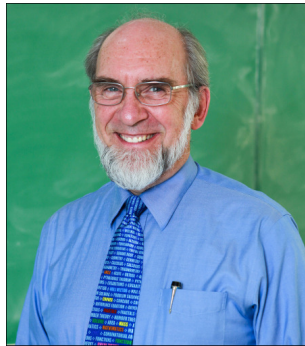




Conference to Honor  
Tom Thompson  
and Ken Wiggins



On the campus of Walla Walla University

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MAY 17, 2013

# Welcome

Welcome to the Mathematics conference held in honor of Tom Thompson and Ken Wiggins. We are pleased that you have chosen to join us for this special event. The conference highlights the work of alumni and friends of the WWU Mathematics department who are on the cutting edge in their diverse fields. Each of the presenters has a special connection with one or both of our honorees.

Thomas M. Thompson started teaching at Walla Walla University (then Walla Walla College) in 1972. During his career in the Mathematics department at WWU, he has inspired and changed generation after generation of mathematics students. Tom has received numerous teaching awards, including the Pacific Northwest Mathematics Association of America 2012 Award for Distinguished College or University Teaching of Mathematics. Tom will retire at the end of December after more than 40 years of service.

Kenneth L. Wiggins joined the WWC Mathematics department in 1980. After more than a decade of excellence in the classroom, Ken became chair of the department in 1992, a position in which he has since served. Ken has been widely recognized for his outstanding leadership skills. After more than twenty years as chair, Ken will go back to full time teaching starting in the 2013-2014 school year.

We would like to extend our gratitude to the administration of Walla Walla University for their generous assistance and support in helping make this conference a reality. We would also like to especially thank all of you who have sponsored or will sponsor this conference and its associated scholarship.

Jonathan Duncan  
Conference Organizing Committee

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# General Information

## **Check-In**

All registered attendees are asked to check in at the registration desk in the Fine Arts Center lobby.

## **Conference Badges**

Your conference badge displays your name and any institutional affiliation. Additionally, the QR code in the top-right corner contains your contact information, including the phone number and email address you provided upon registration. Use your smart phone or tablet to scan these codes and save contact information.

## **Lunch and Dinner**

Lunch is included with your registration. Your conference badge is your lunch ticket, so please keep it with you at all times. Tickets for the banquet dinner may be purchased for \$20 each at the registration desk.

## **Use of Cell Phones**

The use of cell phones is prohibited in the auditorium. We request that all cell phones be turned off or placed on vibrate during the presentations.

## **Presentations**

Presentations start promptly every thirty minutes and consist of a twenty minute talk followed by a five minute question and answer period. Out of respect for the presenters and other attendees, please refrain from entering or exiting the auditorium during a presentation. There will be a five minute break between presentations.

## **Banquet**

The banquet will be held at the Walla Walla Country Club:

1390 Country Club Rd.  
Walla Walla, WA US 99362

# Agenda

## Friday Morning, 17 May 2013

- |                     |   |
|---------------------|---|
| 8:00 AM - 9:00 AM   | <b>Conference Registration</b>  |
| 9:00 AM - 9:30 AM   | <b>Carlton Cross</b><br>Opening Remarks   |
| 9:30 AM - 10:00 AM  | <b>Andrea Hawkins-Daarud</b><br>Combining Mathematics and Biology to Create a New Weapon in the Fight Against Brain Cancer              |
| 10:00 AM - 10:30 AM | <b>John Foster</b><br>Actions of the Quantum Double   |
| 10:30 AM - 11:00 AM | <b>Shandelle Henson</b><br>Coadaptive Dynamics of Cannibalism and Ovulation Synchrony: a Discrete-Time Mathematical Model               |
| 11:00 AM - 11:30 AM | <b>Laura Foster</b><br>From Equations to Pictures: an Explanation of Magnetic Resonance Imaging and other Mathematical Gems in Medicine |
| 11:30 AM - 12:00 PM | <b>Jason Damazo</b><br>Flames, Shocks, and Detonations: Understanding Explosions in Tubes   |
| 12:00 PM - 1:00 PM  | <b>Lunch</b><br>FAC Lobby   |

