Kappa Mu Epsilon
National Mathematics Honor Society

KME 47th BIENNIAL NATIONAL CONVENTION
March 20 - 22, 2025

Hosted by Missouri Eta Chapter at Truman State University in Kirksville, MO

Participating Chapters

Alabama Theta, Jacksonville State University
Kansas Alpha, Pittsburg State University
Kansas Beta, Emporia State University
Kansas Delta, Washburn University
Maryland Delta, Frostburg State University
Missouri Beta, University of Central Missouri
Missouri Epsilon, Central Methodist University
Missouri Eta, Truman State University
Missouri Theta, Evangel University
North Carolina Zeta, Catawba College
Texas Kappa, Univ of Mary Hardin-Baylor
West Virginia Alpha, Bethany College

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Scott Thuong, Kansas Alpha, President-Elect
Mark Hughes, Maryland Delta, Historian
David Dempsey, Alabama Theta, Secretary
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Cynthia Huffman, Kansas Alpha
Seth Loudermilk, Kansas Alpha
Diane Twigger, Missouri Theta
Abby Harrison, Missouri Theta
Herman Ogden, Missouri Theta

AGENDA

Thursday, March 20, 2025

7:00 – 9:00 PM	Registration, Reception, and Mixer in Violette Hall Commons
8:00 – 9:00 PM	National Council Meeting in Violette Hall 2151

Friday, March 21, 2025

9:00 AM – 10:00 AM	Registration and Coffee in Violette Hall 1000
9:30 AM	Awards committee meeting in Violette Hall 1436
10:00 AM – 10:30 AM	First General Session in Violette Hall 1000 • Welcome and introductions, Don Tosh, President • Roll call, David Dempsey, Secretary • Filling of delegates, Scott Thuong, President-Elect
10:30 AM	Student Presentations in Violette Hall 1000 • ***The Stern-Brocot Tree and Pythagorean Primes*****,** Jordan Hinton, Susanna Landis, Lucas Saone, Alabama Theta, Jacksonville State University • ***Mathematical Breakthroughs Driven by Major Geopolitical Conflicts in the Twentieth Century***, Seth Loudermilk, Kansas Alpha, Pittsburg State University • ***Twisted Toe Tac Tic,*** Tori Risner, Missouri Theta, Evangel University
12:00 PM	Group Photo in Violette Hall Stairs
12:15 PM	Lunch in Student Union Activities Room Meetings of the National Committees • Resolutions Committee in Violette Hall 2151 • Auditing Committee in Violette Hall 2251 • Awards Committee in Violette Hall 1232
1:45 PM	Section Meetings • Student section in Violette Hall 1000 • Faculty section in Violette Hall 1232
2:30 PM	Faculty Workshops in Violette Hall 1232 • ***Using Origami to Learn Mathematics***, Brian Hollenbeck, Kansas Beta, Emporia State University • ***Knotty Numbers,*** Cynthia Huffman, Kansas Alpha, Pittsburg State University • ***Borromean Rings and Polytopes from Pipe Cleaners***, Stephen Lacina, Truman State University
4:00 PM	**Break**

7:00 PM	Banquet • Welcome, Scott Thuong, President-Elect • Dinner • Presentation of Mach and McKee Tosh Awards, Don Tosh, President • Keynote Address, ***Juggling Counts,*** Steve Butler, Iowa State University

Saturday, March 22, 2025

8:30 AM – 9:00 AM	Coffee in Violette Hall 1000
9:00 AM	Mathematics Trivia

10:00 AM	Second General Session in Violette Hall 1000
	• Reports of national officers
	  ○ Doug Brown, Editor, *The Pentagon*
	  ○ John Snow, Webmaster
	  ○ Mark Hughes, Historian
	  ○ Rajarshi Dey, Treasurer
	  ○ David Dempsey, Secretary
	  ○ Scott Thuong, President-Elect
	  ○ Don Tosh, President
	• Reports of sectional meetings
	• Report of Resolutions Committee
	• Report of Auditing Committee
	• Election of Officers
	• Installation of Officers
	• Report of the Awards Committee and presentation of awards
	• Payment of travel vouchers

11:00 AM	Box lunch

KEYNOTE ADDRESS

Juggling Counts

Professor Steve Butler

Iowa State University

Mathematics is a language which can help us describe and explore patterns. One source of patterns that mathematicians have been exploring comes from juggling (the tossing of objects, usually balls or clubs). In this talk we will look at multiple ways to describe juggling patterns that allow us to find new juggling patterns, and to count how many possible patterns exist. We can compare answers to various problems to give a combinatorial proof of Worpitzky's identity. We will also look at a few juggling-based problems that mathematics has not yet succeeded in answering.

