Math 1040 Syllabus, Spring 2023:

Instructor: Prof. Rich Schwartz

Time and Place: Tu-Th 2:30 - 3:50, Page-Robinson 302

Texts: I will use my book *Mostly Surfaces*, and I will also give handouts.

General Description: This is a course on geometry, taught from a modern point of view. I will cover the basic honogeneous geometries: Euclidean, spherical, and hyperbolic, and also projective geometry (which really subsumes the first three). I will also explain some classic theorems in geometry, such as the existence of aperiodic tilings and the theorem that you cannot cut a cube into a regular tetrahedron by straight-edged cuts. The class, I hope, will feature some group activities where students work together drawing pictures, making things, or trying to figure out things on their own.

Homework: I'll give out weekly assignments each Tuesday and then collect them the next Tuesday.

Grading: Your grade will be based on three components:

- Midterm: 25%

- Homework: 35%

- Final: 40%

Topics: Here is a tentative list of topics for the course:

Euclidean geometry:
metrics
distances, lines, etc.
group structure
convexity
polytopes.

polygons:
Pick's theorem

2D scissors congruence
affine averaging
polygonal billiards

Polyhedra:
platonic solids
E4 cell, E8 cell
3D: cannot cut cube into a regular tetrahedron

Tilings:
wallpaper groups
Penrose tilings
Robinson Tilings
Taylor-Socolar Tiling

spherical geometry:
geodesic polygons
parallel transport
Gauss-Bonnet
Cauchy rigidity

hyperbolic geometry:
exponential area growth
Gauss-Bonnet
surfaces
Lorentz model

Projective Geometry:
Pappus, Desargues, Brionchon Theorems
pentagram map
fundamental theorem of projective geometry
finite projective planes