## Friday Afternoon, 17 May 2013

- |                   |   |
|-------------------|---|
| 1:00 PM - 1:30 PM | <b>Jon Vanderwerff</b><br>Nearest Points and the Chebyshev Set Problem                    |
| 1:30 PM - 2:00 PM | <b>Don Schafer</b><br>What I Really Learned in Class                                      |
| 2:00 PM - 2:30 PM | <b>Kevin Vixie</b><br>Geometry from Derivatives: from Edges in Images to Volumes of Tubes |
| 2:30 PM - 3:00 PM | <b>James Klein</b><br>Tom & Ken's Last Theorem  |
| 3:00 PM - 3:30 PM | <b>Rob Frohne</b><br>Analog or Digital: Comparing Signal Processing in Radio Receivers    |
| 3:30 PM - 4:00 PM | <b>Sharif Ibrahim</b><br>Shape from Non-asymptotic Densities                              |
| 4:00 PM - 4:30 PM | <b>Jonathan Duncan</b><br>Your Thompson/Wiggins Number                                    |
| 4:30 PM - 5:00 PM | <b>Recognition Ceremony</b>   |

## Friday Evening, 18 May 2013

- |                   |   |
|-------------------|---|
| 6:00 PM - 8:00 PM | <b>Banquet Dinner</b><br>Walla Walla Country Club |
|-------------------|---|

## Sabbath, 18 May 2013

- |                     |  |
|---------------------|--|
| 10:30 AM - 11:30 AM | <b>Sabbath School</b>                                      |
| 11:45 AM - 1:00 PM  | <b>Church Service</b>                                      |
| 1:30 PM - 3:00 PM   | <b>Haystack Lunch</b><br>University Church Fellowship Hall |

# Speakers and Abstracts

## Welcome and Opening Remarks

### Carlton Cross

Carlton Cross graduated from Walla Walla College in 1966 with a Bachelor of Science in Engineering, Electrical Engineering Concentration, and completed a Ph D in Electrical Engineering at Oregon State University in 1972. After working at Bell Laboratories in New Jersey and Illinois, Cross began teaching electrical engineering at WWC in 1981 and retired in 2009, but continues with contract assignments for classes and laboratories as needed. His teaching has focused on circuit analysis, electronics and feedback systems.



*Because many engineering students feel little affection for mathematics unless they see how it solves a practical problem, Cross claims that Tom and Ken owe him a debt of gratitude for his nearly thirty years of motivating students to value the insights offered by linear algebra, particularly when applied to the solution of systems of differential equations. While Cross feels that his feeble credentials in mathematics do not qualify him for presenting the opening remarks, perhaps his motivation of students has amounted to something after all.*

## Combining Mathematics and Biology to Create a New Weapon in the Fight Against Brain Cancer

### Andrea Hawkins-Daarud

Glioblastoma is the most aggressive form of primary brain tumors and monitoring them over time and through treatment remains difficult due to the obscuring lens of clinical imaging. Here we consider a continuum model of glioblastoma growth and its associated edema, or swelling, to help in interpreting imaging changes after treatment affecting the tumor's vasculature. We also discuss possible implications for selection of this therapy for individual patients.



*Andrea Hawkins-Daarud has two fields of love: biology and mathematics. She is currently trying to utilize computer code to generate answers to complex biological problems with mathematical descriptions. Andrea received her Ph.D. from The University of Texas at Austin in Computa-*

tional Sciences, Engineering, and Mathematics in 2011 and is now in the process of completing postdoc with Dr. Kristin Swanson at Northwestern University in Chicago IL. Her current work focuses on mathematical modeling on the tissue level of brain cancer, but she also has interest in Bayesian statistics and incorporating uncertainty into her model predictions.

## Actions of the Quantum Double

John Foster



In linear algebra we learn how to write any linear transformation of a finite-dimensional vector space as a matrix. The basic idea of Representation Theory is to study mathematical structures by describing all the ways in which they can be written as collections of matrices. These are called representations. In this talk I will give an overview of the methods I have used recently to find representations of the Hopf algebra and verify their properties.

*After graduating from Walla Walla College in 2007, John enrolled in the graduate mathematics program at the University of Oregon. After bicycling several miles to and from school each day of his first year there, he decided that in the event of snow or heavy rain, taking the bus might be a more comfortable option. He is busily preparing his thesis defense for the end of May.*

## Coadaptive Dynamics of Cannibalism and Ovulation Synchrony: a Discrete-Time Mathematical Model

Shandelle Henson



Cannibalism and ovulation synchrony are common across many taxa. We consider discrete-time models to show that (1) cannibalism of juveniles by adults can be adaptive by redirecting reproductive effort from times of low resource to times of high resource, and (2) the immediate negative effects of cannibalism can be ameliorated through the synchronization of individuals' ovulation cycles within a dense population.

