



JOINT  
MATHEMATICS  
MEETINGS

SEATTLE • JAN 6-9, 2016

AMERICAN MATHEMATICAL SOCIETY  
MATHEMATICAL ASSOCIATION OF AMERICA

WASHINGTON STATE CONVENTION CENTER  
AND THE SHERATON SEATTLE HOTEL



The complete program is online at [jointmathematicsmeetings.org/meetings/national/jmm2016/2181\\_intro](http://jointmathematicsmeetings.org/meetings/national/jmm2016/2181_intro). This pdf document is not being updated. For current information, check the JMM homepage.

## MAA Invited Addresses

### MAA INVITED ADDRESS

**T. Christine Stevens / American Mathematical Society**  
*Singing along with Math: The Mathematical Work of the Opera Singer Jerome Hines*

Wednesday (1/6), 2:15–3:05 p.m.



For over 40 years, Jerome Hines (1921–2003) sang principal bass roles at the Metropolitan Opera in New York and in opera houses around the world. He was also a math major who retained a lifelong interest in mathematics. During the 1950s Hines published five papers in *Mathematics Magazine* that were based on work done as a student, and

he later produced several lengthy mathematical manuscripts about cardinality and infinite sets. I will discuss some of Hines's mathematical work, as well as the way in which his undergraduate experience at UCLA converted him from a student with no particular liking for mathematics into an aspiring mathematician. I also hope to explore the question of what mathematics meant to Hines and why, in the midst of demanding musical career, he felt it important for him to develop and publish his mathematical ideas.

### MAA INVITED ADDRESS

**Katherine Crowley / Washington and Lee University**  
*Mathematics and Policy: Strategies for Effective Advocacy*

Wednesday (1/6), 3:20–4:10 p.m.



One day in the U.S. Senate, a team of political staffers took a spontaneous break from writing legislation to request combinatorial proofs on demand of their favorite mathematical identities from their mathematician colleague (me). As the barrage of job demands implored us to disperse moments later, our legislative director chided

me for sneaking in the final answer by induction. What is the level of understanding of mathematics among those who craft our national policies? What impact does a mathematician have in a seat at the table of debate over our country's most pressing challenges? How can mathematicians inform policy, and how can policy support mathematics? I will discuss the elements of effective advocacy for our discipline.



### MAA INVITED ADDRESS

**Steven Brams / New York University**  
*Fair Division*

Thursday (1/7), 9:00–9:50 a.m.

Ideas about fair division, including "I cut, you choose," can be traced back to the Bible. But since the discovery 20 years ago of an  $n$ -person

algorithm for the envy-free division of a heterogeneous divisible good, such as cake or land, interest in fair division has burgeoned. Besides envy-freeness, properties such as equitability, efficiency, and strategy-proofness have been studied, and both existence results and algorithms to implement them will be discussed (some implementations will be shown to be impossible). More recent work on algorithms for the fair allocation of indivisible items, and tradeoffs among properties, will be presented. Applications, including those to dispute resolution, will be discussed.

#### MAA INVITED ADDRESS

**Alan Schoenfeld / University of California Berkeley**

*What Makes for Powerful Classrooms—and What Can We Do, Now That We Know?*

Friday (1/8), 9:00–9:50 a.m.



We now understand the properties of classrooms that produce powerful mathematical thinkers and problem-solvers. The evidence comes mostly but not exclusively from K-12. The question for us: What are the implications for the ways we teach postsecondary mathematics?

#### MAA INVITED ADDRESS

**Charles R. Hadlock / Bentley University**

*A Mathematical Tour through a Collapsing World*

Saturday (1/9), 10:05–10:55 a.m.



