

# Elementary Modern Algebra

## Mathematics 320 Syllabus

**Instructor:** Patrick Gambill

**Meeting:** Webster Hall 11, TU 9:10AM - 10:25AM, Spring 2024

**Instructor Email:** patrick.gambill@wsu.edu

**Office Hours:** T 2:00-3:00 and F 12:00-2:00 in MLC

**Prerequisites:** Math 220 or equivalent and Math 301

We will not have a required text for this course. However, a recommended text and some supplemental texts are listed below. It is a good idea to purchase a copy of the recommended text as the lectures will loosely follow the chapters of this text. The supplemental texts will have different explanations or additional topics not in the recommended text.

**Recommended Text:** *Contemporary Abstract Algebra, 10th Edition*, by Gallian

### Supplemental Texts:

- *Visual Group Theory*, by Carter
- *A First Course in Abstract Algebra*, by Fraleigh and Katz
- *An Introduction to Abstract Algebra with Notes to the Future Teacher*, by Towsley, Sutherland, and Nicodemi
- *A Book of Abstract Algebra*, by Pinter

### Course Goals and Objectives:

In this course we will study algebraic structures and their applications to introductory algebra, geometry, and trigonometry. In particular, we will focus on groups, rings, and fields. By learning about these abstract structures, students should get a deeper understanding of the "why" behind

many concepts from previous math courses. In addition, students will refine their proof writing skills.

## Grade Criteria

This is the tentative grade makeup of the course. This is subject to change.

- Homework 45%
- Participation 5%
- Midterm 15%
- Project 15%
- Final 20%

## Homework

We will have a homework assignment every week or two. Each assignment will consist of 5-10 problems, with half of the problems as computation and the other half as proofs. Each problem will be graded using the following criteria:

0	1	2	3	4
No attempt was made at the problem or the work is not relevant to the problem.	A legitimate attempt was made at the problem.	The student has missed a key idea needed to solve the problem or has missed some cases.	The key ideas needed to solve the problem are present, but there are a few small errors.	The proof has no errors.

As homework will be challenging, you are encouraged to work together on these problems. If you collaborate, then you must each submit your own written solutions to the problems and note which students you worked with. You are welcome to use resources besides the book or lecture notes when working through a problem, but you must cite these resources. These policies are in place to avoid plagiarism. Late work will not be accepted unless you have a legitimate excuse and contact me before the due date.

## **Corrections**

Developing proof writing skills is an iterative process. You will make mistakes and learn from feedback. As such, students are encouraged to make corrections on each homework. Corrections submitted within a week of when feedback is provided will be awarded the missed points from the original submission. Students can continue to make corrections with each additional round of feedback until they are satisfied with their grade or until the end of the semester. Corrections will not replace unexcused or missing assignments.

## **Participation**

Students will receive full participation points as long as they consistently contribute to in-class activities and discussions.

## **Midterm/Final Exam**

More details for these exams will be provided as we get closer to them. These exams will test the concepts covered in class and in homework. We will spend the class period before each exam reviewing previous concepts. In addition, I will provide practice problems in preparation for the exam. If you have to miss an exam, please contact me as soon as possible to schedule a make-up exam.

## **Project**

One of the goals of this class is to learn about some of the applications of abstract algebra. As such, you will create a project to explore some of these applications.

## **Attendance**

It is important to attend class, since there will be topics covered in the lecture that are not in the recommended text. If you have to miss class, you are responsible for getting notes from a classmate or coming to office hours to cover any missed materials.

## Grade Scale

The tentative grade scale is provided below:

Percentage	Guaranteed Grade
[94, 100]	A
[90,94)	A-
[87,90)	B+
[84,87)	B
[80,84)	B-
[77,80)	C+
[74,77)	C
[70,74)	C-
[67,70)	D+
[60,67)	D
[0,60)	F

I may adjust these cutoffs, but only if such a change would benefit students.

## Tentative Schedule

The Week Of:	Topics	Additional Notes
Jan. 8th	Syllabus, Proof Techniques, Sets	
Jan. 15th	Functions, Relations, Binary Operations	HW 1 Due
Jan. 22nd	Groups (Definitions and Examples), Multiplication Tables, Cyclic Groups, Subgroups	HW 2 Due
Jan. 29th	Generators, Cayley Diagrams, Dihedral Groups, Permutations, Symmetric Groups, Representing Permutations	HW 3 Due
Feb. 5th	Permutation Groups, Alternating Groups, Cayley's Theorem, Orbits, Stabilizers, Orbit Stabilizer Theorem	HW 4 Due

Feb. 12th	Isomorphism, Automorphisms, Automorphism Groups, Homomorphisms	HW 5 Due
Feb. 19th	Review, Midterm	
Feb. 26th	Direct Product, Digraph Products, Cosets	
Mar. 4th	Normal Subgroups, Quotient Groups, Lagrange's Theorem	HW 6 Due
Mar. 11th	Spring Break	
Mar. 18th	Application Week	HW7 Due
Mar. 25th	Rings, Subrings, Integral Domains, Fields	
Apr. 1st	Ideals, Quotient Rings, Principle Ideal Domains	Project Due
Apr. 8th	Ring Isomorphisms, Ring Homomorphisms, Polynomial Rings	HW 8 Due
Apr. 15th	Division Rings, Division Algorithm, Rational Expressions	HW 9 Due
Apr. 22th	Rings and Fields in high school algebra, Review	HW 10 Due
Apr. 29th	Final Exam: 5/1/2023 in Webster Hall 11, 8:00-10:00 AM	

### **Academic Integrity Statement**

All members of the university community share responsibility for maintaining and promoting the principles of integrity in all activities, including academic integrity and honest scholarship.

