MATH 4000/6000: MODERN ALGEBRA
**SPRING 2024**

### First Things First

This page is an offine copy of the **online** syllabus, available at <https://pollack.uga.edu/4000s24.html>

**Time and Place:** MWF 11:30 AM-12:20 PM, Boyd 304
**Instructor:** Paul Pollack
**Office:** 406 Boyd Graduate Studies Building
**Office hours:** TBD (more on this soon)

### Course Synopsis

At this point in your mathematical career, you have accumulated a wealth of experience computing with integers, real numbers, and complex numbers. These items are so familiar to you that they may even have the appearance of being God-given --- as if understanding those objects is What Mathematics is All About.

Abstract algebra challenges this notion. Integers, real numbers, and complex numbers are indeed fantastic, but they are fantastic not because they are handed down from on high, but because they have a rich and (presumably) consistent theory with useful consequences. And given how useful these objects are, we are compelled to isolate (and consider in the abstract) their most important properties. Once we do so, we find that there are many other objects with the same sorts of interesting properties. For example, we will see that the integers are an example of what is called a *ring*, while the real numbers and complex numbers are *fields*. These more abstract-seeming objects are not just interesting in an intellectual let's-talk-about-this-over-coffee kind of way, but understanding them deeply often leads to a new understanding of the objects of original interest.

Let me give one concrete example: Some primes, like 5, can be written as a sum of two squares: $5=1^{2}+2^{2}$. And other primes, like 3, cannot. The question of when this is possible is a question about the integers. But our answer to this question --- and we will answer it by the end of the semester --- will require us to visit a totally different mathematically system, the ring of Gaussian integers.

### TextbookS (NOT REQUIRED)

No textbook is required for this course. However, if you are looking for a textbook resource, the following are recommended:

Abstract Algebra: A Geometric Approach, by Theodore Shifrin
Abstract Algebra: An Introduction (3rd edition), by Thomas W. Hungerford

Topics to be covered include integers and unique factorization, modular arithmetic, analogues of these for polynomials over fields, homomorphisms and quotient rings, and field extensions.

We will aim to cover Chapters 1--4 of Shifrin's text and to start Chapter 5. This corresponds roughly to Chapters 1--6 and some of Chapter 11 in Hungerford's book. For further adventures in Algebra-land, I encourage you to take MATH 4010.

### Office Hours

Mathematics is not a spectator sport! One learns mathematics by doing it. What I'll be sharing with you in class can be thought of as a hindsight-informed summary of productive struggle by many mathematics over several centuries. Just as it's impossible to absorb the material in a textbook by sleeping with the book under your pillow, it's impossible for you to come to grips with the results of their hard labor by sitting in lectures. Thinking hard about problems --- and being stumped a good deal of the time! --- is part and parcel of coming into your own as a mathematical person.

Office hours exist to make this struggle a little more pleasant. They are intended to function as a safe space for you to share ideas and to work through the homework, with the support of both myself and your peers. I strongly encourage you attend.

Both at office hours and in class, you should expect that your input will be treated respectfully, by myself and by your classmates. Turning it around, you are expected to show respect and understanding for your classmates’ ideas. Kindness is important, everywhere and always!

### Exam Dates

There are three in-class midterm exams as well as a final exam.

* Midterm #1: Friday, February 16
* Midterm #2: Wednesday, March 27
* Midterm #3: Friday, April 19
* Final exam: Wed, May 3, 12:00 PM – 3:00 PM (location TBA)

No make-up exams will be given. The final exam is **cumulative**.

### Attendance/Homework/Exam Policies

Your grade is made up of the following weighted components:

* Each midterm: 15% (total of 45%)
* Homework: 25%
* Final exam: 30%

This class falls into the interactive lecture genre (not entirely unrelated to the practice of call and response in a liturgical context). What this means is that I intend to punctuate the lectures frequently with questions for you. For the show to go on, class participation is absolutely essential. Since you cannot participate in class if you are not present in class, your attendance is required. In particular, more than four unexcused absences may result in you being automagically withdrawn from the class. Of course, missing class is sometimes a necessity; keep me posted whenever you have a conflict and we should not have any issues.

Homework will be collected roughly once each week. As a general rule, late homework assignments are not accepted. Your lowest HW score will be dropped at the end of the semester.

All exams are closed book and closed notes.

Students enrolled in MATH 6000 will take the same exams as the students in MATH 4000 but will be assigned additional homework problems.

You are not only allowed, but encouraged to collaborate with your classmates on the homework assignments. The joy of mathematical discovery was meant to be shared! Having said that, collaboration does not mean copying. You may not copy solutions from a textbook, classmate, website, etcetera, and you must be the one to handwrite (or type) your solutions. By entering UGA, you have already agreed to abide by the UGA honor code described in detail at <https://honesty.uga.edu/Academic-Honesty-Policy/>. A good rule of thumb is that you should be able to explain any work you turn in to a hypothetical interrogator.

### Special Accommodations

Students with disabilities who may require special accommodations should talk to me as soon as possible. Appropriate documentation concerning disabilities may be required. If you plan to request accommodations for a disability, please register with the Disability Resource Center. They can be reached by visiting Clark Howell Hall, calling 706-542-8719 (voice) or 706-542-877 (TTY), or by visiting <http://drc.uga.edu>.

### Mental Health and Wellness

If you or someone you know needs assistance, you are encouraged to contact Student Care and Outreach in the Division of Student Affairs at 706-542-8479 or visit <https://sco.uga.edu>. They will help you navigate any difficult circumstances you may be facing by connecting you with the appropriate resources or services. UGA has several resources for a student seeking mental health services (<https://caps.uga.edu/well-being-prevention-programs-mental-health/>) or crisis support (<https://healthcenter.uga.edu/emergencies/>).

### FERPA Notice

The Federal Family Educational Rights and Privacy Act (FERPA) grants students certain information privacy rights. See the registrar’s explanation at [reg.uga.edu/general-information/ferpa/](https://reg.uga.edu/general-information/ferpa/). FERPA allows disclosure of directory information (name, address, telephone, email, major, activities, degrees, awards, prior schools), unless requested in a written letter to the registrar.

### Disclaimer

The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary.