Math 335 (Modern Algebra)
Spring 2021

Professor: Dr. Emily Clader (she/her)

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Virtual Office Hours: Mondays 10-10:50am, Wednesdays 2-2:50pm (access these via the Zoom link on the course iLearn)

Class Meetings (via Zoom): Monday/Wednesday/Friday, 9:00am–9:50am

Text: There is no required textbook for this course; all content will be conveyed via videos posted on iLearn. For those who prefer to learn by reading—due to bandwidth limitations, learning style, or any other reason—I will give a text reference for the material in each video from the book *Contemporary Abstract Algebra* by Joseph A. Gallian.

Course Description and Objectives: Algebra studies the structure of sets with operations, such as integers with addition and multiplication, or vector spaces with linear maps. The abstract point of view, based on an axiomatic approach, reveals many deep ideas behind seemingly innocent structures and serves as an elegant organizing tool for the vast universe of modern mathematics. By rigorously exploring the similarities and differences between different algebraic operations, students will prepare themselves to more carefully explain the mathematics they have long known, and to better process the mathematics they have yet to encounter.

The main goal in Math 335 is the study of groups and rings. Upon successful completion of the course, students will be able to:

- Explain the definition and basic properties of a group.
- Use a toolkit of specific groups—including $\mathbb{Z}_n$, matrix groups, and symmetric groups—to provide examples and counterexamples of group-theoretic properties.
- Prove that two groups are, or are not, isomorphic.
- Work with cosets and quotient groups, and use them to construct isomorphisms.
- Explain the definition and basic properties of rings and ideals.

More generally, students will improve their ability to explore mathematics in a methodical but open-ended way, to communicate mathematical thoughts rigorously yet clearly in writing, and to move fluidly between intuitive explanation and careful proof.

Prerequisite: Completion of Math 301GW (Exploration and Proof) and Math 325 (Linear Algebra) with grades of C or better. If you are missing one or both of these prerequisites, I will ask you some questions and give you a pre-test to determine whether you have the necessary background for Math 335.

Community Norms: This course is based on the conviction that mathematics is a participatory enterprise, and that every single member of the class has both the ability and the right to make an authentic contribution to our collective mathematical conversation. You will be challenged and supported. Together, we will strive to create an environment of equity and collaboration, in which every student can bring their full identity to the class.

Recommendations for Success: Watch each day's video before coming to class, and expect to need to stop/start/rewind it multiple times. The videos are only about 10 minutes long, but it may very well take you an hour to watch them. Take notes as you do so.

This course will take time: I expect that, outside of the Zoom class meetings, you'll need about 7–9 hours per week for watching the pre-class videos and completing the homework. At the same time, don't torture yourself; **if you've worked on a particular homework problem for an hour and still feel stuck, stop!** Post to an iLearn forum, send me an e-mail, or best yet, ask me about the problem during office hours.

On that note: come to my office hours! **Seeking help is not a sign of failure but an indication of wisdom and courage.** It won't always feel easy or natural to speak up, but I promise to do my very best to support you when you do. If you can't make it to my regular office hours, try e-mailing me or chatting with me during down-time before/after class.

Another crucial resource is each other. I highly recommend that you get to know your classmates, and seek help and support from one another. Often, hearing a peer explain their understanding of a concept in their own words—even if that understanding is incomplete— can be more helpful than hearing the rehearsed explanation of a professor or textbook. You can reach out via e-mail (I'll give you opportunities to exchange contact information), by chatting during the Zoom Breakout Room sessions, or by posting to the iLearn forum. **I will offer 1 point of extra credit for each forum post** (either asking or answering a question), up to a total of 5 points throughout the semester.

This course is meant to be challenging, and success will require your active participation: thinking critically about the things you learn in the videos, asking follow-up questions, sharing ideas during the in-class group-work even when doing so takes you out of your comfort zone. At the same time, I recognize that this is a course happening during a pandemic, and that your lives challenge you daily in a variety of ways that have nothing to do with mathematics. If you know that life is going to (perhaps temporarily) get in the way of your active participation in this course, please reach out to me so I can do my best to support you.