If you search the word “collapse” on Google News on any given day, you are sure to get thousands of hits, as well as a healthy reminder that we do live in a world where a very wide variety of things are collapsing every day. When assessing the risk of collapse, one’s initial mind-set about its source can lead to insufficient attention being paid to alternative

sources. That’s why financial auditors, accident investigators, and similar professionals follow systematic protocols that attempt to ensure that a wide field of issues are addressed, even in the presence of strong evidence pointing in a particular direction. This same mentality is important in more general and less structured treatments of risk and possible collapse, whether to companies, currencies, species, governments, facilities, diseases, societies, or almost anything else. Mathematics provides an ideal framework for capturing the essence of a wide range of common collapse dynamics that permeate many areas of application. After all, we customarily discuss subjects like probabilities, extrema, stability, nonlinearity, games, networks, and others, all of which are closely related to

possible collapses. But beyond capturing the concepts, which itself should not be understated as an important contribution to workers from diverse disciplines, we also offer powerful tools for going deeper to mine important insights, resolve specific uncertainties, and guide future actions. I will expand upon these ideas with examples from the real world and with some mathematical gems that many of us might not ordinarily encounter in our mathematical training or reading. I will also mention how this work grew out of an exhilarating interdisciplinary undergraduate seminar course.

#### MAA LECTURE FOR STUDENTS

**Robert Devaney / Boston University**

*The Fractal Geometry of the Mandelbrot Set*

Friday (1/8), 1:00–1:50 p.m.



In this lecture I describe several folk theorems concerning the Mandelbrot set. While this set is extremely complicated from a geometric point of view, I will show that, as long as you know how to add and how to count, you can understand this geometry completely. We will encounter many famous mathematical objects in the Mandelbrot set,

like the Farey tree and the Fibonacci sequence. And we will find many soon-to-be-famous objects as well, like the “Devaney” sequence. There might even be a joke or two in the talk.

#### MAA-AMS-SIAM GERALD AND JUDITH PORTER LECTURE

**Jennifer Chayes, Microsoft Research**

*Network Science: From the Online World to Cancer Genomics*

Saturday (1/9), 3:00–4:00 p.m.



Everywhere we turn these days, we find that networks can be used to describe relevant interactions. In the high-tech world, we see the Internet, the World Wide Web, mobile phone networks, and a variety of online social networks. In economics, we are increasingly experiencing both the positive and negative effects of a global networked economy. In

epidemiology, we find disease spreading over our ever-growing social networks, complicated by mutation of the disease agents. In biomedical research, we are beginning to understand the structure of gene regulatory networks, with the prospect of using this understanding to manage many human diseases. In this talk, I look generally at some of the models we are using to describe these networks, processes we are studying on the networks, algorithms we have

devised for the networks, and finally, methods we are developing to infer network structure from measured data. I'll discuss in some detail particular applications to cancer genomics, applying network algorithms to suggest drug targets for certain kinds of cancer.

### AMS Invited Addresses



**Panagiota Daskalopoulos** /  
Columbia University  
*Ancient Solutions to Parabolic Partial Differential Equations*

Saturday (1/9), 9:00 a.m.



**Alex Eskin** / University of Chicago  
*The  $SL(2, R)$  Action on Moduli Space*

Friday (1/8), 10:05 a.m.

### COLLOQUIUM LECTURES



**Timothy Gowers** / University of Cambridge  
*Generalizations of Fourier Analysis, and How to Apply Them*

Wednesday–Friday (1/6–1/8), 1:00 p.m.



**Marta Lewicka** / University of Pittsburgh  
*Prestrained Elasticity: Curvature Constraints and Differential Geometry with Low Regularity*

Wednesday (1/6), 10:05 a.m.

### JOSIAH WILLARD GIBBS LECTURE



**Daniel A. Spielman** / Yale University  
*Graphs, Vectors, and Matrices*

Wednesday (1/6), 8:30 p.m.

### AMS RETIRING PRESIDENTIAL ADDRESS



**David Vogán** / Massachusetts Institute of Technology  
*Conjugacy Classes and Group Representations*

Thursday (1/7), 3:20 p.m.



**Steven M. Zelditch** / Northwestern University  
*Chaotic Billiards and Vibrations of Drums*

Thursday (1/7), 2:15 p.m.

