

Introduction to Modern Algebra, Fall 2015

What is modern algebra? Or, since you already know what algebra is, what makes it so ‘modern’? Up to this point, your experience with algebra has likely consisted of solving equations with real numbers. This approach is historically consistent as well: the Persian poet and mathematician Omar Khayyam dubbed algebra the *science of solving equations*. You might be relieved to find out that, on this point, there is not much change. Modern algebra, just like school algebra, is concerned with solving equations and the algebraic properties needed to do just that. What changes, instead, is the setting – we are no longer confined to solving equations and examining polynomials in the real numbers. Put a different way, instead of confining ourselves to the real numbers (as we have in virtually every mathematics class to this point), we are going to explore the algebra of other structures. Some of these domains behave in a manner that is surprising and perhaps even unsettling when compared to the docile and generally agreeable real numbers, and this invites interesting questions! Which algebraic properties does this structure share with the reals? Which doesn’t it share? What are the ramifications for proving? As you might have suspected, we, as mathematicians, we will use whatever properties we find in common to our advantage:

‘When mathematicians look at different parts of algebra and notice that a common pattern of proofs keeps recurring, and essentially the same assumptions need to be made each time, they find it natural to single out this choice of assumptions as the axioms for a new system. All the important new systems of algebra were created in this fashion.’

– Charles Pinter, *A Book of Abstract Algebra*, p. 16

This is what makes this type of algebra different. Instead of just algebra in \mathbb{R} , we’re going to be investigating (some might even say *abstracting*) common features from many different structures. Specifically, we are going to investigate modular arithmetic, rings, and polynomial rings.

Course Objectives: the above characterization of the course nicely leads into our course objectives:

- (1) to develop the logic and rigorous reasoning skills that are essential to advanced work in the mathematical and physical sciences and in the teaching of mathematics, including critical thinking and the articulation of mathematical ideas;
- (2) to investigate, subsequently characterize, and prove results about algebraic structures, as well as to learn content in modern algebra that are the foundation for further study in such areas as cryptography, coding theory, number theory, and symmetry.

Encouraging and promoting the development of the general mathematical skills mentioned above is every bit as important as the specific content in this course. In response, this course, will often involve active participation on your part. Many classes will consist of small group activities and whole class discussions. You are expected to attend every class period prepared to actively contribute to both your own learning and the learning of your classmates. This includes asking questions, answering questions, making conjectures, giving explanations, and presenting solutions.

Instructor contact information: I am Dr. John Paul Cook. Please feel free to contact me outside of class using any of the following:

- *Office Hours:* My office is room 406 (fourth floor) of the Mathematical Sciences building, and my office hours on Mondays (10:30am - 11:30am), Fridays (10:30am - 11:30am), Thursdays (2pm - 3pm), and by appointment as needed.
- *Email:* cookjp@okstate.edu
- *Skype:* username: cookjohnpaul
- *Google Hangouts/GChat:* username cookjohnpaul@gmail.com (please only use this username for Hangouts; if you'd like to email me, please use my official @okstate email)

Course Communication and Website: Important course announcements, whenever possible, will be made in class. I will also make use of the following methods to disseminate course information:

- Your official @okstate.edu email
- The class's Desire2Learn page (oc.okstate.edu)

If you are interested, I'd recommend signing up for the free class texting service: text @OSUmodalg to 81010.

Course Prerequisites: Successful completion of Math 3013, Linear Algebra, with a grade of C or better is required for this course. A student who has not mastered the reasoning skills and level of abstraction in Linear Algebra is unlikely to succeed in Modern Algebra.

Course Materials: We will rely on two primary textbooks for this course:

- *Abstract Algebra: An Introduction*, 3rd Edition, by Thomas Hungerford
- *How to Prove it: A Structured Approach*, 2nd Edition, by Daniel Velleman

Grades, or, how your progress towards the course objectives will be evaluated: Your experience with grades in mathematics courses might unfortunately share some resemblance to following sentiment:

'We tend to teach mathematics as a long list of rules. You learn them in order and you have to obey them, because if you don't obey them you get a C-. *This is not mathematics.*'

- Jordan Ellenberg, *How Not to Be Wrong*, p. 12

I have endeavored to design the evaluation methods and criteria in this course to avoid an 'obey the rules or get a C-' classroom environment. In this class, we adopt something closer to the following stance:

'First, learning is a developmental process rather than only a question of acquisition. Learning entails primarily intellectual and personal changes that people undergo as they develop new understandings and reasoning abilities ... grading becomes not a means to rank but a way to communicate with students.'

