

# Math 534, Spring 2020

## Elements of Modern Algebra

**Credit hours:** 3

**Department:** Mathematics

**Time/location:** MWF, 10:10AM – 11:00AM in Phillips 385

**Instructor:** Dr. David Rose

**Office hours:** Priority: 4:30pm–5:30pm on Thursdays

Secondary: 5pm–6pm on Wednesdays

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**Teaching Assistant:**

- Josh Kiers  
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Office hours: 10am–11am on Tuesdays in Phillips 362

**Target audience:** Mathematics and science majors interested in learning about the algebraic structures underlying number systems, symmetry, geometry, coding, puzzles, etc.

**Course prerequisites:** Formally, Math 381. More specifically, I expect everyone to be comfortable with elementary techniques in proof-based mathematics. You should be comfortable with basic logic, sets, functions, induction, and elementary facts about integers and prime numbers. If in addition you should know about equivalence relations, and arithmetic “mod  $n$ ” (but we may also quickly review those concepts).

**Course goals and learning objectives:** To develop an understanding of groups and rings, their ubiquity in mathematics, and their applications.

**Course requirements** To demonstrate knowledge of the above, via homework assignments and examinations.

**“I have a question, whom/how should I ask”:** Unfortunately, the following inequality holds for this class:

$$\# \text{ of students} > \# \text{ of TAs} = \# \text{ of Prof. Roses.}$$

As such, the follow scheme should be used if you have a question:

1. First, post your question to **Piazza**. This is an online Q&A forum for our course, where students can post questions, and have them answered by fellow students, the TA, or

Prof. Rose. Please sign up here: <https://piazza.com/unc/spring2020/math534>, or via the link on the course website. Be sure to post with **public visibility**.

2. As an alternative, a great time to ask questions is in person, during office hours.
3. If your question is not appropriate for public discussion, please post privately on Piazza. Such posts are only visible to myself and Josh (the TA).
4. Finally, for extremely urgent and sensitive matters, you can send myself or Josh an email. Note that we will do our best to respond to email sent during normal work hours (Monday – Friday from 9am – 5pm) in a timely fashion. Email correspondence should contain a salutation and a closing, and messages asking questions that should have been asked via items 1. – 3. above may elicit the response “you should ask this via Piazza,” or none at all.

**Course content:** Here is a preliminary schedule:

	Dates	Topics	Chapter
Week 1	1/8, 1/10	Introduction to abstract algebra	1
Week 2	1/13, 1/15, 1/17	Groups, their basic properties, and examples	2
Week 3	1/22, 1/24	Further examples and subgroups	3
Week 4	1/27, 1/29, 1/31	Cyclic groups	4
Week 5	2/3, 2/5, 2/7	The symmetric group	5
Week 6	2/10, 2/12, 2/14	Parity and the alternating group	5
Week 7	2/17, 2/19, 2/21	Homomorphism and isomorphism	6
Week 8	2/24, 2/26, 2/28	Theorem of Lagrange and applications	7
Week 9	3/2, 3/4, 3/6	Optional Topics	
Spring Break	3/9, 3/11, 3/13	Whooooo!	
Week 10	3/16, 3/18, 3/20	Optional Topics	
Week 11	3/23, 3/25, 3/27	Wrap up groups	
Week 12	3/30, 4/1, 4/3	Rings	12, 15
Week 13	4/6, 4/8	Polynomial rings	13, 16
Week 14	4/13, 4/15, 4/17	Factorization	16, 17
Week 15	4/20, 4/22, 4/24	Wrap up rings	

Time permitting, we'll cover optional topics in group theory, chosen from: group actions, orbit-stabilizer theorem, braid groups, quotient groups, or other topics as determined by the interests of students in the class. Professor Rose reserves the right to deviate from the listed schedule based on such interests and time constraints.

**Homework:** In order to properly learn the course material, it is crucial to develop the necessary problem-solving skills. As such, homework will be assigned semi-regularly (11 or

12 total) on the course website, and announced via Piazza post. You will have (at least) a week to complete each assignment.

**A note about the textbook:** We are officially using the 9<sup>th</sup> edition of *Contemporary Abstract Algebra* by Joseph Gallian. However, in practice any relatively recent edition of the book will suffice, as it will mainly be used for additional/supplementary reading. We will discuss more about textbook options during the first class meeting.

**Grades:** Your grade will be based on the following:

- Homework (30%)
- Mid-term examination (30%): it will take place in class on **Wednesday, March 4th**.
- Cumulative final examination (40%) on **Monday, April 27th at 8:00AM** in Phillips 385

Although not a formal component of the grading scheme, students are expected to regularly attend lectures and participate in recitation.

Raw final course grades will be curved (typically with the average score set no lower than a B-), and the curve will be no harsher than the standard 10-point UNC grading system. An approximate curve for the midterm will be announced when the exams are returned.

**Missed midterm exams** will be treated on a case-by-case basis. If the absence is excused, the final exam grade will be substituted in place of the missed midterm. **No** make-up midterm will be given.

**Academic integrity:** Don't cheat. Don't act dishonestly.

**Device policy:** Laptops, tablets, and phones may not be used during lecture.

**Syllabus changes:** Professor Rose reserves the right to make changes to the syllabus, including test dates, should any unforeseen circumstances occur. These changes will be announced as early as possible so that students can adjust their schedules.