### Joint Invited Addresses

#### AMS-MAA



**Kristin Estella Lauter** / Microsoft Research  
*How to Keep Your Genome Secret*

Friday (1/8), 11:10 a.m.

#### AMS-MAA



**Xiao-Li Meng** / Harvard University  
*Statistical Paradises and Paradoxes in Big Data*

Friday (1/8), 11:10 a.m.

#### AWM-AMS NOETHER LECTURE



**Karen E. Smith** / University of Michigan  
*The Power of Noether's Ring Theory in Understanding Singularities of Complex Algebraic Varieties*

Thursday (1/7), 10:05 a.m.

Information on the JMM website is posted as it is received.

[jointmathematicsmeetings.org/](http://jointmathematicsmeetings.org/)

jmm

### Conference vs. Convention

Some sessions are being held in the Washington State **Conference Center**, which is across the street (by skybridge) from the Washington State **Convention Center**. Where this is the case, we are writing out Conference Center. Please pay attention!

### MAA Invited Paper Sessions

#### Current Trends in Mathematical and Computational Biology

Thursday (1/7), 9:00–11:20 a.m., WSCC Room 607

Mathematical and computational biology encompasses a diverse range of biological phenomena and quantitative methods of exploring those phenomena. This session of current research topics will sample from this diversity. Biological application areas will address current research in growth and control of populations, spread and development of disease, evolution and bioinformatics, and molecular interactions in the cell. Mathematical approaches will include deterministic and stochastic dynamical models as well as combinatorial and algebraic models.

**Organizers:** Brian Walton, James Madison University; and Maeve McCarthy, Murray State University  
**Speakers:**

- Joseph Felsenstein, Department of Genome Sciences, University of Washington
- Suzanne Lenhart, Department of Mathematics and National Institute for Mathematical and Biological Synthesis, University of Tennessee

- David Murrugarra, Department of Mathematics, University of Kentucky
- Ami Radunskaya, Department of Mathematics, Pomona College
- Brandilyn Stigler, Department of Mathematics, Southern Methodist University

**Sponsor:** BIO SIGMAA

## What Do We Know about University Mathematics Teaching, and How Can It Help Us?

Friday (1/8), 1:00–5:00 p.m., WSCC Room 607

Research on university-level mathematics teaching and learning has grown over the past few decades from a cottage industry into a robust enterprise, both in general (with findings on problem solving, “powerful teaching,” and understanding how and why teachers make the choices they do while teaching) and with regard to specific courses (e.g., developmental mathematics, linear algebra, proof). In turn, the research has led to applications to teaching. This, too, is in general (with professional

development framed around the issues raised in research leading to changes in teaching) and in particular courses.

**Organizer:** Alan Schoenfeld, University of California Berkeley

### Speakers:

- Bill Barton, University of Auckland
- Ann Edwards, Carnegie Foundation for the Advancement of Teaching
- Sean Larsen, Portland State University
- Judy Paterson, University of Auckland
- Alon Pinto, UC Berkeley
- Chris Rasmussen, San Diego State University
- Annie and John Selden, New Mexico State University
- Günter Törner, University of Duisberg-Essen

## Fair Division

Thursday (1/7), 1:00–4:15 p.m., WSCC Room 607

This session accompanies Steven Brams’s invited address on the same topic. The goal of the session is to show how different types of mathematics can be used to address

questions in both theoretical and applied aspects of fair division. Although a relatively new field, fair division now encompasses a wide variety of approaches (analytic, combinatoric, geometric, and axiomatic) to address both discrete and continuous problems. Fairness criteria can be applied to such diverse applications as cake cutting, the establishment of priority lists, and resource allocation. Although the talks will be research oriented, speakers will include an expository overview to introduce fair division to a diverse audience including students.

