

Categories, Symmetries and Manifolds

Math 4800, Fall 2020

Project Ideas.

- Investigate categories further, including functors and the Yoneda lemma.
- Describe the symmetries of the permutation groups, especially S_6 .
- Classify the finite (and finitely generated) abelian groups.
- Investigate the upper half plane model for hyperbolic geometry.
- Describe all the finite subgroups of $SO(3, \mathbb{R})$.
- Investigate the symmetry groups of the Platonic solids in greater detail.
- Discuss Jordan normal form, and describe all the conjugacy classes of $GL(n, \mathbb{C})$.
- Investigate the group $SL(2, \mathbb{Z})$ and its action on the upper half plane by linear fractional transformations.
- Explore the category of finite extensions of \mathbb{Q} and Galois groups of symmetries.
- Look into the “Coxeter” reflection generators and relations of the groups S_n and D_{2n} . Describe some more Coxeter groups and their Cayley graphs.
- Describe the Lie algebra $\mathfrak{sl}(2, \mathbb{C})$ and explore its representations.