

MATH 444  
ABSTRACT ALGEBRA  
CSULB  
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OFFICE: TUE/THU 4-5 (STUDIO)

## Overview

What is symmetry? If math is about anything, it's about structure. How do we capture the *structure of symmetry*? This task leads to the idea of a *group*—one of the most profound mathematical ideas. By exploring this concept, we'll develop the beginnings of a theory of groups. Although we'll study many concrete examples, this subject is highly abstract. Historically, its development led to a revolution in mathematical thought. Perhaps we'll sense some of this revolutionary character as well.

This semester, Math 444 is running as part of the **Long Beach Project in Geometry and Symmetry**—a multi-year effort to promote thinking that's rooted in perception and experimentation. The project's centerpiece is *The Geometry Studio* which we'll be using as a classroom. At scheduled times—to be announced—outside of class the studio and its resources will be available to you. I encourage you make regular visits in order to meet with classmates, to chat with Catherine (the project's Student Fellow) or Scott, or just hang out and play.

Your critical comments—signed or anonymous—on the project or studio experience are welcome at all times. Toward the end of the semester, we'll invite you to evaluate your experience in the course.

## Class cancelations

Due to the state's lack of support for higher education, there will be no class on the following days.

Wednesday 23 September  
Monday 2 November

Furthermore, marking of written work and office hours will be proportionately curtailed.

See [savethecsu.com](http://savethecsu.com) for more information on budget cuts, fee increases, and faculty furloughs. It appears that collective action will be required to convince the legislature to support high-quality education adequately. Please consider joining the campaign to save education in the state of California. Everyone's future in the state depends on it.

## Course-work

### Exercises and problem presentation

There will be regular assignments designed for you to write up (but not submit) and for us to discuss in class. A selection of these will be eligible for student presentation (10-15 minutes) Each member of the class is responsible for **one presentation** over the semester. Some might be available for group work.

### Exams

There will be take-home exams at about weeks 6 and 12.

## Course project

Find a topic to explore independently. A theoretical development, a challenging problem, an application, a computer program, or an historical development are suitable projects. A list of ideas will appear after a few weeks. If you come up with your own topic, so much the better. Bear in mind that your project should have a *narrow focus* and *substantive mathematical content*.

You're welcome to work in groups of two (possibly three). Be advised that the standards for group work will be proportionally higher. You'll provide a project write-up—length is not important. (Typically, 3-5 pages should suffice.) Clarity, creativity, and illumination are what matter most.

Also, you'll present your findings to the class (10-15 minutes) during the final exam session. (If there's not enough time then, we'll use the last week of class.) If you work in a group, each member must make some contribution during the presentation.

By the 11th week you should have discussed a proposal with me. If you're having trouble, please see me.

## WWW

Materials related to the course (course description, assignments, reference materials) will appear at

[geomsymm.cns.m.csulb.edu](http://geomsymm.cns.m.csulb.edu)

Please make recommendations for things that you'd like to see on the site.

## Text

I. Grossman and W. Magnus, *Groups and their Graphs*

## Rough outline

Week	Topic
1-4	Symmetry and the group concept
5-9	The structure of groups
10-11	When two groups are the same
12-15	Group actions: the theory of symmetry
Final exam time (12.30-2.30, 14 Dec)	Project presentations

## Evaluation

Exams	40% (20% each)
Problem presentation	20%
Course project and presentation	40%

Here's a *rough* indication of how I will assign grades. These are **minimum** standards. The actual boundaries between grades might be lower than these, but won't be higher.

85-100%	A
75-85%	B
65-75%	C
50-65%	D

To each individual part of your work I assign a mark 0-10. See below for an *indication* of what these marks mean.

- 10 . . . . Clear, elegant, mathematically correct, shows depth of understanding, insight
- 9 . . . . . Clear, shows understanding and some elegance and insight, mathematically correct
- 8 . . . . . Mathematically correct, little elegance and insight
- 7 . . . . . Mostly mathematically correct, little elegance and insight
- 6 . . . . . Some significant misconceptions
- 5 . . . . . Quite significant misconceptions (with honest effort, this is about as low as it goes)
- 0-4 . . . . Deep misconceptions—shows little effort.

**Let me know if you're happy or unhappy about something.**

**Key to comments on marked papers**

- a This needs a supporting **argument**.
- a? What's the **argument**—the line of reasoning—here?
- d **Describe** what's going on here.
- e **Explain** what you're doing here.
- h? **How** did you get this?
- i **Illustrate** what your talking about—give an example, a picture, etc.
- p A **picture** would help here.
- s This is not a **sentence**.
- w **Wording** is awkward, confusing, etc. Meaning is unclear.
- y? **Why** is this so? What's the connection to what you've already said?
- ! Very nice. Something especially clear, insightful
- ? What this means or what you're doing is **unclear**. Where does this come from?
- X Something's wrong here—in concept or calculation.
- ✓ This is right—you have the idea.

## Fine Print

**Withdrawal** A copy of the School of Natural Sciences withdrawal policy is available from the Department Office. Note that it's different from the University withdrawal policy and the deadlines are earlier. Deadlines to which you should pay particular attention to appear below. Withdrawals from this course will be allowed only in accordance with University and College policies. Please be aware of the more specific and restrictive withdrawal policy for the College of Natural Sciences and Mathematics.

**Weeks 1-2.** Withdrawals will not appear on the student's permanent record.

**Weeks 3-8.** Withdrawals are permissible only for serious and compelling reasons. Academic progress unsatisfactory to the student is considered a serious and compelling reason during this period. Instructor and Department Chair signatures on the drop form are required.

**Weeks 9-12.** Withdrawals are permissible for serious and compelling reasons, but during this period, unsatisfactory academic progress is not considered a serious and compelling basis to drop a course. Circumstances must be shown that preclude the student from attending class or from any effective opportunities to study. In addition to the normal withdrawal form, a special form must be completed, and instructor and department chair signatures are required.

**Weeks 13-15.** Withdrawals are permissible only for serious accident or illness and involve a total withdrawal from the University. Detailed written documentation must accompany withdrawal forms. Instructor, chair, and college dean signatures are required.

**Disability** It is the student's responsibility to notify the instructor in advance of their need for accommodation of a disability that has been verified by the University.

**Cheating/Plagiarism** Cheating and plagiarism are in violation of the California Administrative Code, Title 5, Section 41301. CSULB has adopted a specific policy with respect to the violations of this nature (see the Bulletin or Schedule of Classes). Any student in violation of this code and policy in any assignment or examination related to this course shall be subject to the options specified in the policy statement. This may result in the student receiving a failing grade in the course or, in certain circumstances, being expelled from the University.