*Shandelle Henson is professor and chair of mathematics and STEM division chair at Andrews University. As a dynamicist, she studies how*



*things change over time. She notes, however, that in this system some things haven't changed over time, namely the friendship and mentorship that Ken and Tom have given consistently since she was a young mathematician first out of graduate school, and the respect and warm regards she has for them. As an "honorary" student of Ken and Tom, she is excited and honored to participate in this conference.*

## **From Equations to Pictures: an Explanation of Magnetic Resonance Imaging and other Mathematical Gems in Medicine**

**Laura Foster**

The purpose of this presentation is to outline the process of obtaining magnetic resonance imaging used in clinical brain imaging. We will discuss the differences among T1-weighted, T2-weighted, FLAIR, and diffusion-weighted imaging, as well as some clinical applications. Anecdotes about being a mathematician in the medical world will also be presented.



*Laura Foster is the genetic product of two Walla Walla math majors. In elementary school, she quickly learned to do her math homework by herself because her parents would "help" by saying, "This would be really easy to solve with the quadratic equation. Do you know what that is?" She eventually followed her parents' example by graduating from the math department in 2008. She has since completed medical school at Loma Linda University and is currently in a neurology residency at the University of Minnesota.*

*For pleasure, she attends symphony concerts and runs outside. She completed her first marathon in May of 2012, and the latest challenge to dress properly for runs in temperatures between 0 and 30 degrees Fahrenheit.*

## **Flames, Shocks, and Detonations: Understanding Explosions in Tubes**

**Jason Damazo**

Sometimes explosions happen. When they do, surrounding things can break—important things like nuclear processing facilities. To prevent disaster, we need to understand just how badly explosions can dam-

age structures. To this end we'll use laboratory experiments to explore supersonic gaseous combustion waves called detonations, and will investigate how explosions effect destruction so that said destruction can be prevented. Nanosecond-speed schlieren photos will be presented to show how detonations actually behave.



*Jason Damazo always liked math, but it was the kindness and openness of the Walla Walla mathematics department that convinced him to be a math major (in addition to mechanical engineering). After leaving Walla Walla, Jason accepted Guggenheim and NDSEG fellowships to study combustion at the California Institute of Technology in Pasadena. Jason convinced Caltech to let him play with lasers, flammable gases, and half-million dollar cameras all in the same room. To prevent any further damage, Caltech will be awarding him a PhD in Aeronautics in May—at least assuming his thesis defense is successful. Afterwards, he'll be returning to Washington as a Shock Physicist for Boeing.*

*When he's not studying or blowing things up, he likes to run, cook, and play board games; but not usually at the same time.*

## Nearest Points and the Chebyshev Set Problem

Jon Vanderwerff



The question as to whether a Chebyshev set in a Hilbert space must be convex has been described by some authors as perhaps the most important problem in abstract approximation theory. This talk will attempt to explain the Chebyshev problem and use it to illustrate that unanswered questions in abstract mathematics are not just esoteric puzzles that fascinate specialists, but that they can be geometrically intuitive and related to relevant topics—and this particular problem just might even involve mathematical concepts connected to research interests of Tom Thompson and Ken Wiggins.

*Jon completed a mathematics degree from Walla Walla College in 1985 and in doing so he was fortunate to have taken classes from some of the best mathematics professors anywhere! In his doctoral program he studied the geometry of Banach spaces, although that topic has very little to do with what most people would consider geometry or space.*

*Currently, Jon is a professor of mathematics at La Sierra University*

*and has found that a career teaching mathematics is not only fun and rewarding, but along the way he has met fascinating people and visited interesting places that he otherwise would not have imagined doing.*

## What I Really Learned in Class

**Don Schafer**

It has been some 30 years since I sat in advanced and abstract mathematics classes with Tom Thompson and Ken Wiggins. Calculus, Advanced Calculus, and Modern Algebra were awesome classes, but the course my career has taken has given me few opportunities to use and apply the specific theorems and ideas explored in these classes. However, the life lessons learned have an abiding and continuing day-to-day influence in my life.