**Organizers:** Michael A. Jones, *Mathematical Reviews*; and Jennifer Wilson, the New School

### Speakers:

- Julius Barbanel, Union College
- Jonathan Hodge, Grand Valley State University
- Michael A. Jones, *Mathematical Reviews*
- D. Marc Kilgour, Wilfrid Laurier University
- Kathryn Nyman, Willamette University
- William Webb, Washington State University

“WSCC” stands for Washington State Convention Center.

## Joint Prize Session

To showcase the achievements of recipients of the various prizes, the AMS and MAA are cosponsoring this event at 4:25 p.m. on Thursday. A cash bar reception will immediately follow. All participants are invited to attend.

The AMS, ASA, MAA, and SIAM will announce the JPBM Communications Award winner. The AMS, MAA, and SIAM will award the Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student.

The AMS and SIAM will announce the Norbert Wiener Prize in Applied Mathematics. The AMS will announce the winners of the Award for Distinguished Public Service,

*Chevalley Prize in Lie Theory, Levi L. Conant Prize, E. H. Moore Research Article Prize, David P. Robbins Prize, Leroy P. Steele Prizes, and the Oswald Veblen Prize in Geometry.*

The MAA will award the Chauvenet Prize, Euler Book Prize, Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics, and the Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics.

The AWM will present the Louise Hay Award for Contributions to Mathematics Education, the M. Gweneth Humphreys Award for Mentorship of Undergraduate Women in Mathematics, and the Alice T. Schafer Prize for Excellence in Mathematics by an Undergraduate Woman.

## MAA Workshops

### The Enjoyment of Employment: Finding the Right Organizational Culture

Wednesday (1/6), 2:15–3:35 p.m., WSCC Room 612

This workshop is targeted to graduate students and postdocs who are considering nonacademic careers. Are you aware of the different kinds of workplace cultures you’ll encounter? People look for different things in a job: one person might want to change the world, while another just wants a paycheck. Matching your work personality to the culture of the organization is one of the prime factors in workplace happiness. In this workshop you’ll assess your workplace personality, which we will then match

against different work environments to see what kinds of organizations are compatible with your work style. We'll end with a checklist and timeline for starting your job search so that you'll be fully prepared when the time comes. Before the workshop, go to [dousguides.com/personality](http://dousguides.com/personality), take the personality assessment, and bring the results with you.

**Organizer:** Douglas Kalish, University of California Berkeley

"WSCC"

stands for

Washington

State

Convention

Center.

### Guiding Your PhDs to Nonacademic Careers

Thursday (1/7), 8:00–9:20 a.m., WSCC Room 612

The  
Conference  
Center is  
a separate  
building.

According to the NSF, in 2010 nearly 50 percent of mathematics and statistics PhDs held nonacademic positions. More faculty are accepting and promoting nonacademic career alternatives for their graduate students and postdocs. But for some faculty without extensive industry experience or contacts, it's difficult to offer advice and counsel to these students. This workshop provides information and tools for faculty who want to mentor their PhDs as to the opportunities available and additional skills required for a successful nonacademic job search. Some of the topics we will cover:

- The nonacademic job market for quantitative PhDs
- Skills required of PhDs for nonacademic jobs
- Making industry internships work for the PhD and adviser
- Counseling and networking resources for nonacademically bound PhDs
- Supporting nonacademic career PhDs emotionally and behaviorally
- Managing academic and non-academic career PhDs in the same department
- Sharing experiences and challenges in mentoring nonacademic career PhDs

The tools and topics of this workshop are targeted to mathematical sciences faculty who embrace (or at

least accept) nonacademic career choices for their graduate students and postdocs. The workshop is not a discussion of the appropriateness of a graduate education for nonacademic career candidates.

**Organizer:** Douglas Kalish, University of California Berkeley

### Applications of Gapminder for Undergraduate Mathematics and Statistics Courses

Thursday (1/7), 8:00–9:20 a.m., Conference Center Tahoma 1

Do a nation's GDP and its youth's math ability go hand-in-hand? Are geriatric car crashes on the decline? Which nations are the most "developed"? These are all captivating questions, and the commonality among them is that they were tackled by students using data from Gapminder.org. While such questions are non-trivial for a mathematician or sociologist to approach, it is worthwhile for students to approach them—doing the work could change their mind about the utility of mathematics.

