Invited Talks: Abstracts and Biographical Information

Sir Randolph Bacon III, *Blown Away: What Knot to Do When Sailing*

Sir Randolph Bacon III is a British adventurer and bon vivant whose interest in mathematics comes from his cousin-in-law Colin Adams. Sir Randolph makes a living giving talks about his escapades under the auspices of the British Geographic Society, which happens to be unaware of this fact.

Abstract: Being a tale of adventure on the high seas involving great risk to the tale teller, and how an understanding of the mathematical theory of knots saved his bacon. No nautical or mathematical background assumed.

Laura Taalman, *Functioning in Calculus: Combining Algebra, Precalculus, and Calculus for underprepared college students*

Laura Taalman is an Associate Professor of Mathematics at James Madison University, with a Ph.D. in mathematics from Duke University and an undergraduate degree from the University of Chicago. Her research includes singular algebraic geometry, knot theory, and the mathematics of puzzles. She is the author of the textbook Integrated Calculus that combines calculus, pre-calculus, and algebra into one course, one of the organizers of SUMS undergraduate mathematics conference at JMU, and a recipient of the MAA Trevor Evans award and the 2005 MAA Alder Award, recognizing her as one of the most distinguished beginning college professors in North America.

Abstract: Many entering undergraduate students have already taken precalculus or even calculus but nonetheless find themselves lost when they take calculus at the college level. Somehow we are expected to teach delta-epsilon proofs and Riemann sums to students who can't factor, simplify fractions, or graph y=x^2 without a calculator! In this session we explore ways to integrate algebra and precalculus into calculus material to help underprepared students get up to speed to succeed in freshman calculus.

Robin Blankenship, *Conducting Undergraduate Research: Book Embeddings and Pebbling Numbers of Chessboard and Sudoku graphs, and Hextile Knot Mosaics of a Given Radius*

Dr. Blankenship is an associate professor of mathematics at Morehead State University. She received her M.A. in mathematics from the University of North Carolina with thesis in chaos theory, and her M.S. and Ph.D. in mathematics from Louisiana State University (LSU) with dissertation in topological graph theory. In 2002 and 2003, she received the LSU Alumni Association Teaching Assistant Award. In the fall of 2000, 2001, 2002, and 2003, she received the Alpha Lambda Delta Freshman Honor Society, Superior Instruction of Freshman Students Award. In the fall of 2000, 2001, and 2002, she received the LSU Department of Mathematics Certificate of Teaching Excellence. In the fall of 1999, she received the David Oxley Memorial Teaching Award.

Abstract: Advising undergraduate research is one of my greatest joys, beginning as a new faculty member under the encouragement of Project NExT in my home subject of graph theory, with students investigating book embeddings of sudoku graphs and chessboard graphs. Results from these projects will be discussed, along with strategies for getting started as an undergraduate research adviser. After hearing an inspiring talk, I began to supervise research on pebbling numbers of sudoku and chessboard graphs. Audience investigation of pebbling numbers will be facilitated and results on this project summarized, along with a brief discussion of the routines into which I've settled as an adviser. While undergraduate research in graph theory continues, discussion of my current project on hextile knot mosaics, inspired by the UnKnot Conference, will conclude this talk, with audience investigation of hextiles as an introduction and results from this project summarized, along with my hopes for advising in the future.

Panel Discussion: The Common Core State Standards in High School Mathematics

The panelists will give an overview of the Common Core Standards in high school mathematics and their impact on mathematics education in the commonwealth. They will engage the audience in a discussion of this important topic.

Panelists:
Sue Cain, Director of College Readiness and Developmental Education
Kentucky Council on Postsecondary Education
Robin Hill, Mathematics Consultant
Kentucky Department of Education
Chyleigh Rose, Division of Program Standards
Kentucky Department of Education
Steve Newman, Mathematics Professor
Northern Kentucky University

Abstracts of Contributed Talks

(u)=undergraduates, (g)= graduate, (f)= faculty member

Amir Ahmadi, Morehead State University (u)
Model Development for Lignocellulosic Biofuels
Second generation biofuels (biofuels from various types of biomass) hold a prominent role in current clean energy research. This presentation illustrates the economic and physical feasibility of bio-oil production from a fluidized bed reactor given a wood input's physical and cost characteristics.

