

# Math 327 - Group Theory

## Course Information

### Instructor and Course Meeting Information

*Instructor:* Lola Thompson

*E-mail:* lola.thompson@oberlin.edu

MWF 3:30-4:20 PM

*Location:* King 243

*Office:* King 200

*Office Hours:*

M 1:30 - 2:30

W 4:30 - 5:30

F 1:30 - 2:30

\*And by appointment.

### Course Objectives

By the end of this course, you will be able to:

- Build up the basic theory of finite groups
- Write clear, precise mathematical proofs
- Apply your theoretical knowledge to a variety of problems from other areas of math

### Course Structure

This course will be taught using an Inquiry-Based Learning (IBL) model. The format will be very different from that of a typical math course. In particular, there will be few (if any) lectures and very little assigned reading (normally, no more than 1-2 pages per class). A typical class period in Math 327 will consist of a short discussion of the pre-class reading followed by time to work on problems in small groups. Rather than being presented with neatly-packaged theorems and proofs, in this course you will be asked to devise your own conjectures and then prove them for yourself!

### Textbook

There is no textbook for this course! Students will write their own group theory textbook over the course of the semester... (for more info, see the “Textbook Project” section)

### Grades

The grades in this course will be calculated as follows:

	Weight
Class Participation	10%
Class Problems	15%
Homework Problems	15%
Midterm Exam #1	15%
Midterm Exam #2	15%
Textbook Project	30%

### Class participation

Class participation is essential in a course of this nature. When you miss class, you are not only affecting your own progress in the course but you are also causing your working group to be short one member. Your class participation grade (worth 10% of your course grade) will be calculated using biweekly self-assessment surveys.

*Attendance:* Each student is granted three “unexcused” absences. After that, students will lose 1% of their final grade per missed class (up to a maximum of 5%). There is no need to e-mail me to explain an

unexcused absence. If you have a legitimate academic reason for missing a class (or a documented illness), please e-mail me as soon as possible. All “excused” absences must be cleared with me before the start of the missed class period.

*Group Work:* Groups will be shuffled every two weeks. At the end of every two week period, each student will be asked to fill out the biweekly self-assessment survey. At the end of the semester, I will compile all of the survey data to create your Group Work score.

## Homework Assignments

Problem sets will be due on Tuesdays at noon. Each group will be expected to turn in a single copy of the Class Problems. In addition, each student will be expected to turn in their own Homework Problems. You are welcome (and encouraged!) to work closely with your group members on solving any of the problems (including the Homework Problems), provided that each student writes up their own set of solutions in their own words. **Late homework will not be accepted unless you have cleared it with me in advance.** I will drop your two lowest scores (on either the Class Problems or Homework Problems) at the end of the semester.

## Exams

There will be two midterm exams. The midterm exams will have two components: an in-class portion and a take-home portion. The in-class portion will test your ability to solve routine problems and write some basic proofs. The take-home portion will involve a few more-sophisticated proofs. You will be permitted to complete any missed problems from the in-class portion when you work on the take-home portion (for reduced credit).

## Textbook Project

The final project will involve revising all of your work from over the course of the semester and compiling it into a textbook. You will be expected to fix any errors, add any missing details, and organize your problems into sections. Points will be awarded based on a number of criteria, including: mathematical completeness/correctness, clarity of exposition, organization of content.

Tips for Writing a Successful Final Textbook Project:

- Write up each of your problem sets using ShareLaTeX. That will make it much simpler to edit your work later on.
- Revise your work early and often (ideally, immediately after the graded assignments are returned each week). This will prevent you from having a time crunch at the end of the semester. It will also help you learn from your mistakes.
- Feel free to show me your textbook drafts during office hours. I am happy to offer feedback to help steer you towards creating a strong finished product.

## Blackboard

Copies of the Pre-Class Reading (as well as the Problem Sets) can be found on the course Blackboard site. Go to <http://blackboard.oberlin.edu> to access these materials.

## ShareLaTeX

Students are *strongly* encouraged to write up all of their homework (especially group assignments) using ShareLaTeX, which can be found here: <https://www.sharelatex.com>

## Course Policies

### Academic Honesty

#### *Homework*

Each week, your homework assignment will be to finish and carefully write up solutions to the in-class problem sets. You are welcome to consult with your class notes, your classmates and the instructor. However, you *may not* consult any books (other than our course textbook) or internet resources – otherwise, you run the risk of ruining the surprise of discovering the course content for yourself. Your experience in Math 327 will be much richer (and your intuition for the subject far greater) if you arrive at the solutions without the aid of a book.

