Department of Mathematics
Johns Hopkins University

110.401 Intro. to Abstract Algebra Course Syllabus

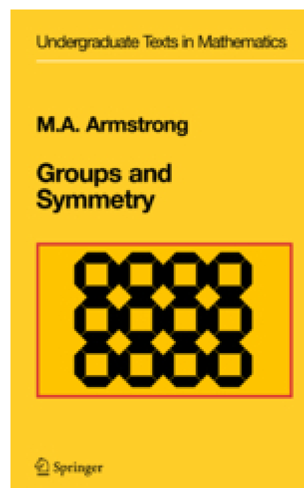
Course Description: A first introduction to abstract algebra through group theory, with an emphasis on concrete examples, and especially on geometric symmetry groups. The course will introduce basic notions (groups, subgroups, homomorphisms, quotients) and prove foundational results (Lagrange's theorem, Cauchy's theorem, orbit-counting techniques, the classification of finite abelian groups). Examples to be discussed include permutation groups, dihedral groups, matrix groups, and finite rotation groups, culminating in the classification of the wallpaper groups.

Course Prerequisite: 110.201 Linear Algebra or equivalent.

Course Category: This is an Introduction to Proofs course (IP) and may be taken as a first proof-based mathematics course. This course also satisfies a core requirement of the mathematics major.

Text: Groups and Symmetry, *1st Edition*, Armstrong, M.A., Springer-Verlag New York, 1988. **ISBN: 978-1-4757-4034-9**.

Course Topics (chapters to be covered)



1. **Symmetries of the tetrahedron**
2. **Group axioms**
3. **Number groups**
4. **Dihedral groups**
5. **Subgroups and generators**
6. **Permutations**
7. **Isomorphisms**
8. **Plato's solids and Cayley's theorem**
9. **Matrix groups**
10. **Products**
11. **Lagrange's theorem**
12. **Partitions**
13. **Cauchy's theorem**
14. **Conjugacy**
15. **Quotient groups**
16. **Homomorphisms**
17. **Actions, orbits, and stabilizers**
18. **Counting orbits**
19. **Finite rotation groups**
20. **Finitely generated abelian groups**
21. **Row and column operations**
22. **Automorphisms**
23. **Euclidean group**
24. **Lattices**
25. **Wallpaper patterns**