Math 590: Discrete Geometry
Spring 2026

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Course Content: Convex polyhedra and polytopes; lattice point enumeration methods; Ehrhart's theorem; generating functions; applications to discrete optimization and enumerative combinatorics.

Texts: Material will be pulled from the following source, among others. Purchasing is **optional**.
- *Computing the Continuous Discretely*, by Matthias Beck and Sinai Robins, ISBN: 978-1493929689

Prerequisites: Math 245 and Math 254 with a grade of C or better. Recommended: one additional proof-based math course (e.g., Math 302, 320, 330, 522, or 579).

Course Organization: The class will be organized as follows.
- One class day each week (usually Monday), I will give a lecture on course material.
- The other class day each week will be a "problem session" wherein you work in small groups on problems designed to lead you to discover some of the course content (in particular, these problems **introduce new material**).

A problem list will be distributed at the beginning of each problem session, containing the in-class problems as well as the weekly homework problems. The in-class problems will not be turned in, but the content they introduce will be vital to the course. All completed homework probems will be turned in for credit, usually the following Wednesday.

Before each problem session, a short list of "preliminary problems" will be assigned, and should be completed before the problem session. These assignments will be short, usually requiring at most 10 minutes to complete, and will be computational in nature (i.e. no proofs).

Although I intend to use this format throughout the course, I reserve the right to restructure the course as the term progresses, based in part on student feedback and performance. I will periodically collect anonymous feedback in class, but feel free to come talk to me if you have suggestions or concerns.

Grading Policy: Your grade will be determined by weekly homework submissions, a midterm exam, a final project, and a participation grade, weighted as follows.

Participation	10%	Midterm Exam: April 13	A = 90-100
Homework Average	30%	Final Presentations: May 11	B = 80-89
Exam 1 (Oral)	10%		C = 70-79
Exam 2 (In Class)	20%		D = 60-69
Research Project	30%		F = 0-59
Total	100%		

The final project presentations will occur during the final exam time. Keep this date in mind when making travel plans for the end of the term.

Exams: The oral exam will be administered in one-on-one meetings, and will be interactive in nature. It will last roughly 20 minutes. One timed in-class midterm exam will also take place part way through the term, with an option for oral exam corrections given in a similar structure to the oral exams.

Research Project: Each student will complete an independent research project. Topics will be selected from a list provided by the instructor. The research project grade will be determined by
- regular progress in biweekly(ish) meetings with the instructor,
- a final writeup due in-class on the day of our final exam, and
- an optional final presentation during the final exam time (**required** for graduate students).

Participation: Attendance in problem sessions is vital to success in this class, since **new material** will be covered. Your participation grade will be based on the following:

- attending and participating in lectures;
- attending and engaging in problem sessions; and
- completing all preliminary problems.

Missing class will result in a lowered participation grade, and only absences with **advance notice** to the instructor will be accepted. I reserve the right to deduct one **additional full letter grade** from your course grade if you miss too many classes, or if sufficient participation is not demonstrated during problem sessions.

Homework: There will be one homework assignment given each week, as well as a short list of preliminary problems before each problem session. Completed homework assignments will be submitted to the instructor for a grade, but preliminary problems will not be collected. Collaboration on homework is encouraged, but solutions should be written individually, and **collaborators should be identified** on the front of your assignment.

You are highly highly encouraged (though not required) to complete your assignments in LaTeX; this is a fantastic skill to develop whose utility extends far beyond this course. To use LaTeX for free online, or to access numerous tutorials, visit `https://www.overleaf.com/`.

Homework assignments, along with their due dates, will be posted on the course webpage as they are assigned. If you need an extension, for any reason, come talk to me **before** the deadline. Usually, I will ask you when you think would be fair and feasible for you to get it done, and that will become your new deadline to turn it in. Out of fairness to the other students, late homework assignments in the absence of such an extension will **not** be accepted for credit. However, the lowest homework grade of the term will be dropped.

Class Announcements, E-mail Policy and Communications: Class announcements will be posted to my class web page and sent to your university e-mail account. Be sure to regularly check your e-mail. If you send me an e-mail, please include your name, course information, and any additional information that I might need to respond.

Student Learning Outcomes: Students will be able to

- state and prove precise geometric statements, and provide high-level explanations of their significance and the intuition behind them;
- prove discrete math statements in different ways (e.g., combinatorial, algebraic, and geometric); and
- formulate conjectures substantiated by existing results and well-chosen examples in response to open-ended research style questions.

Boilerplate A.D.A. Statement: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. This legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring accommodation, please contact Student Disability Services. If you require additional time on exams, you must **contact me ahead of time**.

For additional information, visit `https://sds.sdsu.edu/`.

Full Disability Statement (adapted from Lydia X.Z. Brown's): I am committed to creating a learning space where everyone can participate as fully as possible. I strive to provide information and resources in multiple formats (text, visuals, audio, silent work, group work, lecture, conversation, etc.) to enable more access possibilities for every student. I recognize that there are many reasons students may need to adjust their pace, style, or method of learning, including but not limited to disability, temporary or ongoing personal life circumstances, unexpected emergencies, or other learning differences.

All students are always allowed to use the bathroom, get drinks of water, or take breaks outside the classroom at any time without needing to ask permission. If you are responsible for childcare, you are welcome to bring your children to class with you, and they do not need to be shushed. All students are also always allowed to use technology and devices in the classroom at any time, including cell phones. My only requests are that: (a) you set your devices to silent or vibrate-only during class time; (b) you don't intentionally open any visuals that contain sudden or rapid flashing, since these can cause potentially fatal seizures, migraines, and sensory overload; and (c) if you plan or expect to use a device for a non-traditionally academic purpose, you sit on the sides or back of the room to reduce chances of accidentally distracting someone else. You can also step outside to take calls if needed.

If you have any access needs that I can better support by changing any aspect of my teaching (including class discussions) or the way I have handled assignments, you are welcome and encouraged to let me know in public or in private how I can better support your access needs. Disabled students/students with disabilities may also formally

register with the office responsible for disabled student support services, which is the official process for receiving reasonable accommodations in the classroom. You need not have a specific reason or diagnosis to talk to me about your access needs; everyone deserves to learn in the way that makes the most sense for them at any point in time.

Scholastic Dishonesty: _An Aztec Does Not Lie, Cheat, or Steal, or Tolerate Those Who Do._ The San Diego State University Student Conduct Code will be enforced in this course. For the purpose of this course, cheating will be defined as (but not limited to) access or use of unauthorized material during exams and quizzes, collaboration between students during exams, quizzes or assignments for which group work is not allowed, perusal of another individual's work during exams and quizzes, copying other individual's work or allowing other students to copy your work on any assignment, quiz or exam, submitting work generated in part or in full by ChatGTP or other generative AI as if it were your own work, and having unauthorized programs or other information stored on calculators when these calculators are accessible during an exam or quiz. Note: Falsifying documentation is considered scholastic dishonesty and may result in a grade of F for the course.

For more info: `https://sacd.sdsu.edu/student-rights/academic-dishonesty/cheating-and-plagiarism`.

Land Acknowledgment: For millennia, the Kumeyaay people have been a part of this land. This land has nourished, healed, protected and embraced them for many generations in a relationship of balance and harmony. As members of the San Diego State University community, we acknowledge this legacy. We promote this balance and harmony. We find inspiration from this land, the land of the Kumeyaay.