Created in 2005, Gapminder is a nonprofit site with the goal of enhancing sustainable global development through an increased use of information regarding social, economic, and environmental development at local and international levels. With more than 520 data sets to peruse, the site is a powerhouse for applications in the classroom; one might use it for demonstrations, short-term assignments, or semester-long research projects.

But deciding how to use the tools so that neither you nor your students become overwhelmed can be a challenge. The first component of this interactive workshop is to familiarize instructors with the site and its visualization tools. Next, we will move on to discuss the applications of it in classes such as college algebra, first-year seminar, introductory and upper-level statistics, differential equations, and other modeling courses. Finally, participants will work in teams to

create assignments for immediate use in their classrooms. Whether one has used the site before or not, each participant should expect to take away meaningful, tangible strategies for its use. Participants should come prepared to learn more about the world and how to bring it into the classroom!

**Organizers:** Samuel L. Tunstall, Sarah Greenwald, and Bill Bauldry, Appalachian State University

### MAA Contributed Paper Sessions

CONTRIBUTED PAPER SESSIONS WITH THEMES

#### Experiences and Innovations in Teaching Probability Theory

Wednesday (1/6) morning

Papers and scholarly presentations will be given on improving the teaching of probability theory, at the undergraduate or beginning graduate level by innovative methods. Topics can include inquiry-based learning, projects, mathematical writing, real-world applications, connections to other areas of mathematics, integration of technology, or simulation. The session will focus on the teaching of probability theory (the construction, analysis, and theoretical properties of probabilistic models) rather than statistics or data analysis.

**Organizers:** Jonathon Peterson, Purdue University; and Nathaniel Eldredge, University of Northern Colorado

#### Topics and Techniques for Teaching Real Analysis

Wednesday (1/6) afternoon

Real analysis is a core component of the mathematics program. It has traditionally been considered difficult for students but is also challenging to teach since the student body can be diverse and there are many choices

in subject matter. Students may end up applying their knowledge of real analysis in differential equations, functional analysis, probability, even economics and physics. There are many possible strategies for success. Speakers at this session will present topics that could be added to real analysis courses and will discuss improved presentation techniques of traditional topics.

**Organizers:** Erik Talvila, University of the Fraser Valley; Paul Musial, Chicago State University; Robert Vallin, Lamar University; and James Peterson, Alma College

### Using Philosophy to Teach Mathematics

*Thursday (1/7) morning*

Courses in the philosophy of mathematics are rare, but philosophical questions frequently arise in the regular curriculum, often presenting difficulties to teachers who haven't prepared to respond to them. In recent years, a growing number of teachers of mathematics are discovering that addressing philosophical issues deliberately in their courses not only eases the strain but also enhances students' ability to grasp difficult mathematical concepts. The upcoming MAA Notes volume *Using the Philosophy of Mathematics in Teaching Collegiate Mathematics* illustrates the ways a wide variety of teachers have found to introduce philosophical questions as an exciting part of presenting standard

mathematical material. This session teachers at all levels will discuss ways they have found to include philosophy in the mathematics classroom.

**Organizers:** Carl Behrens, Alexandria, Virginia; and Dan Sloughter, Furman University

**Sponsor:** POM SIGMAA

### Common Core State Standards (CCSS) for Mathematics Practices and Content: The Role of Math Departments in Preparing Math Education Candidates for New Assessments

*Thursday (1/7) afternoon*

The Common Core State Standards for Mathematics have been widely adopted and implemented nationally. Mathematics departments share responsibility with teacher education programs to prepare future teachers who are ready to teach school mathematics so that their students can meet both the content and especially mathematical practices standards. Mathematics faculty also collaborate with the K-12 system to ensure a smooth transition from school to higher education, one of the primary purposes of the CCSS.