Grading: Your final grade for the course will be comprised of the following components:

- Participation: 70 points available
- Weekly Homework: 200 points available
- Exam 1: 100 points available
- Exam 2: 100 points available
- Exam 3: 100 points available
- Final Project: 100 points available

In total, this is **670 possible points**, and I will also offer numerous opportunities throughout the semester to earn additional points through extra credit (including up to 5 points for forum posts, as mentioned above). Your final grade will be computed from your total number of points by the following scale:

A	A-	B+	B	B-	C+	C	C-	D	F
623–670	603–622	583–602	556–582	536–555	516–535	489–515	469–488	402–468	0–401

(These numbers aren't as strange as they look: they're based on percentages of 670. For example, an "A" grade corresponds to earning at least 93% of the 670 total points.) This grading system is designed as an absolute scale rather than a curve to promote collaboration among one another; **you are not in competition with your classmates**!

Participation: You will be expected to attend each Zoom class session, and before each one, to watch a short video and answer a comprehension question to prepare you for the day's material. You will earn one participation point for each class attended and each comprehension question answered (regardless of the correctness of your answer). There will be approximately 41 class sessions and 37 comprehension questions over the course of the semester, so you can miss several of each and still earn the maximum score of 70 points on this course component.

Homework: Homework assignments will be posted on iLearn every Wednesday, and will be due the following Wednesday at 5pm via the iLearn submission link. I strongly encourage you to work together with classmates on homework, but I expect each student to turn in individual solutions in their own words. Work that is identical, or nearly identical, to that of another student will be considered plagiarized and will not be given credit. Late work will not be accepted, but there will be 11 assignments worth 20 points each, so you can miss one assignment and still earn the maximum score of 200 points on this course component.

Exams: There will be three equally-weighted exams, on the following dates:

> **Exam 1:** Wednesday, February 24
> **Exam 2:** Wednesday, April 7
> **Exam 3:** Wednesday, May 12

Final Project: In the last third of the semester, you will explore a topic that extends the course content. This will require you to undertake some open-ended investigation and some independent learning—in other words, mathematics research. I will suggest a number of possible topics and encourage students working on the same topic to collaborate, but each student will be responsible for writing up their own report on the project at the end of the semester.

Other Important Dates: The following are university-wide deadlines:

> **Audit and Add/Drop Deadline:** Friday, February 12
> **Deadline for Withdrawal** (with petition): Monday, April 19
> **Deadline for CR/NC:** Friday, May 21

Disability Access: Students with disabilities who need reasonable accommodations are encouraged to contact me. The Disability Programs and Resource Center (DPRC) is available to facilitate the reasonable accommodations process. The DPRC is located in the Student Service Building; it can be reached by telephone (voice/415-338-2472, video phone/415-335-7210) or by e-mail (dprc@ sfsu.edu).

Sexual Violence: SF State fosters a campus free of sexual violence, including sexual harassment, domestic violence, dating violence, stalking, and/or any form of sex or gender discrimination. If you disclose a personal experience as an SF State student, the course instructor is required to notify the Title IX Coordinator by completing the report form available at `http://titleix.sfsu.edu`, emailing vpsaem@sfsu.edu, or calling 338-2032. To disclose any such violence confidentially, contact the SAFE Place (415-338-2208; `http://www.sfsu.edu~safe_plc/`) or the Counseling and Psychological Services Center (415-338-2208; `http://psyservs.sfsu.edu/`). For more information on your rights and available resources, see `http://titleix.sfsu.edu`.

WU Policy: WU (Withdrawal Unauthorized) indicates that an enrolled student did not withdraw from the course and also failed to complete course requirements. It is used when, in the opinion of the instructor, completed assignments or course activities or both were insufficient to make normal evaluation of academic performance possible. For purposes of grade point average and progress point computation, this symbol is equivalent to an F.

International students who have enrollment unit requirements for their stay in the United States need to be aware that a course with a WU grade is not viewed as a course attempted whereas a course with an F grade is considered to be a course attempted. The Mathematics Department will not approve petitions to retroactively change a grade of WU to a grade of F.