Marian Anton, Centre College (f)
How to use topology to safeguard a forest?
To safeguard a forest against fire we enclose the area within a sensor fence and spread a great number of cheap sensors inside. Each sensor senses fire within its own vicinity and broadcasts signals to a central facility. How to guarantee that no spot evades detection? We give a topological answer from an elementary view point.

Joel Archer, Robert DiMartino, Alasdair Wooffitt, Asbury University (u)
Snowboard Halfpipe Shape Optimization
We endeavored to determine the shape of a snowboard course, known as a halfpipe, that would produce the most "vertical air" for a skilled snowboarder. After delineating some crucial assumptions, we demonstrated that vertical air is dependent on the effectiveness of pumping done by a talented snowboarder. Initially we considered the inverted cycloid as the best shape for achieving the maximum possible velocity by virtue of its brachistochronic shape. However, we encounter a substantial difficulty pertaining to pumping in a brachistochrone; as a result, we construct a variation of the brachistochrone to remedy this difficulty. Finally, we conclude by discussing other competitive requirements for snowboarding such as twisting.

Haddi Bayo, Kentucky State University (u)
You can't win with Nontransitive Dice!
Imagine you and I will play a game. You choose one of three not quite standard 6-sided dice, then I choose one of the remaining two. We each roll and the winner is the one whose die shows the higher number. This talk will explain how I can always have the greater likelihood of winning this game. Extensions of the original game will also be explained.

Howl Bean II, Murray State University (u)
Statistics in Baseball
This project proposes a new evaluative offensive statistic for baseball. The end goal is to help teams to better evaluate players so that they can sign a player to a contract that is truly reflective of the player's real talent level. With better evaluative tools, the hope is that less unreasonable contracts will be handed out to players who have no real hope of fulfilling the expectations that are heaped upon them by said contract.

Matias von Bell, Asbury University (u)
Repeaters Repeaters Repeaters
Because the number of amateur radio enthusiasts is relatively low in the United States, incidences of repeaters being overwhelmed by too many simultaneous communications are rare. If, however, there were 1,000 licensed ham radio operators within a circle with a 40-mile radius, interference would become a significant obstacle, even given ideal conditions—flat land, negligible weather interference, and symmetrical distribution of users, for instance. Although the number of repeaters required for such a scenario can vary largely based on the number of users per repeater and the distance users want to communicate across, we determined that 200 repeaters would be reasonable. We reached this conclusion by constructing an algorithm that approximated best possible distribution of repeaters across the area. We also consider how this number would change if the terrain was mountainous or the number of users was to increase to a total of 10,000.

Michael A. Blankenship and Drew Pearson, Morehead State University (u)
Counting Radius N Hextile Knot Mosaics
Hextile knot mosaics, inspired by the work of Lomonaco and Kauffman on square tile knot mosaics, are tessellations of hexagons containing zero to three strands that connect edge midpoints in various over and under crossing patterns to form knots and links. Each mosaic has a center tile and a radius that is the greatest distance from the center tile to any other tile in the mosaic. The focus of the presentation is on the development and implementation of a computer-based approach to determining the number of possible mosaics in any given radius.

Joshua Bradley, Morehead State University (u)
Ranking base stations in the 4G Mobile Network
In this presentation, we will discuss a base station ranking technique currently under development that will support the new generation of mobile networks that can be integrated into network management techniques to enhance the service provided to mobile users. In this technique, we apply combinatorial Hodge theory to fixed nodes in the mobile networks in order to obtain a global ranking of base stations. This technique will incorporate factors such as network traffic flow, cluster density, and link-structure based link prediction results. Hodge theory provides a way to obtain this global ranking from sparse graphs by decomposing pairwise rankings (represented as edge flows) into two orthogonal components, a gradient flow and a divergence free flow, which acts as a measure of confidence on the global ranking of the edge flow and relates information as to why a global ranking might be unobtainable.