- Ken Bain, *What the Best College Teachers Do*, p. 153

You will have many opportunities to demonstrate evidence of your learning and progress in this course:

- *Homework and Quizzes:* The best way to learn mathematics is to do mathematics. Practicing and thinking about concepts and skills in this course outside of class on a regular basis is critical to learning modern algebra. On each homework assignment, you are expected to attempt each problem on the homework assignment and to explain your efforts, even if these efforts did not result in a correct solution. Because of the importance of keeping pace with the course content, all homework should be submitted on time in class on the due date, and, generally, late assignments are not accepted. Fortunately, though, there are many other opportunities, and I will drop each student's two lowest homework scores at the end of the course.

Oftentimes, there will be short quizzes in class over content covered in a recent class period or homework assignment (while the homework assignment is submitted along with the quiz, the quizzes are not open notes because they are designed to practice concepts and skills from the homework). Moreover, the quizzes will provide you with opportunities for regular, low-risk feedback. Quizzes are not able to be made-up. A student who misses a quiz – even for an excused absence – has missed this opportunity for practice and feedback. Fortunately, though, there are many other opportunities, and I will drop each student's two lowest quiz scores at the end of the course.

At the end of the course, the homework and quiz scores will be averaged and scaled to 100 points.

- *Exams:* Whereas the point of homework and quizzes is to help you learn something, the motivation behind an exam is for you to show what you have learned. There will be 3 midterm exams (100 points each, for a total of 300) and a comprehensive final exam (200 points). I will always provide details in class about specific content to be covered on the exam with an appropriate amount of time for preparation (usually 1 week in advance). The midterm exams will occur during regularly scheduled class periods on the following dates:

Exam 1: September 23rd

Exam 2: October 30th

Exam 3: November 23rd

The final exam will take place on **Wednesday, December 9th from 8:00am to 9:50am** in our usual classroom. Aside from a sudden, documentable illness or emergency, makeup exams are not permitted. Please come speak with me directly if you encounter circumstances that you believe merit an exception.

At the end of the term, the total amount of points you have earned will be divided by the total amount of points possible (100 points for quizzes/HW, 300 for midterms, and 200 for the final exam = 600 total points), and that percentage will translate into your final course letter grade (based on the standard 10 point scale): 90%-100% guarantees an A, 80%-89.99% guarantees a B, 70%-79.99% guarantees a C, 60%-69.99% guarantees a D.

What you can expect from me: I've spent this entire syllabus talking about what I expect from *you*. Let's change focus. Here is what you can expect from me: my overall goal, in addition to teaching you algebra, is to teach you to be an independent learner and a critical thinker. I want you to learn and, more importantly, learn how to learn. And, believe it or not, I'll enjoy it. I hope you do, too.



OKLAHOMA STATE UNIVERSITY SYLLABUS ATTACHMENT Fall 2015

<http://academicaffairs.okstate.edu/>

**YOUR SUCCESS AS A STUDENT IS OUR TOP PRIORITY.
THIS INFORMATION IS PROVIDED TO ANSWER QUESTIONS MOST OFTEN ASKED BY STUDENTS.**

IMPORTANT DATES

Last day to add a class (without instructor permission)	8/24/2015
Last day to drop a course with no grade and 100% refund	8/24/2015
Last day to add a class (requires instructor & advisor permission)	
Last day to drop a course or withdraw from the University with an automatic "W" and receive a partial refund (requires advisor signature)	8/28/2015
Last day to post 6 week grades	9/29/2015
Last day to file diploma application (for name to appear in Fall Commencement program)	11/2/2015
Last day to drop a class or withdraw from the University with an automatic "W"	11/6/2015
Last day to withdraw from all OSU classes with an assigned grade of "W" or "F"	11/20/2015
Pre-Finals week	11/30 – 12/4/2015
Final examinations	12/7 – 12/11/2015

Note: Outreach, Internet, and short courses have unique drop/add and refund deadlines; lookup the specific deadlines for these courses on the Short, Internet and Outreach Class Schedules page of the Registrar's website <http://registrar.okstate.edu/SIO-Schedule>.

Fall Semester Holidays

University Holiday	9/7/2015
Students' Fall Break	10/9/15
First day of students' Thanksgiving break (no classes)	11/25/2015
University Holiday	11/26 – 11/27/2015

DROPPING A COURSE AND WITHDRAWING FROM THE UNIVERSITY, students often confuse these terms.

Dropping a Course (or courses) may occur during the first twelve weeks of the semester. This means, however, that you are still enrolled in at least one other OSU course. Exceptions to the deadlines above may only be considered by petition due to documented extraordinary circumstances and committee approval. The Retroactive Drop/Withdraw Petition and the Petition for a Refund of Tuition and Fees forms are available on the Registrar's website <http://registrar.okstate.edu/Forms>.

