather than an individual. However, in all cases you should generously acknowledge the contributions of others.

This concern is most acute on the homework assignments. You should write up all solutions by yourself, and acknowledge any sources from which you received help. This could be other students, textbooks, or the internet. Submitting the work of others as your own (even if you’ve, say, reworded or paraphrased) will be treated as academic misconduct. On the other hand, substantial partial credit can be awarded for writing something like, “I

was unable to figure this problem out, but here's a solution I read online ([<url>](#)), which I've tried to put in my own words."

Course Materials and Technologies

Course text

Our main text will be Francis Bonahon's *Low-dimensional geometry: from Euclidean surfaces to hyperbolic knots*. You can access a PDF of the book through the Georgia Tech library: https://galileo-gatech.primo.exlibrisgroup.com/permalink/01GALI_GIT/1vc2ggp/alma999468363402947. (Select the American Mathematical Society full text link. You'll probably need to be on campus or using a VPN to access the PDF.)

Additional resources may be added to the course webpage during the semester.

Course websites

- The class webpage (<https://austinchristian.math.gatech.edu/teaching/4803-s24/>) is where I will post class notes, homework assignments, and announcements. This page will also have a regularly-updated course schedule.
- Canvas (<https://gatech.instructure.com/courses/365734>) will be used for the gradebook, announcements, and some additional resources.
- Gradescope (accessed through Canvas) will be used to collect and return graded assessments. This is also where you can submit regrade requests.
- Discord (<https://discord.gg/ZNHpm94fUj>). I've created a Discord server for our class, and I prefer to discuss math here rather than via email. This will lead to quicker responses, and reduces duplicate questions. **Note:** Please apply common sense to your use of our Discord server. Do not use the server during an exam, do not post illegal or inappropriate content, and do not post commercial advertisements.

Mathematica

For some of our in-class activities, a *Mathematica* notebook may be made available to help with computations and visualizations. You might additionally find *Mathematica* to be useful for exploring course topics on your own. As a Georgia Tech student, you have access to *Mathematica* through the Office of Information Technology, and can request this software via <https://www.software.oit.gatech.edu>. Feel free to reach out with any questions.

Email protocol

Our plan is to not have math discussions by email this semester. Math questions should be posted on Discord, so that everyone in the class has a chance to follow the discussion. (Feel free to ask your questions anonymously.) Any math questions emailed to me will be redirected to Discord.

Course Expectations and Guidelines

Academic integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit <http://www.catalog.gatech.edu/policies/honor-code/> or <http://www.catalog.gatech.edu/rules/18/>.

Accommodations for students with disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or <http://disabilityservices.gatech.edu/>, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also email me as soon as possible in order to set up a time to discuss your learning needs.

Meeting format

Almost all class meetings will be held in-person. However, I will be traveling on at least two class days (possibly more). On those days we will likely hold class virtually via Zoom. In that case, the meeting will be recorded to allow for asynchronous attendance.

Class meetings will not generally be livestreamed or recorded, but please reach out if you need this accommodation for your health (mental or otherwise) or other extenuating circumstances.

Class etiquette

Whether attending class in-person or online, please be respectful of your classmates and instructor. In person, please refrain from personal conversations and any behavior that might be distracting to your classmates or instructor. Online, feel free to use the chat feature to ask relevant questions, but refrain from posting inappropriate content or engaging in unrelated discussions.

We will maintain a respectful, inclusive classroom culture, and **disrespect of your classmates or instructor will not be tolerated.**

Regrade requests

Any regrade request should be submitted on Gradescope, with an explanation of the reason, within one week of the date the graded item has been returned to you. **Papers submitted for regrading could be adjusted up or down;** so please make sure to check the solutions before submitting a regrade request.

Student-faculty expectations agreement

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See <http://www.catalog.gatech.edu/rules/22/> for an articulation of some basic expectation that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Campus Resources for Students

In your time at Georgia Tech, you may find yourself in need of support. Below you will find some resources to support you both as a student and as a person.

Academic support

- Drop-In Tutoring/Math Lab: <https://tutoring.gatech.edu/drop-in/>
 - The Math Lab offers free drop-in math help, and is staffed by math Graduate Teaching Assistants.
 - A live schedule for the Math Lab can always be found at the above website, and any questions can be directed to dropintutoring@gatech.edu.
- Center for Academic Success: <http://success.gatech.edu>
 - 1-to-1 tutoring: <http://success.gatech.edu/1-1-tutoring>
 - Peer-Led Undergraduate Study (PLUS): <http://success.gatech.edu/tutoring/plus>
 - Academic coaching: <http://success.gatech.edu/coaching>
- Residence Life's Learning Assistance Program: <https://housing.gatech.edu/learning-assistance-program>
- OMED Educational Services: <http://omed.gatech.edu/programs/academic-support>
- Communication Center: <http://www.communicationcenter.gatech.edu>
- Academic advisors for your major: <http://advising.gatech.edu/>

Personal support

- The Office of the Dean of Students: <https://studentlife.gatech.edu/>; 404-894-6367; Smithgall Student Services Building 2nd floor. You also may request assistance at https://gatech-advocate.symlicity.com/care_report/index.php/pid383662?
- Counseling Center: <http://counseling.gatech.edu>; 404-894-2575; Smithgall Student Services Building 2nd floor.
 - Services include short-term individual counseling, group counseling, couples counseling, testing and assessment, referral services, and crisis intervention. Their website also includes links to state and national resources.
 - Students in crisis may walk in during business hours (8am-5pm, Monday through Friday) or contact the counselor on call after hours at 404-894-2204.
- Students' Temporary Assistance and Resources (STAR): <https://studentlife.gatech.edu/content/star-services>. Can assist with interview clothing, food, and housing needs.
- Stamps Health Services: <https://health.gatech.edu>; 404-894-1420. Primary care, pharmacy, women's health, psychiatry, immunization and allergy, health promotion, and nutrition.
- Women's Resource Center: <https://www.womenscenter.gatech.edu>; 404-385-0230.
- LGBTQIA Resource Center: <https://lgbtqia.gatech.edu>; 404-385-2679.
- Veteran's Resource Center: <https://veterans.gatech.edu>; 404-385-2067.
- Georgia Tech Police: 404-894-2500.

Statement of Inclusivity

As a member of the Georgia Tech community, I am committed to creating a learning environment in which all of my students feel safe and included. Because we are individuals with varying needs, I am reliant on your feedback to achieve this goal. To that end, I invite you to enter into dialogue with me about the things I can stop, start, and continue doing to make my classroom an environment in which every student feels valued and can engage actively in our learning community.

A note from Austin

It is important to me that you not become overwhelmed in this class. Mathematics can be very challenging and is often frustrating, but you shouldn't feel that succeeding in mathematics is impossible. **Everyone is a math person.** If you feel that the coursework is beginning to slip away from you, please let me know *before* you become completely lost. I expect you to invest a lot of time and energy into this course, but I am committed to helping you learn and enjoy the material, and will do my best to help you succeed.

Changes to the syllabus

This syllabus represents my expectations for the content and timing of this course as well as possible. However, because these expectations may change, I reserve the right to modify course policies as the need arises. If this happens, students will be notified by email and in class.