

Senior Theses

There is a wide range of projects that can constitute a senior thesis. These include original research, expository writings on an advance topic, or historical expositions in mathematics. The following is a partial list of students who worked with me on their theses.

- Camila Friedman-Gerlicz – CMC (Spring 2010)
Thesis title: The Four-Point Property and Metric Geometry
Synopsis:
In this thesis, we will examine metric spaces such as Banach spaces, $CAT(0)$ space, and metric trees, and look at various different four point properties on them. We will begin with $CAT(0)$ spaces and see how they relate to the CN inequality and the quadrilateral inequality. We then examine the convexity of metric spaces and see that that metric trees lie in the intersection of $CAT(0)$ spaces and Hyperconvex metric spaces, so they retain the properties of both. The four point property will be introduced and used to prove many results on metric trees, their hyperconvex hulls, and extensions of Lipschitz mappings on them.
- Catherine Ann Janes – Scripps (Spring 2010)
Thesis title: Möbius Transformations Through a Geometric Lens
Synopsis:
This paper explores the beauty and complex analysis through geometric rather than purely algebraic observations. This idea will be illustrated by looking at the geometric behavior of Möbius transformations.
- Andrew Dugowson – PO (Fall 2009)
Thesis title: Compactness and Convexity in Metric Trees
Synopsis:
This paper can be broken into two broad pieces: first, a survey of the important results in the study of metric trees and second, a presentation of our original results. The bulk of the paper will be spent on the former topic as I re-drive and explain the importance of the theorems involved in my later proofs.
This paper presents variations on the Heine-Borel and Krein-Milman theorems that work in the world of metric trees.
- Jeffrey Eagle-Hall – CMC (Spring 2007)
Thesis title: There Is No *Ignorabimus*: An Explication of Hilbert's Problems
Synopsis:
At the start of the twentieth century a Prussian mathematician by the name of David Hilbert stood before his peers in Paris. His goal was to present to them a vision of the future of mathematics through a list of problems that he believed would be important in the upcoming years. The goal of this thesis is to present a vision of the man and his problems.
- Matthew R. Green – CMC (Fall 2006)
Thesis title: Exploring Mathematics through Religion and Religion through Mathematics
Synopsis:

This thesis contains three chapters. These are: Plato: A link between Math, Morality and Religion; Cantor and Newton: The Actual Infinite and God's Absolute Perspective; Banach – Tarski Paradox and Saint Anselm: Some Connections between Mathematics and Religion.

- Adam Bley – CMC (Spring 2006)

Thesis title: Sendov's Conjecture

Synopsis:

Arguably one of the simplest conjectures in all of mathematics, Sendov's conjecture is a statement about the proximity of critical points of a given complex-valued polynomial to the roots of that polynomial.

The beauty of Sendov's conjecture lies in the intersection of its conceptual simplicity with its structural complexity. Finding its foundation with Rolle and Gauss, Sendov's conjecture quickly reveals itself to have many faces. We have demonstrated that Sendov's conjecture can be approached by brute force through complex analysis or through the more subtle methods of operator theory. Each approach introduces new complexities which bring about new questions and conjectures.

- Christopher Jones – CMC (Spring 2006)

Thesis title: Fixed Point Theorems with Applications to Economics

Synopsis:

This exposition details a collection of fundamental fixed point theorems, along with some of their applications to economics. We begin with an introduction to the field of fixed point theory, providing its mathematical context and the motivation behind its study in economics.