MATH 411: HONORS ALGEBRA I

EMILY RIEHL

> What is algebra? Is it a branch of mathematics, a method or a frame of mind?
> - Igor Schafarevich, *Basic Notions of Algebra*, §1

Instructor:

- Emily Riehl, eriehl@math.jhu.edu, she/her, Mondays 3-4pm in Krieger 312

TA:.

- Luochen Zhao, lzhao39@jhu.edu, he/him, Krieger 201 (office hours: Mondays 10:30-11:30am)

Lectures: MW 12-1:15, Croft Hall G02

Section: F 12-12:50, Krieger Laverty

Textbook: *Algebra: Chapter 0*, Paolo Aluffi

Course website:

- Grades etc will be posted on the Blackboard website for AS.110.411.FA19 Honors Algebra I.
- Problem sets and supplemental materials can be found at www.math.jhu.edu/~eriehl/411

What you can call me. You are welcome to address me as "Professor Riehl," "Dr. Riehl," or "Emily." I use she/her pronouns.

Classroom Climate. I am committed to creating a classroom environment that values the diversity of experiences and perspectives that all students bring. Everyone here has the right to be treated with dignity and respect. I believe fostering an inclusive climate is important because research and my experience show that students who interact with peers who are different from themselves learn new things and experience tangible educational outcomes. Please join me in creating a welcoming and vibrant classroom climate. Note that you should expect to be challenged intellectually by me, Luochen, and your peers, and at times this may feel uncomfortable. Indeed, it can be helpful to be pushed sometimes in order to learn and grow. But at no time in this learning process should someone be singled out or treated unequally on the basis of any seen or unseen part of their identity.

If you ever have concerns in this course about harassment, discrimination, or any unequal treatment, or if you seek accommodations or resources, I invite you to share directly with me or Luochen. I promise that we will take your communication seriously and to seek mutually acceptable resolutions and accommodations. Reporting will never impact your course grade. You may also share concerns with the department chair (David Savitt, savitt@math.jhu.edu), the Director of Undergraduate Studies (Richard Brown, brown@math.jhu.edu), the Assistant Dean for Diversity and Inclusion (Darlene Saporu, dsaporu@jhu.edu), or the Office of Institutional Equity (oie@jhu.edu). In handling reports, people will protect your privacy as much as possible, but faculty and staff are required to officially report information for some cases (e.g. sexual harassment).

Personal Wellbeing.

- If you are sick, in particular with an illness that may be contagious, notify me by email and you will be excused from coming to class. Rather, visit the Health and Wellness Center: 1 East 31 Street, 410-516-8270. See also studentaffairs.jhu.edu/student-life/support-and-assistance/absences-from-class/illness-note-policy
- All students with disabilities who require accommodations for this course should contact me at their earliest convenience to discuss their specific needs. If you have a documented disability, you must be registered with the JHU Office for Student Disability Services (385 Garland Hall; 410-516-4720; web.jhu.edu/disabilities) to receive accommodations.

- If you are struggling with anxiety, stress, depression or other mental health related concerns, please consider visiting the JHU Counseling Center. If you are concerned about a friend, please encourage that person to seek out our services. The Counseling Center is located at 3003 North Charles Street in Suite S-200 and can be reached at 410-516-8278 and online at studentaffairs.jhu.edu/counselingcenter/.

Support.

> At key times, it is more useful to take stock of what one knows than blindly march forward hoping for the best. A difficulty at this time signals the need to reread the previous material carefully. *If the mystery persists, that's what office hours are there for.* But typically you should be able to find your way out on your own, based on the information we have given you, and you will most likely learn more this way. You should give it your best try before seeking professional help.   -Paolo Aluffi, *Algebra: Chapter 0*, §I.3

If you are stuck on a problem on the homework or confused about something that happened in class, my first recommendation is to ask one of your classmates. If they know the answer, you'll give them an invaluable opportunity to reinforce their knowledge by putting it into words. If they don't, chances are you'll be able to figure it out together, and both learn more via the process of self-discovery.

If you need further guidance, my office hours will be held on Mondays 3-4pm in Krieger 312. Luochen's office hours will be held on Mondays from 10:30-11:30am in Krieger 201. If you'd rather not wait to see us, the Math Help room is open from 9am-9pm Monday-Thursday and 9am-5pm on Friday, and I assure you that the graduate students who staff it would much rather talk about abstract algebra than calculus.

Problem Sets. A problem set will be due each week in class on Wednesday, with the exception of the first Wednesday meeting and the Wednesday of the midterm. At the end of the semester, the lowest problem set grade will be dropped. Late homework will be accepted only with an exceptionally good excuse.

Collaboration on homework is allowed and encouraged. However, each student must write up their solutions to the problems individually and in their own words, and must acknowledge their collaborators by name on their written assignments. Copying from another student or any other source is prohibited. The policies of the Johns Hopkins Ethics Guide will apply to this course: http://e-catalog.jhu.edu/undergrad-students/student-life-policies/

Class participation requirement. To satisfy the class participation requirement, each student must ask one question or make one comment in class at least once before the midterm and at least once after the midterm. An acceptable question might be: "would you remind us what X means?" or "could you explain why you are using this notation?" I will do everything I can to help everyone satisfy the class participation requirement.

Exams. There will be one midterm exam in class on Wednesday, October 16.

The final will take the form of an oral exam to be scheduled at a mutually agreed-upon time after the final class meeting and at the latest on the morning of December 17th, the scheduled exam date. During the oral final, which will take place in my office, I will ask each student to answer questions drawn from a list that I will post in advance. No notes can be used during the exam. While the particular questions I ask may vary from student to student, there will be no surprises in the sense that the possible exam topics will be known in advance with enough time to prepare solutions.

Grades. A numerical grade will be assigned based on the following formula:

- 1/10 class participation (full credit received if the class participation requirement is satisfied)
- 1/2 problem sets

totaling 60% of your final grade, plus

- 1/5 midterm
- 1/5 final exam.

Schedule. The following schedule is aspirational and subject to change.

- August 29: naive set theory (§I.1)
- September 4: functions (§I.2.1-5)
- September 9: more functions (§I.2.6-9)
- September 11: categories (§I.3)
- September 16: morphisms as arrows (§I.4)
- September 18: definition of group (§II.1.1-4)

- September 23: commutativity and order (§II.1.5-6)
- September 25: group homomorphisms (§II.3-4)
- September 30: examples of groups (§II.2)
- October 2: universal properties (§I.5)
- October 7: free groups (§II.5)
- October 9: subgroups, kernel, and image (§II.6)
- October 14: quotient groups (§II.7)
- October 16: MIDTERM (in class)
- October 21: canonical decomposition & Lagrange's theorem (§II.8)
- October 23: group actions (§II.9)
- October 28: conjugation action, center, class formula (§IV.1)
- October 30: symmetric groups (§IV.4)
- November 4: Sylow Theorem I (§IV.2.1-2)
- November 6: Sylow Theorems II & III (§IV.2.3-5)
- November 11: rings (§III.1)
- November 13: the category of rings (§III.2)
- November 18: ideals and quotient rings (§III.3)
- November 20: prime and maximal ideals (§III.4)
- December 2: modules over a ring (§III.5)
- December 4: classification of finite abelian groups (§IV.6)