Stanford Math Directed Reading Program Colloquium
Spring 2019

June 10th, 6:30pm–8:30pm
Sloan Mathematics Center, room 384-H (fourth floor)
Dinner available at 6:15pm

Topology and the Universe

Galit Roque

Mentor: Paul Falcone

We will begin by discussing some basic notions about manifolds, focusing in particular on the quotient topology and constructing three manifolds. We will then explain how physical evidence suggests that space has little to zero curvature, which dramatically limits the number of possibilities for the shape of the universe, some of which would be deeply surprising.

Topology and the Fundamental Theorem of Algebra

David Lin

Mentor: Sarah McConnell

I will first introduce basic notions of paths, homotopies and fundamental groups of a topological space. This will provide sufficient context to begin the discussion of covering spaces. As a simple application, I will prove the Fundamental Theorem of Algebra using the fact that $\mathbb{R}$ is a cover of S_1.

ABRACADABRA Problem and Martingales

Zhuoer Gu

Mentor: Alex Dunlap

In this talk, we will find a solution to the ABRACADABRA problem with martingale theory by transforming the problem into a gambling game. With nice properties of martingale sequence of random variables, we can find interesting result on stopping time of such stochastic process.

Elliptic curves and the Nagell-Lutz Theorem

Chady Ben Hamida

Mentor: Vivian Kuperberg

The problem of finding rational points on elliptic curves is an intricate one, and has many useful applications in cryptography. I will give a brief introduction to the arithmetic of elliptic curves, as well as prove of fundamental result, the Nagell-Lutz theorem which gives a precise procedure for finding all of the rational points of finite order on an elliptic curve.

Projective Geometry for Elliptic Curves

Mel Guo

Mentor: Jonathan Love

Is it true that a line always intersects a cubic curve 3 times? What about the case for a vertical line? In this talk, we use projective geometry to answer these questions. We start off with discussing familiar objects (parallel lines and parabolas) and how they compare in the Euclidean and projective plane. From there, we define key concepts (i.e. points at infinity) in projective geometry to answer the problem of the intersection of a vertical line with a cubic curve.

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