Joshua Bradley and Brad Schneider, Morehead State University (u)
Design and Implementation of a BlackBerry Friend Tracking App
In this presentation, we present a BlackBerry friend tracking application that was developed as a project in a software engineering class. The design is based off of a GPS tracking system. This application allows mobile users to locate their friends on a map anywhere on the globe in real time via a graphical map display, which can also be modified to the users' preference. To preserve the privacy of each contact, our application also provides the option for a user to appear "visible" or "invisible" to his friends at any time. A software engineering cycle of design, development, and testing will be presented. Possible future developments include multiple status options and a "block list" to increase the privacy of each mobile user.

Elizabeth Carter, Anthony Rios, Kurtis Mann, Georgetown College (u)
Sick Jump: Maximizing Vertical Air to Optimize Tricks on a Half-pipe
In modeling a half-pipe for skilled snowboarders, maximizing the vertical air will, in turn, maximize air time, optimizing potential for various aerial tricks. The vertical air is greatest during the first jump, so this jump was the focal point. In order to simplify the model to calculate this height, the snowboarder's path was divided into six phases, each being solved as a precursor to the next. It soon became apparent that the velocity at which the snowboarder enters the jump directly affects the height of the jump. As such, in each phase, an energy approach was taken to solve for final velocity in the first five phases and height in the sixth phase. The entire model was simplified to a two dimensional model and each phase was represented with a right triangle to easily solve for the needed components.

Chris Christensen, Northern Kentucky University (f)
Lester Hill's Error-Detection Codes
The history of error-detecting codes is somewhat of a mystery. The history of error-correcting codes is much clearer and dates from the 1940s. Error-correcting codes are usually attributed to Richard Hamming (1948), although important early contributions were made by Marcel Golay. Lester S. Hill (1891 – 1961), who is best known for his construction of the Hill Cipher (1929), also considered coding theory and published three papers in the 1920s that deal with error-detection and are similar to the linear error-correcting codes that were developed in the late 1940s and early 1950s – although Hill seems to be unaware of error-correcting possibilities. We will explore Hill's papers on error-detecting codes. This is joint work with NKU undergraduate Jenna Torres and David Joyner of the US Naval Academy.

Mathew M. Cropper, Eastern Kentucky University (f)
Tiling a Narrow Rectangle
It is easy to see, and well known, that the number of ways one can tile a 2 x n rectangle with domino-shaped tiles corresponds to the Fibonacci number. This note considers the number of ways to tile this rectangle with combinations of 1 x 1, 1 x 2, 2 x 2 and 'L' shaped tiles. Some interesting sequences and formulas arise. Also considered are ways to tile an m x n rectangle for very small m with variously shaped tiles. This will lead to a sensible problem to consider which has received a bit of attention yet remains unresolved.

Ryan Curry, Centre College (u)
Cracking the K-13 Elliptic Curve Code
Elliptic curve cryptography has come to play an integral role in our lives, from protection of government secrets to secure online shopping. But under what conditions does that security break down? Our work has explored the patterns and potential vulnerabilities that render certain curves unfit for such use. Particularly, in this talk we will outline an algorithm designed to decrypt messages encoded using 13-bit Koblitz curve keys. We conclude with a reassuring look at the secure curves used in practice.

Daniel J. Curtin, Northern Kentucky University
Negative and Imaginary Numbers in 16th Century Italy
By the 1500s there was some awareness of negative numbers, though their reality was in question. In solving the cubic equation, Girolamo Cardano became aware not only of the possibility of negative solutions, but also of negative numbers appearing in formulas, even when the final answer was not complex (our term, not his.) His follower Rafael Bombelli clarified some of the ideas. The notions they proposed to explain these, and even the form in which they wrote them sheds light on their understanding of these new numbers.

Claus Ernst, Western Kentucky University (f)
Knots in viral capsids
Physical knot theory is a branch of mathematics that deals with knots and links that occur in nature. Here I give a short introduction to the mathematical problems that arise from molecular experiments that generate physical knots inside of viral capsids.

