



This is a course in algebraic topology. Many important questions in topology and analysis—e.g., Are two given topological spaces the same, i.e., homeomorphic? Does a given function between spaces preserve the rough shape, i.e., is it a homeomorphism? Can there exist a continuous function from a given space to itself without fixed points? Does a surface (or, more generally, a *manifold*) have non-zero tangent vector fields?—are difficult, if not impossible, to answer directly. In *algebraic topology* we translate these problems into problems in algebra, problems which are often easier to solve, but whose solutions shed light on our original *topological* or *analytical* questions.

In this course we will study the fundamental group of a topological space and its properties and applications. We will also study covering spaces, including those induced by group actions. In the process, we will see the principles discussed above at work in such famous results as the Brouwer Fixed-Point Theorem, the Hairy Ball Theorem (and the *Punk Hairy Ball* Theorem), the Ham-Sandwich Theorem, the Classification of Surfaces, etc. One particular case study will involve finding the fundamental group of the Klein Bottle (pictured above).

Prerequisites: Math 175 or an equivalent undergraduate topology course; Math 128A or an equivalent undergraduate course in abstract algebra. Or instructor consent.

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When and Where: MW 4:00-5:15 pm in MH 323

Textbook: *Topology, 2nd Edition*, by James R. Munkres, Prentice Hall, ISBN 0-13-181629-2