*After graduating from WWC in 1984 with a BS in Math, Don studied languages and linguistics at University of Washington receiving an MA in Linguistics in 1990. Don has taught math and languages at Walla Walla Valley Academy for a long time.*

*He lives in College Place with his wife Sharon Hintz and three children Hannah, Samuel, and Lillyanne with whom he likes to play and read books. In his free time he hikes, identifies wild flowers, and enjoys meeting people from other cultures.*

## Geometry from Derivatives: from Edges in Images to Volumes of Tubes

**Kevin R. Vixie**

I will explain how to use derivatives to extract geometric information from shapes and images. I will start by generalizing the usual derivative so that it works on discontinuous functions (thereby helping us find geometry in images and discover Radon measures) and then move on to derivatives of volumes of shapes (thereby enabling us to find volumes of tubular neighborhoods and discover curvature measures).



The challenge will be doing this in a little bit of time using a little bit of calculus. Exploiting the famous 1 picture = 1000 words formula, we will arrive at our destination just in the nick of time.

*Kevin was born in Hinsdale, Illinois, awhile ago. After that he moved around a bit. Then he attended Walla Walla College. There he studied*

*a bit. Then he moved a bit more, moving through various universities and labs until he found that he once again he was only a bit of a distance from Walla Walla (at WSU).*

*Now he studies things, writes things, teaches things, and makes things in his shop, supported by significant time with his wife Beata, son Levi, dog Obi and cat Charlie ... and with a bit of help from his friends.*

## Tom & Ken's Last Theorem

### James Klein



Tetrated integers grow fast enough to result in fewer solutions to Diophantine equations that involve tetration. Because of this, it appears that proofs of negative results in this area may be quite elementary and easier than proofs of Diophantine equations involving exponents. For example: Tom & Ken's Last Theorem:  $x \uparrow\uparrow n + y \uparrow\uparrow n \neq z \uparrow\uparrow n$  for  $x, y, z \in \mathbb{Z}^{\geq 1}, n \geq 2$ .

*James Klein is a computer scientist and fellow traveler with Tom and Ken, fighting for "Truth, Analysis, and the Mathematical Way." Jimmy first knew about Tommy in 1959 when Tommy was in the 8th grade. It was an awkward and embarrassing encounter at the Thompson's for Jimmy who was only in the 6th grade. Jim first heard about Ken in 1966 from, at that time, Ken's future mother-in-law.*

*To find out what she said about Ken, and what Jimmy had to endure from the Thompsons, come to the conference in honor of Tom and Ken to hear the rest of these stories – as well as an interesting extension of Fermat's Last Theorem to the tetration operator.*

## Analog or Digital: Comparing Signal Processing in Radio Receivers

### Rob Frohne



Electrical engineers have moved the mathematics from analog hardware to software which is much more malleable. In this presentation we will take a quick tour of how it works.

*Rob Frohne is another one of Tom and Ken's students. He became an electrical engineer to better pursue his ham radio habit, and he is still playing with robotic and software defined radios.*

# Shape from Non-asymptotic Densities

## Sharif Ibrahim

Given a shape and a small amount of information about its boundary (informally, how much of the inside of the shape can we see nearby if we are standing on the edge?), when is it possible to uniquely identify and reconstruct the shape from the boundary measurements?



In particular, we consider the area of the intersection of a disk and the shape for disks centered on the boundary.

If the radius is allowed to shrink to zero (as in the usual definition for densities), the problem becomes easy. We focus on nonasymptotic densities where we have a minimum disk size and show that many shapes are reconstructible under this regime. This allows us to provide useful results for image analysis and similar applications. This is joint work with K. Vixie, T. Asaki and K. Sonnanburg.

*Sharif graduated from Walla Walla in 2005 and Ken and Tom put him in touch with Kevin Vixie and his summer internship program at Los Alamos. Sharif followed Kevin to Washington State University where he is now pursuing a Ph.D. in mathematics. None of this would have been possible without Ken and Tom!*

# What's Your Thompson/Wiggins Number?

## Jonathan Duncan

Whether arguing about including zero or wondering what comes after infinity, mathematicians have always been fascinated with counting things. We consider a simple example of counting in mathematics, the Erdős number. This number was created as a tribute to one of the most prolific modern mathematicians. How appropriate, then, to borrow this notion in honor of two mathematicians whose work has counted just as much, if not more.



