

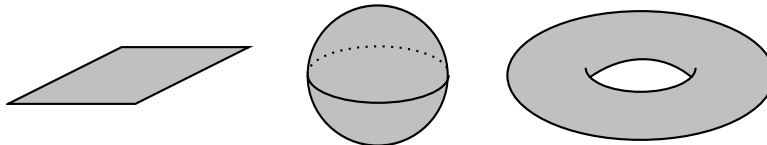
Course Announcement for Fall 2009

Math 591 – Geometry of Surfaces (3 credits)

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Geometry is the study of spaces on which we can measure distances and angles. In this course we will focus on the three most famous types of two dimensional geometry: **Euclidean** geometry, **Spherical** geometry, and **Hyperbolic** geometry. In Euclidean geometry, the interior angles of a triangle sum to π . In Spherical geometry they sum to a number larger than π and in Hyperbolic geometry they sum to an angle less than π . You already know an examples of a space with Euclidean geometry and a space with Spherical geometry, namely the flat plane and the round sphere. We will learn about another fantastic place, the **Hyperbolic Plane**, which of course is an example of a space that has a Hyperbolic geometry.

A surface is a space that is locally 2-dimensional (but doesn't necessarily come with a notion of distance or angle). For instance, \mathbb{R}^2 is a surface, as is the surface of a basketball or a donut. By drawing these surfaces in 3-space, I've accidentally given you a way to measure



distances and angles. Just use the measuring tape and protractor we have in 3-space. If you do this with my pictures, you'll see that the plane has a Euclidean geometry, the sphere has a spherical geometry, and the donut surface has regions with geometries that are similar to each of the 3 model geometries. We generally prefer to endow a surface with a geometry that is "constant." So in this way, the geometry we have on the donut is not our favorite. It turns out that there are lots of ways to give the donut a flat Euclidean structure and we are happier with this.

In this course we will continue to investigate these sorts of issues. Aside from learning about the 3 geometries I've mentioned, we will learn how to "glue" polygons along their edges to get surfaces with predictable geometries. We will see that this is closely related to symmetries and tessellations of the Euclidean plane, the round sphere, and the Hyperbolic plane.

Intended audience/prerequisites: This is a first course in the geometry of surfaces. If you have taken multivariable calculus and one semester of analysis you should be well-prepared for this course.

Text: *Low-dimensional geometry: from Euclidean surfaces to hyperbolic knots*, by Francis Bonahon,

<http://almaak.usc.edu/~fbonahon/Research/Preprints/Preprints.html>.