MATHEMATICS

MATHEMATICS SENIOR PROJECT PRESENTATIONS

Session chair: Matthew Nabity
Math and Nursing Building (MNB) 104

PRESENTATIONS:

9 to 9:15 a.m., MNB 104
Mackenzie Koll

Regular Stars, Polygons, and Musical Scales

Edge scales are musical scales constructed from the edges and vertices of a regular polygon. Regular polygons are polygons that have specific structure that can be constructed from regular stars. We will discuss this structure using elements of rational trigonometry and discuss regular stars of order. A star of order 6 will be used to construct a regular hexagon and motivate the construction of an edge scale. Similar constructions can be used to make other types of musical scales such as stellation scales.
Faculty sponsor: Matthew Nabity

9:15 to 9:30 a.m., MNB 104
Amanda Evola

Examining Ramsey Numbers

This paper explores the work of Frank P. Ramsey who founded Ramsey's Theorem and is centered on the fact that complete disorder is impossible. The goal is to dig into Ramsey's Theory by examining various Ramsey Numbers and bounds. Through this examination of Ramsey Numbers we will begin to see how we can reach structures arbitrarily large and be able to guarantee substructure through the proof of Ramsey's Theorem.
Faculty sponsor: Breeann Flesch

9:30 to 9:45 a.m., MNB 104
Anthony Dominquez

Separability and the Cantor Set

The Cantor Set is a famous set in point-set topology. There is a wide variety of types of Cantor Sets. However, we will only cover the ternary, or standard Cantor Set. In this talk, we will define and discuss what it means for a set to be separable and prove that the Cantor Set satisfies this definition.
Faculty sponsor: Matthew Nabity

9:45 to 10 a.m., MNB 104
Sally Peck

Algorithmic Variants of QR

One of the fundamental computations in numerical linear algebra is the QR factorization. A QR factorization decomposes a matrix into the product of an orthogonal matrix and an upper triangular matrix. The algorithms that compute these decompositions can often be costly, and at times, do not perform well for particular matrices. We investigate different methods of computing a QR factorization on a tall and skinny matrix, that is a matrix with more rows than columns. We discuss algorithmic variants and the move to a new family of algorithms based on tiles.
Faculty sponsor: Matthew Nabity

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10 to 10:15 a.m., MNB 104
Svetlana Dyachenko

Equations for Bacteria Growth

Bacteria growth is really important in our life. Some bacteria cells help us overcome different diseases, while others bring those diseases to us. We have learned to produce medicine with help of bacteria growth, like insulin, to help those who are ill. Modeling bacteria growth is an important part of understanding it. Consider a situation of bacteria doubling every half an hour starting with one cell, how much time will it take to fill all the oceans on Earth? Questions like this are answered by developing mathematical models of bacteria growth. We examine modeling bacteria growth using differential equations. Our focus is on model construction and building realistic models that match empirical data.
Faculty Sponsor: Matthew Nabity

BREAK

10:30 to 10:45 a.m., MNB 104
Tyler McAfee

Commuting Pairs in Finite Non-Abelian Groups

The study of the probability that two group elements commute dates back to 1968 with the work of Paul Erdos and Paul Turan. Since then, much has been deduced about these probabilities, including its bound of 5/8. During this talk, we will look at the associated probabilities of finite non-abelian groups and how to calculate such probabilities using several methods. When calculating specific probabilities, we will look at the conjugacy classes associated with these groups which will reveal the relationship that conjugacy has to commutativity. Next, we will explore the probabilities associated with Dihedral groups and how to calculate probabilities with specific denominators as well as specific numerators. We will also look at the group of GL(2,Zp) matrices and deducing the probability that two of these matrices commute. Finally, we will wrap up with looking into some further research on this topic including some of the bounds associated with Dihedral groups.
Faculty sponsor: Mike Ward

10:45 to 11 a.m., MNB 104
Kayla Vincent

Food Webs as Interval Competition Graphs

A food web is defined as an acyclic graph where vertices represent different species and there is a directed edge from species x to species y if species x preys on species y. Food webs are important in Biology because they model the flow of energy in an ecosystem. A competition graph has the same vertex set as a food web, but now two vertices are adjacent if they prey on a common species in the food web. Most of these competition graphs are interval graphs. Interval graphs are graphs where vertices can be represented as intervals of the real number line such that vertices are adjacent if and only if their intervals overlap. In this talk, we will explain these structures and their relationships with real examples from biology.
Faculty sponsor: Breeann Flesch

11 to 11:15 a.m., MNB 104
Brett Hegge

Manipulatives to Theory in Knot Theory

Knot Theory is the study of simple closed curves in three dimensions. Complicated structures can be analyzed using three basic moves and knots can be shown to be equivalent. We discuss ways of using physical manipulation to get middle school students interested in mathematics. We also, explore the basic mathematical postulates and theoretical foundation of Link/Knot Theory.
Faculty sponsor: Matthew Nabity

11:15 to 11:30 a.m., MNB 104
Robert Siewell

Zero-Sum Games

Gaming is a pastime for most of the population and is something that is very easy to relate to for students. It is a rich mathematical environment where students can explore and learn algebra and probability. Today we will examine several lessons set in the gaming environment of zero-sum games. We are going to look at the algebra and probability behind them as a way to show some of the real world applications of mathematics; as well as show where it can be used and integrated into a high school mathematics curriculum.
Faculty sponsor: Matthew Ciancetta

11:30 to 11:45 a.m., MNB 104
Kaylee Church

Spiraling Insects

The logarithmic spiral, also known as the growth spiral, is an interesting form in mathematics that happens to be very applicable to the natural world. We explore the structure of this curve, and how this spiral can be used to model the flight pattern of a moth. Specifically, we investigate assumptions used to construct a model for insect flight. Analysis of these underlying assumptions gives insight into possible improvements to the model and limitations of specific models.
Faculty sponsor: Mathew Nabity

11:45 a.m. to 12 p.m., MNB 104
Anny Sheie

Research Based Best Practices for Teaching Mathematics and Improving Math Attitudes

Mathematics education is at risk in this country. Not only are we falling behind in international math tests, but our citizens have negative math attitudes and are even math phobic. In this presentation, we investigate solutions to this problem through research and propose best teaching practices.
Faculty Sponsor: Breeann Flesch