This session seeks reports of mathematics faculty experiences with their department's implementation of the CCSS mathematics standards with a focus on the requirements of new assessments. We invite contributed papers describing efforts, including

evidence of their impact, that

- (1) Investigate how well their math education candidates are prepared with the knowledge and skills necessary to assess that their students meet the CCSS for mathematics content and practices;
- (2) Partner with K-12 educators to focus on the implications related to the assessments (such as PARCC and Smarter Balanced) being used;
- (3) Discuss changes mathematics departments have made to their programs implementing the CCSS and assessments for the mathematical education of teachers, or
- (4) Discuss departmental initiatives to ensure a smooth transition from school to higher education in light of the CCSS and their associated assessments.

**Organizers:** William Martin, North Dakota State University; Karen Morgan, New Jersey City University; Gulden Karakok, University of Northern Colorado; and James A. Mendoza Epperson, University of Texas–Arlington

**Sponsors:** MAA Committee on the Mathematical Education of Teachers (COMET) and the MAA Committee on Assessment

### The Teaching and Learning of Undergraduate Ordinary Differential Equations

*Friday (1/8) morning*

The teaching of undergraduate ordinary differential equations (ODEs) provides a unique way to introduce students to the beauty and applicative power of the calculus. ODEs are also rich with aesthetically pleasing theory, which often can be successfully communicated visually and explored numerically. This session will feature talks that describe innovative teaching in the ODEs course as well as the description of either projects or pedagogy that can be used to engage students in their study of ODEs. Successful contributions could include but are not limited to: (1) innovative ways of teaching standard topics in

### Mathematical Art Exhibition

A popular feature at the Joint Mathematics Meetings, this exhibition provides a break in your day. On display are works in various media by artists who are inspired by mathematics and by mathematicians who use visual art to express their findings. Topology, fractals, polyhedra, and tiling are some of the ideas at play here. Don't miss this unique opportunity for a different perspective on mathematics. The exhibition will be located inside the Joint Mathematics Exhibits Hall and open during the same exhibit hours.

**Organizers:** Robert Fathauer, Tessellations Company; Nathaniel A. Friedman, ISAMA and SUNY Albany; Anne Burns, Long Island University C. W. Post Campus; Reza Sarhangi, Towson University; and Nathan Selikoff, Digital Awakening Studios.

the ODEs course; (2) strategies for teaching both differential equations and linear algebra simultaneously; (3) the inclusion of technology in the ODEs course; and (4) descriptions of applications or nonstandard topics and how such topics can lead to student engagement and interest.

**Organizers:** Christopher S. Goodrich, Creighton Preparatory School; and Beverly H. West, Cornell University

**Sponsor:** Community of Ordinary Differential Equations Educators (CODEE)

### Innovative and Effective Ways to Teach Linear Algebra

*Friday (1/8) afternoon*

Linear algebra is one of the most interesting and useful areas of mathematics, because of its beautiful and multifaceted theory, as well as the enormous importance it plays in understanding and solving many real-world problems. Consequently, many valuable and creative ways to teach its rich theory and its many applications are continually being developed and refined. This session will serve as a forum in which to share and discuss new or improved teaching ideas and approaches. These innovative and effective ways to teach linear algebra include, but are not necessarily limited to: (1) hands-on, in-class demos; (2) effective use of technology, such as Matlab, Maple, Mathematica, Java Applets or Flash; (3) interesting and enlightening connections between ideas that arise in linear algebra and ideas in other mathematical branches; (4) interesting and compelling examples and problems involving particular ideas being taught; (5) comparing and contrasting visual (geometric) and more abstract (algebraic) explanations of specific ideas; (6) other novel and useful approaches or pedagogical tools.

