

MAT577: Topology I

Course Description, Spring 2026

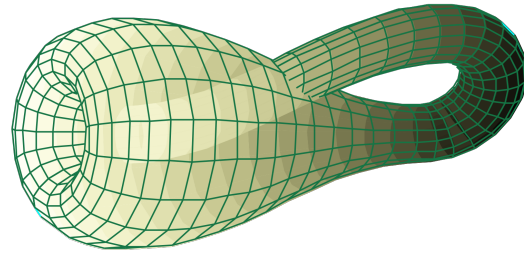
Instructor

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Class

MWF 1:00 PM - 1:50 PM, Neville 204



Course description

Topology is the study of properties of a geometric object that are preserved under continuous deformations such as bending and stretching. These are properties such as whether the object has holes rather than its lengths or volume. Because of this, topology is sometimes referred to as “rubber-sheet geometry”. The ideas of topology are foundational to various areas of mathematics, and have also been used in fields outside of mathematics such as topological data analysis in computer science, applications of fixed point theorems to game theory in economics, and the topology of protein folding in biology.

This course will be a fast-paced and hands-on introduction to three different but related areas of topology:

- **Point-set topology:** the basic concepts in topology, such as continuity, compactness, and connectedness. While you may have encountered these ideas before in real analysis, we will generalize them to arbitrary topological spaces. Here, we will think analytically and visually about the basics, and construct many interesting examples of topological spaces to test our topological intuition.
- **Geometric topology:** the study of manifolds and the maps between them. We will focus on surfaces, which are two-dimensional manifolds like the surface of a donut or the Klein bottle (pictured above). We will discuss invariants of surfaces and the classification of surfaces.
- **Algebraic topology:** the use of tools from algebra to distinguish and classify topological spaces. We will discuss the fundamental group, which is a group that captures the idea of what different loops exist on our space, and end with a discussion of covering spaces.

This course is open to graduate and undergraduate students who have passed an undergraduate real analysis course (e.g. MAT425).

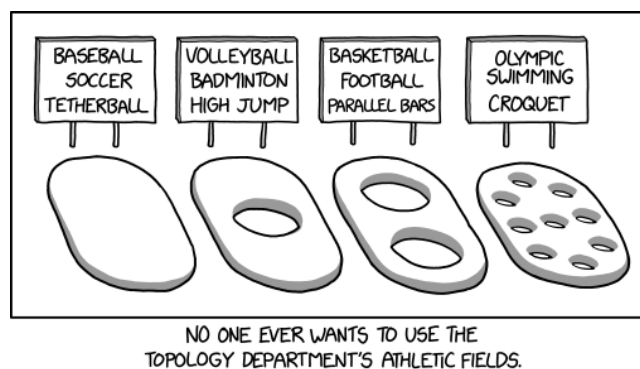


Image source: Wikipedia, “Klein bottle”; Comic source: XKCD #2625, “Field topology”