Keri Eustis, Kaity Bradley, George Lytle, Asbury University (u)
What Goes Up Must Come Down
Freestyle snowboarding involves using challenging courses, such as the halfpipe. How do professional snowboarders like Shaun White do it? We examine the standard shape of the Olympic halfpipe, modeling the change in vertical air based on variations in characteristics of the halfpipe.

Rebecca Gaul, Stephanie Lawrence, Zach Whelchel, Asbury University (u)
Turning over a new LEAF: A look at the economical and environmental impacts of electric cars
To determine the feasibility of electric vehicles (EVs), we begin with economic comparisons on both the personal and population levels. We continue our analysis with environmental evaluation. Our calculations show that environmental implications of widespread adoption would be staggeringly positive. We also analyze feasibility of widespread adoption.

Ashley Gibbs, Kentucky State University (u)
Line Design and Curve Stitching
Many math teachers use curve stitching to introduce children to the relationship between lines and parabolic curves. I will discuss this technique and how it is used. I will choose a curve stitching design, explain, and demonstrate its construction. I will also discuss other uses of curve stitching in art and industry.

Lee R. Gibson, University of Louisville (f)
Active Learning in Elementary Statistics with Numerical Entry Clickers
In this session we will discuss the author's experiences adapting small class activities to address student misconceptions and improve engagement in a large lecture elementary statistics course. Clickers (student response system) which allow students to provide a numerical answer to questions and which provide for easy display of the resulting data play a critical role. Some early indications of student impact will be presented.

Betsy Heines, Transylvania University (u)
Modeling Aeolian Sand Dune Morphology
This presentation illustrates the results of research conducted at an REU at Hope College, Summer 2010. This is the first phase of a long-term project dealing with the movement of sand grains and dunes. Modeling techniques using differential equations and probabilistic methods were used to develop a grain-fall model concerning the movement of sand grains as a consequence of saltation.

Kevin Highley, Biswajit Panja, Morehead State University (u)/(f)
Wireless Sensor Network Android Application
Use of wireless sensor technology has increased rapidly in recent years, with many varied applications. In the same timeframe the ubiquitous cell phone has evolved from a simple voice communication device; smart phone technology has enabled consumers to have mobile computing power that rivals the capabilities of desktop computers not in the too distant past. When one takes into consideration the widespread availability of internet connectivity that cell phone networks provide, juxtaposition of wireless sensor technology and cell phone technology is a natural progression. This presentation consist of designing and implementing a novel Android application (NodeDroid) that integrates without existing secure wireless sensor network and addresses the issues encountered in joining two disparate software systems.

Laura Hochstetler (presenter), Catherine Kaminski, Nathaniel Winckler, Asbury University (u)
Repeaters: You could say that again
The use of repeaters to extend limited signal range is a common radio communication problem. Our research addresses the problem of extending range with minimal repeater interference. We model a solution using 55 repeaters to provide approximately 1,000 low-power users a configuration which allows simultaneous communication with others within a circular flat area of 40 miles radius. A regular tessellation of hexagons is used to approximate the region, and nine pairs of frequencies on the VHF two-meter band are assigned among the repeaters in a pattern that prevents radio frequency interference. We extend our model to accommodate more users as well as mountainous terrain.

Jiwhan Hong, James Breckel and Eungchun Cho, Kentucky State University (u)
Convergence of oscillating sequence
The convergence of oscillating sequence or a1ternating series is slow compared to monotone convergence. We improve the convergence by averaging two sequences that envelope the original sequence, which can be repeated. Wallis' infinite product formula and Euler's formula for π are shown as examples.

Bruce Kessler, Western Kentucky University (f)
A "Peak" at the Algorithm Behind "Peaklet Analysis" Software
In response to a problem posed by faculty at the Applied Physics Institute at Western Kentucky University, the speaker has developed an algorithm for providing an automated analysis of spectrum data for the purpose of determining the elemental composition of the item generating the data. A full, non-provisional patent application has been filed on the idea, and a full marketing campaign has started to license software implementing the algorithm. This presentation will give a brief explanation of the mathematics in use in the algorithm, and will give some examples of the software in action.

