Math 313: Modern Algebra

Syllabus for Fall 2014

Overview and Course Goals

In algebra, we study the ways in which we can use algebraic structures on different sets. Starting with integers and polynomials, we look at how the algebraic structure — properties like commutativity and associativity — provide powerful tools for mathematical study. It can seem a daunting and abstract subject, but that is because the utility of algebra extends into almost every area of mathematics, computer science, and the natural sciences. We are asking not just about sets of objects, but how objects in a set interact with one another.

Catalog Description

Group theory, including structure and properties: subgroups, co-sets, quotient groups, morphisms. Permutation groups, symmetry groups, groups of numbers, functions, and matrices. Brief study of rings, subrings, and ideals, including polynomial rings, integral domains, Euclidean domains, unique factorization domains, and fields.

Key themes for the course

- Algebra is central to understanding how elements of a set interact.
- By focusing on these interactions, we find that the most complex mathematical structures still follow common patterns.
- Much of what we see are first steps: in scratching the surface, we hope to get a sense of the depths of mathematical research.

Course goals

- Solve both computational and conceptual/theoretical problems involving rings and fields.
- Write algebraic proofs with awareness of audience, mathematical context, and proper notation and terminology.
- Demonstrate the ability to think abstractly.
- Read, evaluate, and write mathematical proofs that are correct and logically coherent.
- Communicate clearly and effectively in exploring new algebraic ideas.

Components for the course

Class meetings

Tuesdays and Thursdays, 12:45-2:20pm in PPHAC 233

Required text and materials

Abstract Algebra: An Inquiry Based Approach, by Jonathan Hodge, Steven Schlicker, and Ted Sundstrom

Google Drive and electronic communication

Everyone is expected to have a Google Drive folder shared with me specifically for homework and portfolio submissions. Class communication will be through e-mail (you are responsible for monitoring your Moravian student e-mail account) and through the class web page.

Coverage goals

To touch on many of the fundamental aspects of groups and rings, we will try to work through investigations 1 through 11 and 19 through 27 of the textbook. This should provide a solid algebraic foundation as you work to continue your mathematical career.

The learning cycle — how the class will be structured

Rather than chapters, the text is organized by "Investigations." This is meant to emphasize a student-centered approach to the learning process. With rare exceptions, class time will not be spent with me at the board giving answers or theoretical constructs. Instead, you will be working together in small groups to investigate the topics as guided by both me and the text. We will work together to explore different facets of algebra and algebraic thinking.

I like the metaphor of exploring a rugged wilderness. You could learn this on your own, but have the danger of getting lost or hurt. I will act as a guide to help through the difficult patches, warn of the more dangerous spots to avoid, and point out some of the more beautiful vistas along the way. But this is not a slide show of my own trip: you will need to do the work in order to reach those beautiful vistas.

We will try to follow the same process for each investigation. Over the semester, we may modify this to fit our own needs.

1. You will be asked to read the text before coming to class. Each investigation in the text opens by explaining the learning objective. Based on those, I will provide a reading feedback form that you need to complete before getting to class.

2. Also before you come to class, you will be asked to complete a few preview activities (either on your own or collaboratively with classmates). I will check for completion — not accuracy — at the beginning of class.

3. Using your responses to the reading and the preview activities as a springboard, we will use time in class to work together on activities that help parse the reading. Your responses to these activities will not be collected, but serve to prepare you for the work on the homework and portfolio problems. Exam questions will also be drawn in part from the in-class activities. Depending on various factors, we may spend anywhere form 60 to 180 minutes of class time on each investigation.

4. After working together in class on the investigation, you will be asked each week to complete some homework problems. There will be one homework set due each week, regardless the number of investigations we touch on that week.

Expectations for a successful class
What do I expect of you during the course?

• Keep up-to-date with the information posted on this web site: know what's coming.

• Take the time to complete the readings in a thoughtful manner. This includes taking time to think about the activities in the reading: don't come to class "cold" and hope that you will be able to get by.

• Complete the required assignments — the reading responses, the preview activities, the homework — as they are due. Don't get left behind.

• Be active in class. If you are lost, ask a question. If you're not sure you understand an argument, get it clarified. If you have an idea, share it.

• Visit my office hours or contact me with questions. Lean forward into this class and make the most of it.

What should you expect of me during this course?

• Reading and homework assignments should be posted in a timely manner to give you the opportunity to plan around particularly grueling weeks.

• The flow from preview activity to in-class activity to homework to exam should consistently work to mastering the topic(s) of the investigation.

• Comments and suggestions from me should help you develop your own mathematical thinking. I should be helping you think about the right questions to ask and encourage you to develop your own critical thinking skills.

• Homework and exams should be graded in a timely manner (those who have had me before know that this is one of my biggest challenges . . .).