Students are responsible for understanding the full [Academic Integrity Statement](#). Students who violate WSU's Academic Integrity Policy (identified in WAC 504-26-010(3) and -404) will fail the course, will not have the option to withdraw from the course pending an appeal, and will be reported to the Center for Community Standards. Copying another student's work or copying from a website is plagiarism. If you have any questions about what is and is not allowed in this course, ask me, and I will happily clarify.

### **WSU Reasonable Accommodation Statement**

Reasonable accommodations are available for students with documented disabilities or chronic medical or psychological conditions. If you have such a condition and need accommodations to

fully participate in this class, please visit your campus' Access Center/Services website to follow published procedures to request accommodations. Students may also contact their campus offices to schedule an appointment with an Access Advisor. All disability related accommodations are to be approved through the Access Center/Services on your campus. It is a university expectation that students connect with instructors (via email, Zoom, or in person) to discuss logistics within two weeks after they have officially requested their accommodations. For more information, contact an Access Advisor on your home campus:

- Pullman, WSU Global Campus, Everett, Bremerton, and Puyallup: 509-335-3417 Access Center (<https://www.accesscenter.wsu.edu>) or email at [access.center@wsu.edu](mailto:access.center@wsu.edu).

### **Lauren's Promise: WSU's Commitment to Addressing Discrimination and Harassment**

Lauren McCluskey, a 21-year-old honors student athlete, was murdered on October 22, 2018, on the University of Utah campus by a man she briefly dated. WSU will listen and facilitate support and reporting options if someone is threatening you.

Discrimination, discriminatory harassment, sexual harassment, and sexual misconduct (including stalking, intimate partner violence, and sexual violence) are prohibited at WSU (see Executive Policy 15 – [WSU Policy Prohibiting Discrimination and Harassment](#), the [WSU Standards of Conduct for Students](#), and relevant employee manuals). WSU has instituted procedures to respond to violations of these laws and standards, programs aimed at the prevention of such conduct, and intervention on behalf of victims.

If you are in immediate danger, call 911.

If you are experiencing sexual assault, domestic violence, stalking, discrimination or harassment, you have support and options. If you share information with your course instructor, please know that they are required to reach out to the Title IX Coordinator in WSU's Office of Compliance and Civil Rights (CCR), and CCR will reach out to you with information about on and off campus reporting options and resources. CCR is a system-wide resource (all campuses) which is available for intake consultations for you to learn more about available support. You can reach them directly at 509-335-8288, [ccr@wsu.edu](mailto:ccr@wsu.edu), or [report online](#) (anonymous reports accepted).

You can also speak to a victim advocate, a medical provider, or counselor confidentially about your concerns. Advocates help survivors of crime determine their own needs in regards to their physical and emotional health, reporting options, and academic concerns. At no cost, advocates connect survivors to campus and community services, and provide accompaniment to important appointments (court, hospital, and police) and support throughout the process. For a list of confidential victim advocates and medical providers, please visit [CCR Resources](#).

WSU Police Department (WSU PD) officers and campus security will treat victims of sexual assault, domestic violence, stalking, hate crimes, and other crimes with respect and dignity. WSU PD, campus security departments, CCR, and victim advocates can also help you with safety planning.

### **Religious Accommodations**

Required because Substitute Senate Bill 5166 was signed into Washington State law, effective July 28, 2019. This law requires post-secondary institutions to provide reasonable accommodations for religious observances or activities.

What to include:

Washington State University reasonably accommodates absences allowing for students to take holidays for reasons of faith or conscience or organized activities conducted under the auspices of a religious denomination, church, or religious organization. Reasonable accommodation requires the student to coordinate with the instructor on scheduling examinations or other activities necessary for course completion. Students requesting accommodation must provide written notification within the first two weeks of the beginning of the course and include specific dates for absences. Approved accommodations for absences will not adversely impact student grades. Absence from classes or examinations for religious reasons does not relieve students from responsibility for any part of the course work required during the period of absence. Students who feel they have been treated unfairly in terms of this accommodation may refer to Academic Regulation 104 – Academic Complaint Procedures. See also Academic Regulation 82, available at <https://registrar.wsu.edu/academic-regulations/>.

## **Safety and Emergency Notification**

Classroom and campus safety are of paramount importance at Washington State University, and are the shared responsibility of the entire campus population. WSU urges students to follow the “Alert, Assess, Act,” protocol for all types of emergencies and the “[Run, Hide, Fight](#)” response for an active shooter incident. Remain ALERT (through direct observation or emergency notification), ASSESS your specific situation, and ACT in the most appropriate way to assure your own safety (and the safety of others if you are able).

Please sign up for emergency alerts on your account at MyWSU. For more information on this subject, campus safety, and related topics, please view the FBI’s [Run, Hide, Fight video](#) and visit the [WSU safety portal](#).

Full details can be found at <https://provost.wsu.edu/classroom-safety/>.