Nitija Kharel, Northern Kentucky University (u)
Pearson's Chi Square Goodness-of-Fit Test for Binomial Distribution
Power of the Pearson's chi square test for testing the goodness-of-fit for binomial distribution is studied. It is observed that the test preserves the nominal power very poorly. Thus, the exact distribution of the Pearson chi-square statistic using a parametric bootstrap approach is studied and critical values for the test are provided. Further, the power of the test is studied for several alternatives using the proposed critical values.

Joshua W. Lambert, Murray State University (f)
Better Estimating Biodiversity using Zero-Inflated Distributions
In this presentation a better estimate for biodiversity using zero-inflated distributions based on the framework by Royle (2005) and Wenger and Freeman (2008) will be discussed. An improvement on Wenger and Freeman's model by estimating presence and detection by Bayesian logistic regression and modeling abundance with zero-inflated negative binomial regression, and the use of Gelman (2008) work with prior distributions for Bayesian logistic regression in order to achieve better estimates for presence and detection than via maximum likelihood.

Julie Lang, Morehead State University, (u)
A Mathematics College Readiness Project
The presenter will discuss results from a project aiming at preparing high school seniors for college level mathematics. The project used the Hawkes Learning System to increase the interest and active participation of high school students during a three year project.

Duk Lee, Asbury University (f)
Tears in Mathematics
This talk is a mathematical and musical analysis of the song "Tears in Heaven" by Eric Clapton. Musicians of the past were much more involved with mathematics than of present days. Maybe it is a time to change a paradigm a little: It is an attempt of a mathematician, trying to touch on mathematics in pop music.

Andy Martin, Kentucky State University (f)
Odd items from the complex history of the real number(s) i^i
In this talk I will share some of the events which led to a clear understanding of what such a thing as "*i to the power i* " could be. As an added treat, this talk will have a mascot.

Andy Martin, Kentucky State University (f)
Well what exactly IS the Riemann hypothesis?
Now that Grigory Perlman was officially awarded the first of the $1 million Clay Institute awards for his resolution of the Poincaré Conjecture, only six of the original seven Millennium Prizes remain. Students taking aim at a great unsolved problem, whose solution could make them rich and famous, can do no better than to attack the Riemann Hypothesis. This talk will explain what that problem is.

Lauren May, Morehead State University (u)
A Surreal Analysis of the Card Game Rook
The surreal numbers and pseudo-numbers developed by Conway are useful in their application to game theory. This presentation applies such game theory to the analysis of a two-person, perfect information version of the card game *Rook*.

Rus May, Morehead State University (f)
A Count of Knot Mosaics
Linear equations range from childishly simple to insidiously complex. Such is the case with recurrence relations governing counts of knot mosaics. In this talk you'll find out what knot mosaics are, how to count them recursively, and whether there is an explicit solution for this recursion.

Steven McQuade, Northern Kentucky University (u)
March Madness: Probabilities and NCAA Basketball Pools
The NCAA College Basketball Tournament has intrigued mathematicians and statisticians over these past years, especially when the tournament changed to 64 teams in the mid 1980s. Using historical data and simulations in R, a variation on the traditional NCAA basketball pool is studied along with various probability models for individual tournament games.

Steven McQuade, Anthony Bankemper, Matthew Kahmann, Northern Kentucky Univ. (u)
Angles and Momentum: The Mathematics of Snowboarding: Our Approach to Solving Problem A of the Mathematical Contest in Modeling
We determine the vertical distance achieved by a skilled snowboarder given the dimensions of a half-pipe. We suggest a functional form for the shape of a half-pipe and determine how the parameters (such as angle of inclination, radius of the half-pipe and horizontal length of the half-pipe) affect the speed of the athlete when descending the course. We find that the design of the course directly affects the acceleration and velocity of the snowboarder, which can then be used to determine the maximum height reached by the rider.

Khant Minn, Julia Smith, and Stephen Wechman, Georgetown College (u)
The Ideal Snowboarding Halfpipe
We attempted to determine the dimensions of an ideal half pipe to maximize the vertical air of a snowboarder.

