

Math 409, Spring 2013  
Final Exam Review Information

**Logistics:** The final exam will be on **Monday, May 13, 1:30–4:00 PM, 301 Snow** (the regular classroom). Bring a pen or pencil and scratch paper.

**Office hours:** I will hold office hours on Friday, May 10 (Stop Day) from 2-4 PM and on Monday, May 13 from 10 AM–noon. My office is Snow 623.

The final exam will cover material from the entire course, including the three main units: Euclidean geometry, transformational geometry, and polyhedra.

**1. Euclidean geometry.** Since the midterm was all about Euclidean geometry, it won't be the main focus on the final (roughly 25% of the exam). The problems on the final exam will be similar in difficulty and subject to the ones on the midterm, and I'll give you the same list of axioms and theorems.

**2. Transformational geometry.** This was the big unit of the second half of the course, so it will comprise roughly 50% of the final exam. Here is a list of concepts you should understand and problems you should know how to solve.

- Understand the definition of transformation and group, and why the following sets form groups: (i) all transformations of space; (ii) all isometries of space; (iii) all symmetries of an object in space (such as a polygon). [Relevant problems: TG 5, TG 6]
- Describe all symmetries of an object such as a polygon. [Relevant problems: TG 1, TG 2, TG 13, TG 20]
- Know the basic kinds of transformations (reflections, rotations, translations) and how they interact. [Relevant problems: TG 3, TG 4, TG 8, TG 9, TG 11, TG 12]
- Be able to work with transformations in terms of their permutation words. [Relevant problems: TG 16, TG 18, TG 20]
- Construct and work with the multiplication table of a group. [Relevant problems: TG 15, TG 16]
- Know the Three-Point Theorem and the Three-Reflection Theorem. [Relevant problems: TG 9, TG 10, TG 11]
- Understand the group of symmetries of a regular polygon. [Relevant problems: TG 18, TG 19]
- Be able to count the symmetries of an object without having to list them all. [Relevant problems: TG 17, TG 18, TG 19, TG 20, TG 21, TG 22]

**3. Polyhedra.** This unit will comprise roughly 25% of the final exam. Here's a list of concepts and problems.

- Understand how to use the “handshaking formulas” (see, e.g., Problem 9 in the notes on polyhedra).
- Know Euler's formula and understand how to prove it (for instance, by the “fields, dikes and raging sea” argument).
- Know the classification of the Platonic solids, and understand how to prove that they are the only ones.

Finally, the study suggestions for the midterm exam apply equally well to the final exam.