MATH 312A - GEOMETRY
FALL 2010

MWF: 11:00 - 11:55 A.M. (PETTENGILL 257)

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Office hours: MWF: 2:30pm - 3:30pm, or by appointment

Prerequisites: Math 206

Tentative Syllabus:

Geometry is perhaps the oldest field in mathematics. Since the time of the ancient Greeks, geometry has dominated the field of mathematics for over two thousand years. In this course, selected topics of geometry are discussed, in particular, elementary differential geometry, modern approach to classical Euclidean geometry and hyperbolic geometry.

- Parameterized curves in $\mathbb{R}^2$ and in $\mathbb{R}^3$
  - arc length, curvature, Frenét formulas
- Parameterized surfaces in $\mathbb{R}^3$
  - normal and tangent vectors, Gaussian curvature
- Euclidean isometries, rigid motions
  - isometries in $\mathbb{R}^2$
  - translations, rotations, reflections, and glide reflections
  - isometries as products of reflections
- Symmetries
  - frieze patterns, wallpaper designs
  - groups of symmetries
  - tessellations: regular and semi-regular

- Planar graphs
  - Euler's formula
- Non-planar graphs
  - Cayley graphs of groups
- Solids
  - Euler's formula and classification of regular solids, golden ratio
- Hyperbolic Geometry (dimension 2)
  - upper half plane model
  - linear fractional transformations
  - unit disk model
  - rigid motions in hyperbolic plane
- Miscellany
  - rubber sheet geometry: cut and paste topology
  - Lorentzian Geometry
  - Japanese Temple Geometry

Grades: Presentation (of homework) - 20%; Papers (written homework, abstracts, project proposals) - 40%; final project (presentation - 20%; paper - 20%)