Bryce Norris, Murray State University (u)
Montezuma's Revenge: Learn Math to Save a Life.
Despite ranking sixth in leading causes of death around the world, diarrheal disease goes largely unaddressed by modernized (generally high-income) nations. Cholera is just such a disease. It draws blank stares, yet, has caused significant loss of life in nations across the globe. This research follows a body of work dedicated to investigating the treatment and control of cholera. The exciting aspect of this work is the qualitative implications on outbreaks as recent as those following the earthquake in Haiti.

Ted Porter, Murray State University (f)
The Frequent Hypercyclicity of the Laplacian Operator
A linear operator is said to be hypercyclic if there exists a vector $x \in X$ such that the orbit $\{T^n x; n \geq 0\}$ of x is dense in X. J. Bes, K.C. Chan, and S. Seubert have shown the Laplacian operator $\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}$ is a hypercyclic operator on $L^2(\Omega)$ for bounded open sets $\Omega \subseteq \mathbb{R}$. Later, F. Bayart and S. Grivaux introduced the notion of frequently hypercyclic operators and provided a criterion for showing when an operator is frequently hypercyclic. In this presentation we will use the Bayart and Grivaux's criterion to show the Laplacian operator is frequently hypercyclic on $L^2(\Omega)$.

Robert C. Powers, University of Louisville (f)
The Euler line, orthologic triangles, and homogeneous coordinates
Mitrea and Mitrea (1994) gave a generalization of the Euler line by proving that if two triangles are orthologic and perspective from a point, then the orthology centers and the perspective center lie on a line. We show how this result can be proved using homogeneous coordinates and Maple.

Tom Richmond, Western Kentucky University (f)
Connectedness
We will present some old applications of connectedness, including some applications of the Intermediate Value Theorem. Some of the applications are well-known and others are not as well-known as they should be. For example, given any rectifiable closed curve in 3-dimensional space, there exists a plane which passes through 4 points on the curve which divides the curve into 4 segments of equal length.

Bob Riehemann, Thomas More College (f)
Game Theory as a General Education Course
We have converted our general education course in linear programming to game theory, using Straffin's MAA text, Game Theory and Strategy. This presentation will discuss the attendant issues that accompanied the conversion, including student reactions and the ability to incorporate problems from other academic disciplines.

Kristine Roinestad, Georgetown College (f)
Geometry of Fractal Squares
This talk will examine analogues of Cantor Sets, called fractal squares, and some of the geometric ways in which they trigger issues not raised by Cantor Sets. Also discussed will be the technique using directed graphs to prove bilipschitz equivalence of two fractal squares.

William Rowe, Adam Ward, and Aaron Hill, Asbury University (u)
Snowboarders Getting High . . . Legally
Snowboarders are always looking for the next crowd-shocking trick or jaw-dropping "big air." Half-pipe architects want to give riders the freedom and ability to express themselves through awesome tricks, and ever-higher vertical air. We have successfully modeled a wide range of half-pipe designs in an effort to maximize vertical air given an initial velocity. In addition to the physical design, we have created a user-friendly mathematical model where inputs about the design of the half-pipe and the velocity of the rider determine his vertical air on each jump.

Stefan Schnake, Murray State University (u)
Frequent Hyperclicity of Differential Operators
F. Bayart and S. Grivaux introduced the notion of frequently hypercyclic operators and provided a criterion for showing when a linear operator is frequently hypercyclic. They also showed the dierential operator D(y) = y' is frequently hypercylic on C[0,1]. In this presentation we will show the attempts we have made to prove the linear operator D(y)=y"+y' is frequently hypercyclic on C[0,1].

Timothy Schroeder, Murray State University (f)
Fun with the Euler Characteristic
The Euler characteristic is a simple calculation that has, perhaps surprisingly, many applications and far reaching consequences. We look at its implications in geometry as well as its use in more applied contexts. Students are particularly welcome to attend.