*Jonathan Duncan came to Walla Walla College as a mathematics major in 1992. There he developed an overwhelming curiosity about what went on behind the closed door of the mathematics faculty meeting. This prompted him to attend Indiana University in pursuit of the credentials necessary to attend those meetings. The privilege of collaborating with Tom and Ken over the past decade has been well worth the work it took to get through that door.*

# Becoming a Sponsor

## How To Give

If you would like to help fund this celebration of Tom and Ken's careers, we invite you to become a conference sponsor. Please keep the following in mind as you consider giving.

- This conference is not an official Walla Walla University event. It is supported *entirely by donations* from individuals like you.
- All contributions are tax-deductible.
- Giving is easy. Stop by the registration table, where we accept cash, check, or credit cards, or give electronically at:



<http://math.wallawalla.edu/TomAndKen/sponsor.html>

- All funds remaining after conference expenses have been paid will be donated to a scholarship in Tom and Ken's name.

## Scholarship

Any donations to the conference fund in excess of expenses will be transferred to the **Thomas M. Thompson and Kenneth L. Wiggins Excellence in Scholarship Fund**. The purpose of this fund is to provide scholarships for gifted WWU mathematics students and to support their travel to mathematics conferences at which they may presentations.

Tom and Ken have generously offered to match up to \$10,000 towards this scholarship. Our goal is to raise \$20,000 during and immediately after the conference, so that we can contribute at least \$10,000 towards this worthy scholarship.

# Registered Attendees

Terrie Aamodt  
Walla Walla University

Nolan Cafferky

Larry Aamoet  
Walla Walla University

Roy Campbell  
Walla Walla University

Braden Anderson  
Walla Wall University

Kelley Carr

Austin Archer  
Walla Walla University

Alex Clouzet  
Walla Walla University

Melanie Asaki

David Cowles  
Walla Walla University

Tom Asaki  
Washington State University

Carlton Cross  
Walla Walla University (Retired)

Kyle Bahnsen  
Walla Walla University

Bob Cushman  
Walla Walla University

Ryan Bain  
Washington State University

Justin Daarud

Barry Balof  
Whitman College

Jason Damazo  
California Institute of Technology

Beverly Beem  
Walla Walla University

Lindsey Eggers Damazo  
Loma Linda University

Michael Bell  
Walla Walla University

Greg Dodds  
Walla Walla University

Tim Blackwelder

Daphne Duncan

Lois Blackwelder  
Walla Walla University Church

Jonathan Duncan  
Walla Walla University

David Egolf	John Hawkins The University of Texas at Austin
Max Elliot	Andrea Hawkins-Daarud Northwestern University
Linda Felipez Walla Walla University	Heidi Haynal Walla Walla University
Robert Ferree	Howard Heaton
Bob Fontenot Whitman College	Shandelle Henson Andrews University
Bethany Foster	Abigail Higgins Washington State University
Beverly (Rippey) Foster Digimarc	Mark Hildebrand Lance Hodges
James Foster GemTalk Systems	Sharif Ibrahim Washington State University
John Foster University of Oregon	Sarah Innocent Walla Walla University
Laura Foster University of Minnesota	Kenneth James Oregon Health & Science Univ.
Rob Frohne Walla Walla University	Gordon Johnson Retired
Joe Galusha Walla Walla University	Ron Jolliffe Walla Walla University
David Gustavsen	KaraLeigh Kandoll Walla Walla Valley Academy
Brock Haugen	Edwin Karlow La Sierra University (Retired)



James Klein  
Walla Walla University

Curt Nelson  
Walla Walla University

Kathrin Klemm

Stanley Nelson  
Fiberguide Industries

Mel Lang  
Walla Walla University (Retired)