Withdrawing from the university means dropping *all* courses and you *are no longer enrolled for the current semester*. This may occur until the Friday before pre-finals week. The withdrawal process is initiated with your academic advisor. For additional information and dates, go to: [HTTP://ACADEMICAFFAIRS.OKSTATE.EDU/CONTENT/ADDING-DROPPING-AND-WITHDRAWING-COURSES](http://ACADEMICAFFAIRS.OKSTATE.EDU/CONTENT/ADDING-DROPPING-AND-WITHDRAWING-COURSES)

ALERTS AND RESCHEDULING

If the OSU campus officially closes due to inclement weather or other emergencies, alerts are provided to local news media and posted on the OSU website. Missed exams, classes, or assignments may be rescheduled at times outside the normal meeting schedule. If valid, documented circumstances prohibit students from attending the rescheduled classes, instructors should provide reasonable alternative means for makeup.

SEEK ANSWERS TO YOUR QUESTIONS

The OSU faculty and staff want you to be successful in your educational pursuits. If you have questions or concerns, seek help EARLY. We are here to assist you.

ACADEMIC INTEGRITY

101 Whitehurst, 405-744-5627

<http://academicintegrity.okstate.edu>

OSU is committed to maintaining the highest standards of integrity and ethical conduct. This level of ethical behavior and integrity will be maintained in this course. Participating in a behavior that violates academic integrity (e.g., unauthorized collaboration, plagiarism, multiple submissions, cheating on examinations, fabricating information, helping another person cheat, unauthorized advance access to examinations, altering or destroying the work of others, and altering academic records) will result in an official academic sanction. Violations may subject you to disciplinary action including the following: receiving a failing grade on an assignment, examination or course, receiving a notation of a violation of academic integrity on your transcript, and being suspended from the University. You have the right to appeal the charge.



COPYRIGHT & FAIR USE POLICY OF COURSE MATERIALS

Course materials may not be published, leased, sold to others, or used for any purpose other than appropriate OSU-related individual or group study without the written permission of the faculty member in charge of the course and other copyright holders. This paragraph grants you a limited license giving you access to materials for this course, including PowerPoint slides, audio/video recordings, written, or other materials, for appropriate OSU-related educational use only. Lectures should not be recorded without permission from the faculty member and must not be further disseminated or shared.

CLASS ATTENDANCE

Class attendance is a critical component of learning; therefore, you are expected to attend and participate fully in all scheduled class meetings. Many instructors consider attendance so essential that your grade may be affected by your absence. *SOME DEPARTMENTS AND PROFESSORS HAVE MANDATORY ATTENDANCE POLICIES*. If no written attendance policy is provided before the last day to add a class without instructor permission, no penalty may be assessed for class absences although you may not be permitted to make up certain in-class activities. If you are required to participate in official university-sponsored activities or military training, you should receive an excused absence unless the written course attendance policy indicates otherwise. If you will be absent from class for sponsored activities, you must provide prior notification of the planned absence to the instructor. You may be required to submit assignments or take examinations before the planned absence.

PRE-FINALS WEEK POLICY

Final examinations are scheduled at the end of each semester and are preceded by pre-finals week, which begins seven days prior to the first day of finals. During pre-finals week, all normal class activities will continue; however, no assignment, test, or examination accounting for more than 5% of the course grade may be given; and no activity or field trip may be scheduled that conflicts with another class. This excludes makeup and laboratory examinations, out-of-class assignments (or projects) made prior to pre-finals week and independent study courses. No student or campus organization may hold meetings, banquets, receptions, or may sponsor or participate in any activity, program, or related function that requires student participation. For additional

information, contact the Office of Academic Affairs, 405-744-5627, 101 Whitehurst.

FINAL EXAM OVERLOAD POLICY

In the event you have three or more final exams scheduled for a single day, you are entitled to arrange with the instructor of the highest numbered course (4 digit course number) or two highest, if you have four finals on one day, to re-schedule that examination(s) at a time and place of mutual convenience during final exam week. If the final exam overload includes a common final exam, the common final exam is excluded from rescheduling unless multiple common exams are scheduled at the same time. You should submit this request in writing, with a copy of your class schedule, at least two weeks prior to the beginning of final exam week. The instructor has one week prior to the beginning of final exam week to arrange a mutually convenient time and place for administration of the final exam. After one week, if an agreement cannot be reached, take the request to the department head.

INFORMATION TECHNOLOGY

Student Email - OSU uses your OKSTATE.EDU email address as a primary form of communication. Students are expected to check their OSU email on a frequent and consistent basis to remain informed of their official university business. If you do not use the OSU email system you must redirect your okstate.edu email using the Orange-Key System (www.okey.okstate.edu). Failure to maintain an accurate email address may result in missed or lost university communications. For email assistance contact the IT Helpdesk at 405-744-HELP (4357).

Computer Labs - A complete description of computer labs and hours of operations are available at their website: <https://it.sharepoint.okstate.edu/TechnologySupport/DeskSide/default.aspx>. Lab information is also available by calling the Information Technology Help Desk, 405-744-HELP (4357).

