

# Mathematics 170: Ideas in Mathematics

## Final study guide

The final exam is on Thursday, July 2, from 4:20 to 5:55 pm. I plan to start and end promptly.

There will be about ten questions. As you might expect, they'll be shorter than the homework questions. Each problem will carry approximately equal weight; I'll explicitly indicate the weights on the exam.

The format of the exam will be similar to that of the midterm. In particular, the majority of the questions will ask you to compute things or give simple proofs; a substantial minority will ask for short written answers.

The final exam is not cumulative. In particular, it covers material since the midterm, plus material from the day *before* the midterm (Wednesday, June 10) since what we did that day is not on the midterm. It will *not* include any material that I introduce in class on Wednesday, July 1; anything I introduce there is done for your own edification.

I'll devote roughly the last half of Wednesday's class (somewhere between fifteen minutes and half an hour) to your questions. I'll also hold my usual Wednesday office hour immediately following class.

Here is a list of topics you should concentrate on, roughly in the order we covered them. I've tried to indicate what days we covered these topics in class; I may be off by a day in some places since there were some times when I prepared something for one day but didn't get to it until the following day.

- Cantor's power set theorem (3.4; Wed. June 10)
- The infinite in geometry: proof that the square and the line have the same cardinality, stereographic projection in pictorial terms (3.5; Mon. June 15)
- The art gallery theorem (4.2; Tue. June 16)
- Tessellations (Wed. June 17; note that my emphasis here was quite different than that in the text)
- Polyhedra: duality, counting symmetries, Euler characteristic, angle defects (Thu. June 18; 4.5)
- Geometry on the surface of spheres and polyhedra (Thu. June 18; 4.6)
- Hypercubes and hypertetrahedra (Mon. June 22?; 4.7)
- The Euler characteristic for polyhedra and planar graphs (Mon. June 22; 5.3)
- The Euler characteristic for surfaces with holes (Tue. June 23; 5.3)
- Fractals: the Koch snowflake, the Cantor set, the Sierpinski gasket (Wed. June 24 and Thu. June 25; 6.3)
- Fractal dimension (Wed. June 24 and Thu. June 25; 6.6)
- The problem of points (Thu. June 25; 7.2)
- Basics of probability (Thu. June 25 and Mon. June 29; 7.2)
- Randomness and coincidence (Mon. June 29 or Tue. June 30; 7.3)
- Probability by counting (Tue. June 30; 7.4)

This list corresponds fairly closely with material that was on the homework; thus making sure you understand how to solve the homework problems will be one of the best ways to study for the exam.

Here are some things that I spent a fair amount of time on in class but explicitly will *not* test.

- Explicit formulas for stereographic projection, rational points on circles, map projections
- Proofs of volumes and surface areas of three-dimensional objects
- The geometry of the universe as a whole
- Classification of surfaces and the Poincare conjecture
- Proving that  $K_{3,3}$  and  $K_5$  are not planar
- Paradoxes in probability