Geometry REU Course Description

Instructors: Ben McReynolds[1] and Ben Schmidt[2]

Time: This course will meet each Tuesday and Thursday in E206, between 6:30 and 8:00 p.m., starting July 22nd and ending August 7.

Overview: We will give six independent, self-contained lectures aimed at introducing students to easy to state, though potentially difficult to solve, open questions in different areas of geometry, topology, and dynamics. The lectures will be followed by a short problem session and discussion period.

Week 1: These Are A Few Of My Favorite Things.

This week we will discuss our favorite simple to state open questions, prove some special cases, and discuss some possible approaches to the general case. We'll look for inscribed squares in planar Jordan Curves, take X-rays of convex bodies, try to T the plane, take a closer look at Euclid's axioms, etc...

Week 2: Geometric Groups.

This week we will discuss some open questions in geometric group theory. The Tuesday lecture will focus on left orderable groups: groups with an order invariant under left multiplication. We will give many examples of such groups as well as some groups for which it is unknown if they can have a left order. The Thursday lecture will focus on the Tits' alternative and residual finiteness of a group. We will see groups from geometry, algebra, and algebraic geometry (for instance, pinched word groups and Cremona groups).

Week 3: Let's Play Billiards.

A great source of examples and questions in dynamical systems comes from the theory of billiards. A table may be modeled on a planar domain in which a ball with a given initial velocity moves without friction until hitting the boundary upon which it reflects according to Snell's Law. Here, there are many questions that are very easy to state. For example, does every triangular table have a periodic orbit?

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