ASSESSMENT AND GRADES
Your grade will be determined by the following metrics:

15%	Class preparation and participation
25%	Homework (average of weekly homework scores)
20%	Portfolio
10%	First exam (October 2, in class)
10%	Second exam (November 13, in class)
20%	Final exam (Date TBA)

Most grades in the class will be based on a 4-point scale, aligned with the QPA scale described in the Moravian College Student Handbook.

Class preparation and participation
At the start of each investigation, you will be asked to read through the investigation on your own. I will provide a link to a Google form that you will use to respond to the reading. This response is due by 8:00am on the day of class. Responses after 8:00am, but before the start of class will be accepted with a penalty applied. Responses after the start of class will not be accepted.

The reading questions will typically be simple questions based on a superficial read of the subject. They will be graded for accuracy, and are meant to simply encourage you to complete the reading and not some of the key points.

Additionally, you will be asked to complete a few "Preview Activities." These are meant to get you to start processing the reading and make connections. Responses to the Preview Activities need to be brought to class, and will be checked on at the start of class. These problems will be graded solely on completion (note that writing I don't know does not make for a complete problem!). These preview activities will not be graded on accuracy.

Homework

Each week, homework will be assigned. Completed homework needs to be posted to your submissions folder by Monday at 8:00am. I will not start grading homework until that time.

If you post your homework after I start grading, I will assess a 1 point penalty (on a 4-point scale) to your work. Homework posted more than 24 hours after I start grading will not be accepted.

See the Submissions Guidelines page on the class web site for more information about writing and posting homework assignments. See the Homework page for details on the individual assignments.

Portfolio

Over the course of the semester, you will need to complete a portfolio. This will be a collection of X problems — typically more challenging than the homework problems — that demonstrate your mastery with the topics of the course.

For each problem, you may submit a Draft version or a Final version:

- *Draft version*: This will not be graded, but I will provide comments and feedback to improve the writing. I will also point out significant errors in mathematical reasoning. Note that the draft version must be complete: if your submission only has a partial answer to the question it will be returned unmarked. The goal of the draft is not to help you solve the problem (that's what office hours are for!). Rather, it is to help you improve your exposition. You may submit at most one draft per problem.

- *Final version*: Until you submit a final version of the problem, no grade will be recorded for your portfolio. See the Portfolio section of the class web page for information on how your work will be assessed.

You may submit portfolio problems at any time. However:

You may not submit more than 3 problems in any one week.

To clarify: a "week" is the time from Monday at 8:00am one week until Monday at 8:00am the next week. Draft and final versions each count as a separate "problems." So (for example), you could submit drafts of two problems and final version of a third.

No portfolio submissions will be accepted after 5:00pm on December 5.

Be sure to check the Submission Guidelines section of the web page for details on how to properly post your portfolio problems to your submissions folder.

Exams

There will be two exams during the semester: on Thursday, October 2 and Thursday, November 13. These will assess basic knowledge of the material. Questions will be based in part on work done in class and on the homework.

A comprehensive final exam will be given during finals week. I will update this with a date and time when available.

Course Policies and Additional Support

Attendance

Attendance and participation is a vital component of this course. By missing class, not only do you lose out on valuable learning, but your classmates will lose out on your contributions.

If you miss class, you will not get credit for the "Preview Activity" preparation for the day. If you are chronically absent or late, you're preparation/participation score will be penalized.

Academic Honesty

You are expected to adhere to the Moravian Academic Honesty Policy, as found in the Student Handbook. To clarify how this applies to the work in our class:

- *Preview Activities*: The preview activities are ungraded work. You are welcome and encouraged to work with classmates on these problems. However, each person should have their own copy of responses at the start of class.

- *Class Preparation*: You are welcome and encouraged to discuss the reading with your classmates before the start of class. However, the reading response Google form must be your own thoughts in your own words — I am assessing your reading of the book.

- *Homework*: You may collaborate with friends on strategies or approaches (basically, you can give each other hints). The written solution must be your own. The homework is time for you to work on your own to complete problems.

- *Portfolios*: These are tests of your mastery. You are not to consult with classmates, web resources or text resources (aside from the class textbook). If you have any questions about the problems, they should be directed to me.

Essentially, you should consider the portfolio problems as take-home tests. They are to singularly reflect your own work and thinking.

- *Exams*: No cheating or copying.

Learning Support

Students who wish to request accommodations in this class for a disability should contact Elaine Mara, assistant director of learning services for academic and disability support in the lower level of Monocacy Hall, or by calling 610-861-1401. Accommodations cannot be provided until authorization is received from the Academic Support Center.

Disclaimers

- Your final grade is subject to my judgement as professor.

- This syllabus is subject to change. Revisions will be posted to the class page, and students will be appropriately notified of the changes.