EDMON LOW LIBRARY HOURS

405-744-9775 or 405-744-9741

www.library.okstate.edu

Text 405-592-4128

Monday-Thursday

7:00 a.m. – 2:00 a.m.

Friday

7:00 a.m. – 10:00 p.m.

Saturday

9:00 a.m. – 10:00 p.m.

Saturday and Sunday

9:00 a.m. – 2:00 a.m.

*For holiday and intersession hours, check

<http://www.library.okstate.edu/services/hours.htm>

*Contact the following for information on hours of operation:

Architecture Library	405-744-6047
Curriculum Materials Library	405-744-6310
Veterinary Medicine Library	405-744-6655

GENERAL EXPECTATIONS OF STUDENTS

By enrolling at Oklahoma State University, you accept responsibility for complying with all University policies and contracts, and for local, state and federal laws on- or off-campus that relate to the University's mission. **The Student Rights and Responsibilities Governing Student Behavior** document explains the standards of behavior expected of you, processes in place for enforcing the rules, and the University's response to violations <http://studentconduct.okstate.edu/>

In general, the University expects you to respect the rights of others and authorities, represent yourself truthfully and accurately at all times, respect private and public property, and take responsibility for your own actions and the actions of your guests. Call 405-744-5470 for more information.

WHERE TO GO FOR HELP

Instructor - If you have questions regarding your class, talk to your instructor. Faculty members usually include their office hours and/or phone number in the class syllabus. If you cannot locate this information, set a time to meet with your instructor by speaking with him/her prior to or immediately following your class session or check with the departmental office on when the instructor may be available.

Academic Advisor - All students will benefit by conferring with an advisor on a regular basis. If you do not know your advisor, or are unhappy with your advisor, talk to the Student Academic Services Director for your college.

Academic911.okstate.edu - Your online resource for academic and personal success, sponsored by Student Affairs.

Mathematics Learning Success Center

5th Floor, Edmon Low Library/405-744-5818 <http://www.math.okstate.edu/>

Tutors are available to answer questions for classes ranging from Beginning Algebra through Calculus II. Tutoring for Differential Equations and Linear Algebra is offered at specific times.

Writing Center

440 Student Union/405-744-6671 <http://osuwritingcenter.okstate.edu>

The Writing Center helps writers throughout the composing process; you should plan to visit early and often throughout the semester, not just the day before an assignment is due. Tutors will work with you to improve your brainstorming, organizational, and composing techniques.

Learning & Student Success Opportunity (LASSO) Tutoring Center

021 Classroom Building/405-744-3309 <https://lasso.okstate.edu/>

LASSO offers free individual tutoring for a variety of courses.

University Counseling Services

320 Student Union/405-744-5472 or 405-744-7007 <http://ucs.okstate.edu/>

Professional counselors offer confidential personal and/or career counseling.

Office of Student Disability Services (SDS)

315 Student Union/405-744-7116

<http://sds.okstate.edu/>

According to the Americans with Disabilities Act, each student with a disability is responsible for notifying the University of his/her disability and requesting accommodations. If you think you have a qualified disability and need special accommodations, you should notify the instructor and request verification of eligibility for accommodations from the Office of SDS. Please advise the instructor of your disability as soon as possible, and contact Student Disability Services, to ensure timely implementation of appropriate accommodations. Faculty has an obligation to respond when they receive official notice of a disability but are under no obligation to provide retroactive accommodations. To receive services, you must submit appropriate documentation and complete an intake process to verify the existence of a qualified disability and identify reasonable accommodations.

Office of Equal Opportunity

408 Whitehurst/405-744-9153

OSU is committed to maintaining a learning environment that is free from discriminatory conduct based on race, color, religion, sex, sexual orientation, gender identity, national origin, disability, age or protected veteran status. OSU does not discriminate on the basis of sex in its educational programs and activities. Examples of sexual misconduct and/or sex discrimination include: sexual violence, sexual harassment, sexual assault, domestic and intimate partner violence, stalking, or gender-based discrimination. OSU encourages any student who thinks that he or she may have been a victim of sexual misconduct or sexual discrimination to immediately report the incident to the Title IX Coordinator (405-744-9153) or Deputy Title IX Coordinator (405-744-5470). Students may also report incidents of sexual misconduct or sex discrimination to a faculty or staff member, who is then required by federal law (Title IX) to notify the Title IX or Deputy Title IX Coordinator. If a reporting student would like to keep the details confidential, the student may speak with staff in the Student Counseling Center (405-744-5472) or the University's Victim Advocate (Suzanne Burks: 405-744-5458). For more information regarding Title IX violations, go to: <https://1is2many.okstate.edu/>.