Helo Oidjarv

Edgar Ledezma  
Walla Walla University

Steven Patten  
WW Basin Watershed Council

Scott Ligman  
Walla Walla University

Becky Picard

Stephanie Mae Liongco

Amanda Preston

Doug Logan  
Walla Walla University

Cinthia Ramirez  
Walla Walla University

Alexa Luke

Anya Rasmussen  
Washington State University

Jeremy Lund  
Walla Walla University

Nathan Reeves

Qin Ma  
Walla Walla University

Don Riley  
Walla Walla University

Ross Magi  
University of Utah

William Rippey  
VMware

Marissa Masden

Brian Roth  
Walla Walla University

Christopher Maxwell

Josh Sackos

Lauren Mccoy

Taylor Sarrafian  
Walla Walla University

Macy McVay  
Walla Walla University

Craig Saxby  
Walla Walla University

Julie Scott

Benjamin Van Dyke

Kraig Scott  
Walla Walla University

Heather Van Dyke  
Washington State University

Rudy Scott  
Walla Walla University

Jon Vanderwerff  
La Sierra University

Justin Seibly  
Walla Walla University

Graham Vixie  
University of Idaho

Elizabeth Selby

Kevin R. Vixie  
Washington State University

Melodie Selby  
Walla Walla University

Christa Walikonis

Montgomery Shaw

Bill Wiggins

Victor Shepherd  
Walla Walla University

Janet Wiggins

Natalie Slusarenko  
Walla Walla University

JoAnn Wiggins  
Retired

J. Anthony Smith  
Walla Walla University

Ken Wiggins  
Walla Walla University

Ward Soper  
Walla Walla University (Retired)

Leroy Wiggins

Ralph Stirling  
Walla Walla University

Cynthia Wolf

Yvonne Stratton

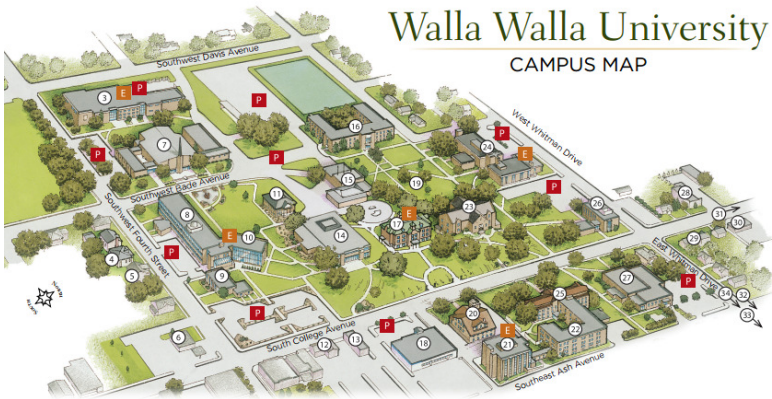
Louie Yaw  
Walla Walla University

Clare Thompson

Helen Zolber

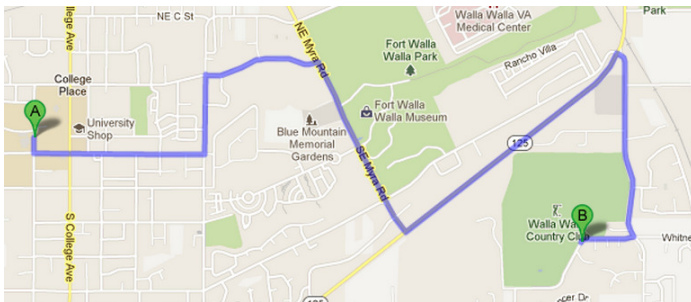
Tom Thompson  
Walla Walla University

# Maps and Directions



- Presentations are in the Fine Arts Center (14)
- Sabbath Haystack Lunch is in the University Church (7)

## Map to Walla Walla Country Club



- From the corner of 4th and College go west on 4th.
- Turn left onto Larch Avenue.
- Turn right onto Whitman Drive.
- Turn right at the stop light onto Myra Road.
- At the second light, turn left onto WA-125 N (divided highway).
- Turn right at the first stop light onto Plaza Way.
- Take the 3rd right onto Country Club Road.
- The Walla Walla Country Club will be on your right.

## Organizing Committee

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- Kevin R. Vixie, Washington State University Department of Mathematics (chair)
- Andrea Hawkins-Daarud, Northwestern University Dept. of Neurological Surgery
- Jonathan Duncan, Walla Walla University Department of Mathematics
- Shandelle Henson, Andrews University Department of Mathematics
- Rob Frohne, Walla Walla University Edward F. Cross School of Engineering
- Jon Vanderwerff, La Sierra University Department of Mathematics