

**Abstract Algebra B**  
**Math 521B**  
Michael E. O'Sullivan

Projects

### Expectations

- Turn in a short, 1-2 paragraph synopsis of what you will study, the first week of April with a rough plan. You may be alter the plan, but I want to give feedback early.
- There is great latitude in choice of topic. Some suggestions are below. CAUTION: (1) Don't get bewildered by having too many choices. (2) Choose something with good references.
- You may work with another person. If you'd like to work with a larger group please discuss with me first. Each person must have a clear role in the group. I need to evaluate each person individually.
- There is a great deal of latitude in the "deliverable." You may turn in a survey of a topic, solutions to some exercises, detailed development of a narrow topic, computational work, or something else. CAUTION: There must be clear and substantial mathematical content.
- There must be a oral presentation of 10-20 minutes.

### Rubric

Up to 25 points may be awarded for each parameter 20 pts. is A level, 25 is "awesome."

- Audacity: is the topic easy (10), average (15), challenging (20), scary (25).
- Quantity:
- Quality: good organization of the material, clear definitions, concise explanations.
- Polish: materials turned in on time, clearly written, neatly presented, references given.
- Oral presentation: Well organized, clear, of appropriate depth for the audience. Able to answer questions.

### Possible topics

- Classification of finitely generated abelian groups (not necessarily finite).
- Classification of groups of small order  $< 100$ .
- Classification of finite simple groups: Understand some of the simple matrix groups.
- Symmetry of chemicals, crystallography
- Symmetry in physics
- Frieze groups and tilings of the plane
- Platonic solids and archimedean solids

- Games with a combinatorial aspect (see D. Joyner's book).
- Rubic's cube
- Lattices
- Matrix rings
- Finite fields
- Power series rings  $k[[x]]$
- $p$ -adic numbers
- Computational/programming work in SAGE (or with other software)
- Applications of algebra in engineering or any other subject
- Teaching algebra to mathematically talented high school students: create a set of lessons.
- Historical development of group theory