

MATH 251: ABSTRACT ALGEBRA I

JOHN VOIGHT

COURSE INFO

- **Lectures:** Monday, Wednesday, Friday, 9:05 a.m.–9:55 a.m.
- **Room:** 223 Votey Hall
- **Course Record Number (CRN):** 92546

- **Instructor:** John Voight
- **Office:** 16 Colchester Ave, Room 207C
- **E-mail:** jvoight@gmail.com
- **Instructor's Office Hours:** Mondays, 11:00 a.m. - 12:00 noon and 1:00 p.m. - 2:00 p.m.; Wednesdays, 11:00 a.m. - 12:00 noon; or please make an appointment!
- **Course Web Page:** <http://www.cems.uvm.edu/~voight/251/>
- **Instructor's Web Page:** <http://www.cems.uvm.edu/~voight/>

- **Prerequisites:** Math 52, 124 or permission.
- **Required Text:** David Dummit and Richard Foote, *Abstract Algebra*, Third edition, 2004.
- **Grading:** Weekly homework will count for 55% of the grade. There will be three 50-minute exams which will each count for 15% of the grade.

I am happy to provide appropriate and fair accommodations for students with documented special needs; early in the semester, please contact the ACCESS office (<http://www.uvm.edu/~access/>) directly.

HOMEWORK

Homework is due on Wednesdays. Be sure to show your work and explain how you got your answer. Correct but incomplete answers will only receive partial credit. Part of the beauty of mathematics is in the elegance of its proofs, and one goal of this course is for you to learn to write mathematics excellently.

Cooperation on homework is permitted (and encouraged), but if you work together, do not take any paper away with you—in other words, you can share your thoughts (say on a blackboard), but you have to walk away with only your understanding. In particular, write the solution up on your own.

EXAMS

The three exams will take place on the following dates:

- **First Exam:** Monday, October 8
- **Second Exam:** Wednesday, November 7
- **Third Exam:** Friday, December 14, 9:05 a.m.–9:55 a.m.

Please note that the third exam occurs in place of the final.

You are permitted to bring to each exam one 8×11 -sheet of paper upon which you may write anything that you like on one side.

SYLLABUS

According to the “official” catalog description, we will cover:

Basic theory of groups, rings, fields, homomorphisms, and isomorphisms.

Although we may deviate from this by adding or skipping topics, the tentative plan for the course is as follows.

- **Chapter 0: Basics**
 - 1, 27 Aug (M): Introduction
 - 2, 29 Aug (W): §0.1: Basics
 - 3, 31 Aug (F): §0.2: Properties of the Integers
3 Sep (M): *No class, Labor Day*
 - 4, 5 Sep (W): §0.3: The Integers Modulo n
- **Chapter 1: Introduction to Groups**
 - 5, 7 Sep (F): §1.1: Basic Axioms and Examples
 - 6, 10 Sep (M): §1.1
 - 7, 12 Sep (W): §1.2: Dihedral Groups
 - 8, 14 Sep (F): §1.3: Symmetric Groups
 - 9, 17 Sep (M): §1.4: Matrix Groups, §1.5: The Quaternion Group
 - 10, 19 Sep (W): §1.6: Homomorphisms and Isomorphisms
 - 11, 21 Sep (F): §1.6
 - 12, 24 Sep (M): §1.7: Group Actions
- **Chapter 2: Subgroups**
 - 13, 26 Sep (W): §2.1: Definitions and Examples
 - 14, 28 Sep (F): §2.2: Centralizers and Normalizers, Stabilizers and Kernels
 - 15, 1 Oct (M): §2.3: Cyclic Groups and Cyclic Subgroups
 - 16, 3 Oct (W): §2.4: Subgroups Generated by Subsets, §2.5: The Lattice of Subgroups
 - 17, 5 Oct (F): Review
- **First Exam:** Monday, October 8, covering material in §§0.1–2.3
- **Chapter 3: Quotient Groups and Homomorphisms**
 - 19, 10 Oct (W): §3.1: Definitions and Examples
 - 20, 12 Oct (F): §3.1
 - 21, 15 Oct (M): §3.2: More on Cosets and Lagrange’s Theorem
 - 22, 17 Oct (W): §3.3: The Isomorphism Theorems
 - 23, 19 Oct (F): §3.4: Composition Series and the Hölder Program
 - 24, 22 Oct (M): §3.5: Transpositions and the Alternating Group
- **Chapter 4: Group Actions**
 - 25, 24 Oct (W): §4.1: Group Actions and Permutation Representations
 - 26, 26 Oct (F): §4.2–4.3: Groups Acting on Themselves
 - 27, 29 Oct (M): §4.4: Automorphisms
- **Chapter 5: Direct and Semidirect Products and Abelian Groups**
 - 28, 31 Oct (W): §5.1: Direct Products
 - 29, 2 Nov (F): §5.2: The Fundamental Theorem of Finitely Generated Abelian Groups
 - 30, 5 Nov (M): Review
- **Second Exam:** Wednesday, November 7, covering material in Chapters 3–4
- **Chapter 7: Introduction to Rings**
 - 32, 9 Nov (F): §7.1: Basic Definitions and Examples
 - 33, 12 Nov (M): §7.1
 - 34, 14 Nov (W): §7.2: Examples
 - 35, 16 Nov (F): §7.3: Ring Homomorphisms and Quotient Rings
19–23 Nov (M–F): *No class, Thanksgiving Recess*
 - 36, 26 Nov (M): §7.3
 - 37, 28 Nov (W): §7.4: Properties of Ideals
 - 38, 30 Nov (F): §7.5: Rings of Fractions
 - 39, 3 Dec (M): §7.6: The Chinese Remainder Theorem
 - 40, 5 Dec (W): Review
- **Third Exam:** Friday, December 14, 9:05 a.m.–9:55 a.m., covering material in Chapter 7