**Organizers:** David Strong, Pepperdine University; Gil Strang, MIT; and Megan Wawro, Virginia Tech

### Helping Students See beyond Calculus

*Saturday (1/9) afternoon*

We need more and better educated mathematics and science students. Too many high school and beginning college students think of mathematics merely as calculus and the topics leading to it. Many talented and promising students lose interest in mathematics—some never take a single math class in college, and some drop out of the math major soon after beginning—because they are never exposed to the beauty and usefulness of the many other areas of mathematics. Students—and society—would immensely benefit from the students' being exposed to other areas of mathematics before leaving high school or during their first semesters in college. Papers describe classroom presentations and materials that provide students with the exposure described above. Such classroom presentations and materials should be:

- An introduction to a specific mathematical idea or application;
- Accessible to high school or early college-level students;
- Self-contained (including information on how to most effectively use the presentation or materials);
- Made of power points, video or audio clips, online or printed handouts, materials or tools for experimentation and visualization, and so on; and
- Interesting, entertaining, and possibly captivating.

The organizer hopes that speakers will make their classroom presentations available online (on their own websites) for use by other instructors.

**Organizers:** David Strong, Pepperdine University; James Tanton, MAA; Courtney Davis, Pepperdine University; and Angela Spalsbury, Youngstown State University

**Sponsor:** SIGMAA TAHSM

### Mathematics and Sports

*Saturday (1/9) morning*

The expanding availability of

play-by-play statistics and video-based spatial data, for professional and some collegiate sports, is leading to innovative kinds of research, using techniques from various areas of the mathematical sciences. By modeling the outcome distributions in certain situations, researchers can develop new metrics for player or team performance in various aspects of a sport, comparing results to expected values. Such work often has implications for strategic game management and personnel evaluation. Classic areas of study, such as tournament design, ranking methodology, forecasting performance, insight into rare or record events, and physics-based analysis, also remain of interest. This session will contain both presentations of original research and expository talks, including topics related to the use of sports applications in curriculum. All talks should be accessible to mathematics majors.

**Organizers:** Drew Pasteur, College of Wooster; and John David, Virginia Military Institute

### Preparation, Placement, and Support of Elementary Mathematics Specialists

*Thursday (1/7) morning*

Over the last decade, there have been numerous calls for the use of mathematics specialists in elementary and middle schools. In 2013, the Association of Mathematics Teacher Educators (AMTE) created a set of Standards for Elementary Mathematics Specialists ([amte.net/publications](http://amte.net/publications)) to encourage states to address the urgent need to increase the mathematical knowledge and expertise of elementary school staff by establishing an elementary mathematics specialist (EMS) license, certificate, or endorsement. Elementary mathematics specialists are teachers, teacher leaders, or coaches support effective mathematics instruction and student learning at the classroom, school, district, or state levels.

Recently some institutions have

begun degree or certificate programs to educate these elementary mathematics specialists. Papers will report on the preparation, placement, and support of mathematics specialists in the elementary grades as well as on the development of degree or certificate programs to educate these mathematics specialists. Papers may describe programs to prepare preservice or inservice teachers to become elementary mathematics specialists or may describe efforts with school districts to create positions and support for these specialists. Reports on the successful installation and implementation of elementary mathematics specialists are also welcome. Papers should include evidence of success or the potential for application to other institutions or districts.

**Organizers:** Laurie J. Burton, Western Oregon University; Cheryl Beaver, Western Oregon University; and Klay Kruczek, Southern Connecticut State University

**Sponsor:** MAA Committee on the Mathematical Education of Teachers (COMET)

### Trends in Undergraduate Mathematical Biology Education

*Friday (1/8) morning*

Several recent reports emphasize that aspects of biological research are becoming more quantitative and that life science students, including premed students, should be introduced to a greater array of mathematical, statistical, and computational techniques and to the integration of mathematics and biological content at the undergraduate level. Mathematics majors also benefit from coursework at the intersection of mathematics and biology because there are interesting, approachable research problems and mathematics students need to be trained to collaborate with scientists in other disciplines, particularly biology. Paper topics may include scholarly work addressing the issues related to the design of effective biomathematics course content, courses and curricula, the integration of

biology into mathematics courses, student recruitment efforts, the gearing of content toward premed students, undergraduate research projects, effective use of technology in biomathematics courses, preparation for graduate work in biomathematics and computational biology or for medical careers, and assessment issues.

