**MATH 312A - GEOMETRY**
**FALL 2012**

TTH: 9:30 - 10:50 A.M. (HATHORN 100)

**Instructor:** Peter Wong

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**Office hours:** T: 1:00pm - 2:00pm, W: 9:00am - 10:00am, or by appointment

**Prerequisites:** Math 206 (multivariable calculus)

**Tentative Syllabus:**

Geometry is perhaps the oldest branch of 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, graphs, and surface topology.

- 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 (if time permits)
- 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%)

**Homework:** Students will be working in small groups. There will be approximately four homework assignments this semester. Solutions are to be discussed and presented in class and the write-ups will be submitted subsequently (normally one week after the presentation of homework).

**Papers:** All written work should be typeset using LaTeX. Prior to the final project presentation, the presenter should prepare and distribute his/her abstract of the presentation to the class.

**Final Project:** Final project presentations will take place during last week of classes. A final project proposal (no more than 2 pages) is due before Thanksgiving break.