Christine Shannon, Centre College (f)
An Interesting Probability Question Arising in a Psychology Experiment
In writing a program to meet the constraints of a psychology experiment for detecting attention deficit, my student and I encountered a very nice application of geometric series and elementary probability. Computer simulations supported and reinforced the theoretical calculations.

Jessica Smith & Zach Wagner, Morehead State University (u)
Hextile Knot Mosaics of (p,p+1)-Torus Knots
Upper bounds are obtained on the minimum size of hextile knot mosaic needed to embed (p,q)-torus knots, where $|p-q| = 1$ and $p \geq 2$ and $q \geq 2$, with respect to the number of hextiles, the radius of hextile knot mosaic, and the grid size. The torus knots of the various hextile knot mosaic embeddings that achieved upper bounds are then converted to stick hextile knot mosaics in order to obtain an upper bound on hex-stick index. The embedded torus knots with the least number of hextiles yielded hex-stick knot mosaic embeddings that obtained a hex-stick number in terms of the square of the bridge index.

Ryan Stuffelbeam, Transylvania University (f)
Mixing Fiction and Mathematics: Integrating Creative Writing into a Mathematics Course
This presentation details ongoing attempts to develop mathematically-based creative writing assignments throughout the mathematics curriculum. This discussion will center on two different approaches: student-produced newspaper articles in a precalculus course and student-written resolutions to mathematical mysteries (in the vein of the *Encyclopedia Brown* series).

André Thomas, Kentucky State University (u)
Astro-conics: Proving the Law of the Heavens.
I will show how Newton's laws implies Kepler's second law.

Evan Trevathan, Murray State University (g)
l^2 –Homology and the Utility Problem
Given a Coxeter system (W,S), we may construct the Davis complex $\sum_{L,}$ whrere L is the nerve of the Coxeter System. If L is triangulation of a 2-sphere and our Coxeter group is right-angles, we have useful results in l^2 homology for solving a "so-called" Utility Problem: Suppose there are 3 houses and 3 available utilities. Can the connection of these 3 utilities to these 3 houses be represented as a planar graph? We prove the classical fact that the graph of 3-points joined with 3-points, $P_3 * P_3$ is not planar.

Steven Wilkinson, Northern Kentucky University (f)
Cylindrical Helices
A cylindrical helix is a space curve whose torsion function is a constant multiple of its curvature function. Such curves are generalizations of the familiar circular helices. A qualitative characterization about the shape of these curves in terms of another curve constructed from the original space curve will be presented.

Kara Wiltrout, BJ Pugh, Joe Thacker, Asbury University (u)
Long Distance Relationships
A network of repeaters allows groups of people to communicate over large distances by radio. The difficulty in this system is in the number of repeaters required and optimal repeater placement. We have analyzed two scenarios: basing a system off of the number of conversations needing to take place simultaneously and a system that minimizes the number of repeaters to cover a given area.

Bangteng Xu, Eastern Kentucky University (f)
Some structure theory of table algebras
In this talk we will present some basic structure theorems of table algebras. In particular, the isomorphism theorems and the Krull-Schmidt type theorems will be discussed.

Margaret Yoder, Eastern Kentucky University (f)
Noticing Numeracy Now
The Pre-Service Teacher Preparation group, organized by the KCM, has designed a module to increase the noticing skills of pre-service teachers. This is being embedded in content or methods classes across the state. The presentation describes the module and the purpose behind the module.

Xiaomei Zhan, Northern Kentucky University (u)
***A simulation study of Type I Error Rates for Statistical Tests Comparing Three Independent Samples of Quantitative Data*.**
When comparing three independent samples of quantitative data, there are two tests that can be performed – the one-way ANOVA or the Kruskal-Wallis test. However, these two tests require certain assumptions to be met in order for the inference to be valid. The first goal of this study was to determine how violating assumptions for these tests affected the Type I error rates. Preliminary results were poor, so the null distribution for the ANOVA and Kruskal-Wallis statistics were constructed to help explain the large error rates. The purpose of this talk is to present my primary simulation study results on the Type I error rates for these two tests under various conditions which violated the assumptions and to discuss why these error rates were so large at times.