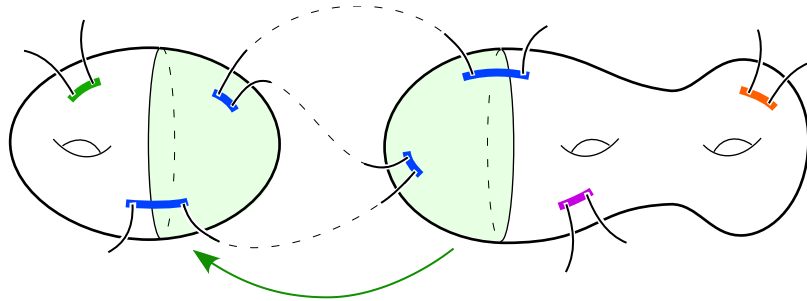# Math 312/512: Topology

Bryn Mawr College

Topology is the study of geometric objects. The curves, surfaces, and solids encountered in multivariable calculus are good examples of such objects, as is the 3-dimensional space, or 4-dimensional space-time, that we live in. And this is only the tip of the iceberg! The way topology fits into the grand scheme of pure mathematics is illustrated below.
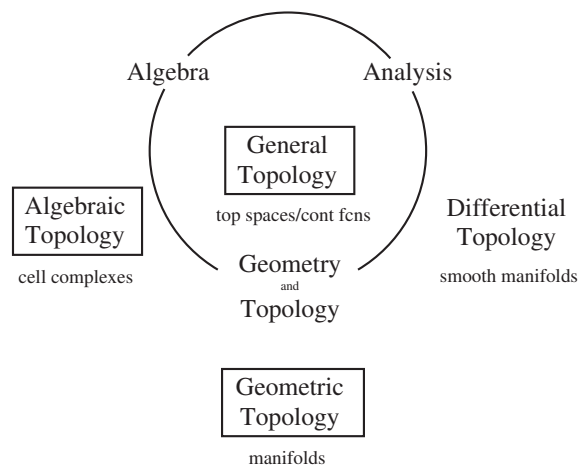
This is a first rigorous course in topology, in which we lay the foundations for the subject and begin to explore its horizons. In fact, by the end of the first week of class we will already get a glimpse of how some famous theorems can be proved using topology. These include:

- Any continuous map from a ball to itself has a fixed point.
- Any nonconstant complex analytic map assumes all but possibly one value.
- Any complex polynomial has a root.
- Any subgroup of a free group is free.
- Any simple closed curve in the plane splits the plane into two pieces.
- Any tangent vector field on the 2-sphere must vanish somewhere.
- Any map from the sphere to the plane must identify some pair of antipodal points

During the course we will develop the tools needed to prove these results and many others.