MATH 945: Category Theory and Homological Algebra; Winter 2026
Syllabus

Instructor Information

- **Instructor:** Jason Bell
- **Office:** MC 5008

Material

The topics covered in the course are:

- Categories and functors
- Natural transformations
- The opposite category
- Adjoints
- Tensor-Hom adjunction
- Yoneda's lemma
- Initial and terminal objects
- Limits and colimits
- Abelian categories
- Mitchell's embedding theorem
- Projective modules and vector bundles
- Injective modules
- Complexes, long exact sequences, homotopies of complexes

- Projective resolutions
- Derived functors
- Ext and Tor
- Ext via Yoneda equivalence

Some topics may be omitted and others may be added depending on time.

Assessments

- There will be four assignments, each worth 20% of your final grade (total 80%).
- Submit your solutions as PDFs via Crowdmark.
- There will be a take-home assessment worth 20% of your final grade.