You are encouraged to work with your group members outside of class. You are also welcome to form study groups with other students in the course. In any collaborative efforts (outside of working with your group members), you must abide by the following guideline: you may discuss the general problem-solving techniques for homework problems with other students, but you must write up your solutions independently.

#### *Exams*

You are not allowed to use any electronic device or consult any source other than the instructor during the in-class portion of the exams. In particular, this means *no calculators, smartphones, regular cellphones, iPods, eReaders, laptops, notes, textbooks, etc.* For the take-home portion of the midterm, you may only use your class notes, problem sets, and your professor as resources (i.e., all other resources, including fellow humans, are off limits). You are on your honor not to talk to another student about an exam until both students have turned them in.

*Note:* Information about the Honor System at Oberlin can be found at the following website: <http://www.oberlin.edu/students/links-life/honorcode.html>. Please familiarize yourself with its content. All students are responsible for maintaining the highest standards of honesty and integrity in every phase of their academic careers. The penalties for academic dishonesty are severe and ignorance is not an acceptable defense.

### Disabilities

Students in this course with disabilities, including “invisible” disabilities such as chronic diseases and learning disabilities, and who may need disability-related classroom accommodations, are encouraged to make an appointment to see their instructor as soon as possible.

### Make-up Policy

Typically, I will not accept late homework, and a missed midterm exam cannot be made up. That said, I understand that some circumstances are beyond your control. Should you contract a serious illness or find yourself in an emergency situation, please contact me *immediately*. I will be happy to make arrangements with you under these types of extreme circumstances.

### Religious Observances

Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me before the end of the second week of the semester to discuss appropriate accommodations.

### Important Dates

Add/Drop Deadline	February 11 (Wednesday)
Spring Break!	March 21st (Saturday) - March 29th (Sunday)
Withdraw and P/NP Deadline	April 6th (Monday)
Classes End	May 8th (Friday)
Reading Period	May 9th (Saturday) - May 12th (Tuesday)
Final Project	May 15th (Friday)

## A Typical Day in Math 327

- **Before Class** – Read the Pre-Class Reading and make a solid effort at solving the Reading Comprehension Problems. Limit yourself to *at most* 1 hour on these activities.
- **During Class** – At the beginning of class, we will clarify any confusion from the Pre-Class assignment (e.g., we will discuss key points from the reading or go over solutions to one of the Reading Comprehension problems). You will spend the bulk of the class period working on the Class Problems with your group members.
- **After Class** – Write up solutions to Class Problems with your group members. Solve the Homework Problems (usually 2 problems per class period) and write up those solutions individually.

\*All written work (Class Problems + Homework Problems) are due at noon on Tuesday of the following week.

\*\*I expect that you will spend roughly 8-10 hours per week outside of class on this course. If you are spending significantly more or significantly less time, please let me know.

## Course Schedule

The following is an estimated schedule for the course. Please note that the midterm exam dates are tentative.

Lectures	Brief Description
2/2	Introduction, Symmetries of Regular Polygons
2/4	Groups, Examples of Groups
2/6	Basic Properties of Groups, Identities and Inverses
2/9	The Order of a Group, Groups of Units
2/11	Integer Powers of Elements in a Group
2/13	Introduction to Subgroups, The Subgroup Test
2/16	The Center of a Group
2/18	A Crash Course in Number Theory
2/20	Cyclic Groups
2/23	Subgroups of Cyclic Groups
2/25	Dihedral Groups
2/27	Symmetric Groups, Permutation Notation and Cycles
3/2	<b>Midterm Exam #1</b>
3/4	<b>No Class – Work on your take-home midterm</b>
3/6	Even/Odd Permutations and the Alternating Group
3/9	Cosets
3/11	Cosets
3/13	Lagrange's Theorem
3/16	Normal Subgroups
3/18	Quotient Groups & Cauchy's Theorem
3/20	Products of Groups
3/21 - 3/29	<b>No Class – Spring Break!</b>
3/30	Products of Groups
4/1	Isomorphisms of Groups
4/3	The Isomorphism Theorems
4/6	The Isomorphism Theorems
4/8	The Isomorphism Theorems
4/10	The Fundamental Theorem of Finite Abelian Groups
4/13	The Fundamental Theorem of Finite Abelian Groups
4/15	Group Actions
4/17	Group Actions
4/20	<b>Midterm Exam #2</b>
4/22	Group Actions
4/24	The First Sylow Theorem
4/27	The First Sylow Theorem
4/29	The Second Sylow Theorem
5/1	The Third Sylow Theorem
5/4	Special Topics
5/6	Special Topics
5/8	Special Topics
5/15	<b>Final Textbooks Due at 11 AM</b>