PAPER ABSTRACTS

Arranged alphabetically by author

• The Stern-Brocot Tree and Pythagorean Primes

Jordan Hinton, Susanna Landis, Lucas Saone, Alabama Theta, Jacksonville State University

A prime number p is called a *Pythagorean prime* if p is congruent to 1 modulo 4. A well-known theorem due to Fermat states that every Pythagorean prime can be uniquely expressed as the sum of two squares. In this study, we will utilize the continued fraction and the Stern-Brocot tree to establish an algorithm to determine the two integers, a and b, for any given Pythagorean prime p such that $p = a^2 + b^2$. Use of 2×2 matrices in the special linear group $\mathrm{SL}_2(\mathbb{Z}) = \left\{ \begin{bmatrix} a & b \\ c & d \end{bmatrix} \mid a, b, c, d \in \mathbb{Z}, ad - bc = 1 \right\}$ is essential. Each rational number in the Stern-Brocot tree will be identified as a matrix in $\mathrm{SL}_2(\mathbb{Z})$ in terms of two matrices $L = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ and $R = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$.

• Mathematical Breakthroughs Driven by Major Geopolitical Conflicts in the Twentieth Century

Seth Loudermilk, Kansas Alpha, Pittsburg State University

Significant mathematical breakthroughs have been recorded during times of war. Due to their historical and geopolitical relevance, a sample from World War I, World War II, and the Cold War is explored to highlight their contributions to the field of mathematics. This is achieved through investigating published work originating from each conflict while utilizing secondary supplementary sources to understand why and how each breakthrough is significant. The twentieth century is chosen due to its recency and modern applications used significantly in society. The research highlights key trends of innovation during and surrounding the time of war. World War I led to aeronautical development impacting all of aviation, World War II spurred the development of encryption and decryption to ensure secure data transmission, and the Cold War fostered fast data analysis, condensing vast amounts of information. Therefore, the twentieth-century wartime contributions significantly accelerated the field of mathematics.

• Twisted Toe Tac Tic

Tori Risner, Missouri Theta, Evangel University

We will introduce a new version to tic tac toe with two key changes: (1) players can play either an X or an O at any turn and (2) a player loses by connecting 3 of a kind in a row (either X or O). We will then discuss strategies of the game for both players and prove a strategy for each player.

FACULTY WORKSHOPS

Arranged alphabetically by author

- ## Using Origami to Learn Mathematics

Brian Hollenbeck, Kansas Beta, Emporia State University

We will explore some basic connections between origami and mathematics. See how mathematics can be artistic, and how art can be mathematical. No experience in paper-folding needed!

- ## Knotty Numbers

Cynthia Huffman, Kansas Alpha, Pittsburg State University

Although relatively short-lived, the Incan Empire was the largest pre-Columbian empire in the Americas. Through pictures taken by the speaker on a recent study trip to Peru, we'll very briefly overview the history of the Incan Empire before delving into more details of their unique writing/accounting system of knotted cords called quipus or khipus. Participants will get to create their own quipus. If time allows, we'll do some arithmetic as the Inca may have, using corn kernels.

- ## Borromean Rings and Polytopes from Pipe Cleaners

Stephen Lacina, Missouri Eta, Truman State University

We will construct Borromean rings from pipe cleaners. This will begin with the question of whether or not it is possible to connect three rings together in such a way that no two of them are connected to each other. We will then construct Borromean flowers (a bouquet of Borromean rings) and combine Borromean flowers to produce a truncated octahedron (a permutahedron). Time permitting we will discuss some basic questions of graph theory by trying to construct the graphs of a tetrahedron and a cube from a single pipe cleaner without doubling any edges. This workshop will be entirely hands-on and will involve students trying to answer questions and figure out constructions with guidance.