The project presentations and reports are an opportunity to learn something new in greater depth. They provide a good way to develop skills at speaking and writing mathematics. In addition, they will give us a chance to have an overview of many interesting topics in abstract algebra that we wouldn’t see otherwise.

**Presentations:** 20 minutes long per person, during last two weeks of class. 
Delivery method: dotcam, computer, or blackboard. 
Make sure to practice - especially if you’re using the blackboard.

**Written report:** 10 pages, due 5/14 at 10 am.

**Things to include:**


2. Where/When/Why: motivation for studying topic, history of topic, applications of topic.

3. **** Facts: important properties and theorems about topic.

4. *** Examples: by hand or using computer.


7. References: (only for written report).

**Possible topics** The topic of your project should be connected to one of the central themes of this class: non-abelian groups and/or group actions.

1. Semi-direct products (generalization of dihedral groups).

2. Alternating groups: simple for \( n \geq 5 \), isomorphism between \( A_5 \) and the symmetry group of a dodecahedron.

3. Solvable groups, composition series.


5. Special unitary groups, orthogonal representation of \( SU_2 \).

6. Linear groups: generators, center, projective linear groups. There are infinitely many simple linear groups.

7. Motions of \( \mathbb{R}^2 \) and \( \mathbb{R}^3 \): classification of finite subgroups of \( O(2) \) (cyclic and dihedral) and \( O(3) \) (platonic solids), discrete subgroups and lattices, 17 crystallographic groups. Classification of conics in \( n \) dimensions. Artin chapter 5.
8. $\mathbb{C}[t]$-modules (abelian group with action of $\mathbb{C}[t]$).

9. Bilinear forms, symmetric positive definite forms, diagonalizing real symmetric matrix, orthogonal complements.


11. The Todd-Coxeter algorithm: using generators and relations for describing a group operation in terms of an action on cosets. Artin 6.9.