Abstracts
Senior Seminar
Fall 2007 Simpson College
Mathematics Department

***Lorenz Curves, Gini Coefficients, and Poverty Redistribution* by Jonna L. Anderson**

Alleviating poverty is one of the major areas of study in both economics and mathematics today. This paper is concerned with examining the endowment portion of poverty and the methods incorporated to reduce inequality. Using Lorenz curves and the Gini coefficient we will show that the redistribution of income within a population is an effective method for reducing inequality. Finally, we will examine the possibilities for creating a simple poverty model dividing the population into a rich and a poor layer based on the Gini coefficient of the system. Provided there is enough incentive, "rich" individuals would then relinquish a certain percentage of their income to the redistribution process. Through numerous tests of this model we would hope to find that the Gini coefficient of the redistribution is significantly reduced indicating an effective reduction in inequality.

***A Focus on Loci* by Robert Joseph Best**

The topic of loci can seem counterintuitive and visually difficult to understand. During the semester I have researched the concept of loci, mainly what they are, how they are constructed and how they can be used in the high school setting. Throughout the research process I have been using the software Geometer Sketchpad and have developed my own theorem about a particular locus. I also draw from a French mathematician Fregier and his theorem about a different locus.

***Geometric representations of the sum of geometric series* by Jayson Crawford**

Throughout this semester I worked on different ways to represent sums of geometric series. I first looked at a geometric proof found in the book *Proof Without Words* by Rodger B. Nelson that showed a generic way to find the sum of a geometric series. Next I looked at a numerical proof of the sum of geometric series. I started with a proof from *Calculus* by Strauss, Bradley, and Smith. Finally I looked at geometric representations of sums of specific geometric series. I found these representations in an article by Michael J. Bossé and Johna Faulconer called "Infinite Sums in Geometry: Inducing Two Sets of Patterns". I recreated, using Geometer's Sketchpad, the figures in the article.

***Enveloping a Curve* by Jerilyn Geneser**

What is a mathematical envelope? Learn the definition of and how to create an envelope based on Scott Smith's article "Paper Folding and Conic Sections". See how the envelopes of conics can be verified mathematically by finding the equation of the envelope and proving tangency. Discover Bezier curves and how they are enveloped curves themselves.

***Game Theory and Gun Control* by Nick Hay**

I develop of model of gun crime and self-defense. This model provides support for the Second Amendment, the right to bear arms, and why this right should be regulated. It also supports the need to maintain a free and democratic society by protecting the freedom and security of potential victims. In a society with moderate gun control the model suggests more can be done to protect potential victims. To do this, the model suggests a zero tolerance policy for those who use guns to commit crime while protecting those who use guns for self-defense.

How will I use this? **by John Kerr**

This article discusses issues evolving the application of geometry to real world applications. It compares textbooks used in the 1970's to currently used textbooks in our classrooms. The article takes real applications from two different careers and applies geometry to real applications used by the careers. These applications are then extended to show the reader that the applications can grow and intensify to challenge the student. The article also calls for action proposing a solution to the almost stagnant growth of career application in geometric education in high school, and who should be involved in such an action. A new approach needs to be considered in introducing career education in geometry and this article suggests one possible solution for secondary math teachers to consider.

Pick's Theorem **by DeAnn May**

In 1899 Georg Alexander Pick developed Pick's Theorem. This theorem was made popular through Steinhaus' book. This theorem also us to find the area of polygonal regions that are constructed on the lattice. Throughout my research I have found two of the many proofs that are accessible to high school students as well as found an application that is used in the forestry industry.

DNA and Knot Theory **by Tracy Robson**

The biological study of deoxyribonucleic acid (DNA) is important in the area of genetics. Recently, topologists have become interested in DNA and its connections to an area of topology called '"knot theory." The study of knots complements the study of DNA, and allows us great insights into what happens to our DNA as it replicates, transcribes, and translates.

This paper outlines some of the broad background information on the study of knot theory and its use in the study of genetics. It discusses topoisomerases, enzymes that help in "untangling" DNA, and the mathematics behind their actions, as well as mathematically models DNA and enzymes, and their work in the body.

Hyperbolic Geometry **by Danielle Shelley**

Concepts of Hyperbolic Geometry are ideas that seem very hard to comprehend. In order to understand this form of modern geometry, we must use a different model for visualization. The Poincaré Disk model is a commonly used to visualize the constructions. The construction of a hyperbolic line is somewhat difficult to work with, so there are many options being shown. In order to create lines in the Poincaré Disk, we must create a unique arc passing through 2 points that is perpendicular to the disk's boundary. Using this information, we can use many different methods of drawing a hyperbolic line.