**Organizers:** Timothy Comar, Benedictine University; and Daniel Hrozencik, Chicago State University  
**Sponsor:** BIO SIGMAA

### Mathematics and the Arts

*Wednesday (1/6) morning and afternoon*

Presentations exploring connections between mathematics and the arts were invited, included from any of various perspectives, including mathematical aspects of traditional art, mathematical topics represented by or incorporated into art, and artistic and aesthetic aspects of mathematical topics. Visual, poetical, dramatic, musical, literary, dance, fiber arts, and so forth, may be included. Practitioners from anywhere along the spectrum of math and the arts as well as educators with experience at this intersection report on their experiences, whether primarily artistic, mathematical, pedagogical, or blended.

**Organizer:** Douglas Norton, Villanova University

**Sponsor:** SIGMAA ARTS, the SIGMAA on Mathematics and the Arts

### The Broad Impact of Math Circles

*Thursday (1/7) afternoon*

A mathematics circle is an enrichment activity for K-12 students or their teachers, which brings them into direct contact with mathematics professionals, fostering a passion and excitement for deep mathematics in the participants. Math circles provide a unique opportunity to reach a wide variety of audiences and have a lasting impact. This session is focused on how math circles have served this variety

of populations and the effect of this service.

**Organizers:** Amanda Matson, Clarke University; Katherine Morrison, University of Northern Colorado; and Philip Yasskin, Texas A&M University  
**Sponsor:** SIGMAA MCST, the SIGMAA on Math Circles for Students and Teachers

### Mathematics Experiences and Projects in Business, Industry, and Government

*Friday (1/8) afternoon*

The MAA Business, Industry and Government Special Interest Group (BIG SIGMAA) provides resources and a forum for mathematicians working in Business, Industry, and Government (BIG) to help advance the mathematics profession by making connections, building partnerships, and sharing ideas. BIG SIGMAA consists of mathematicians in BIG as well as faculty and students in academia who are working on BIG problems. Mathematicians, including those in academia, with BIG experience are invited to present papers or discuss projects involving the application of mathematics to BIG problems. The goal of this contributed paper session is to provide a venue for mathematicians with experience in business, industry, and government to share projects and mathematical ideas in this regard. Anyone interested in learning more about BIG practitioners, projects, and issues, will find this session of interest.

**Organizers:** Carla D. Martin, Department of Defense; and Allen Butler, Wagner Associates

**Sponsor:** BIG SIGMAA

### The Scholarship of Teaching and Learning in Collegiate Mathematics

*Wednesday (1/6) morning and afternoon*

In the scholarship of teaching and learning, faculty brings disciplinary knowledge to bear on questions of teaching and learning and



systematically gather evidence to support their conclusions. Work in this area includes investigations of the effectiveness of pedagogical methods, assignments, or technology, as well as probes of student understanding.

The goals of this session are to:

(1) feature scholarly work focused on the teaching of postsecondary mathematics; (2) provide a venue for teaching mathematicians to make public their scholarly investigations into teaching/learning; and (3) highlight evidence-based arguments for the value of teaching innovations or in support of new insights into student learning. This session may include preliminary or final reports of postsecondary classroom-based investigations of teaching methods, student learning difficulties, curricular assessment, or insights into student (mis)understandings.

**Organizers:** Jacqueline Dewar, Loyola Marymount University; Thomas Banchoff, Brown University; Curtis Bennett, Loyola Marymount University; Pam Crawford, Jacksonville University; and Edwin Herman, University of Wisconsin–Stevens Point

### The Contributions of Minorities to Mathematics throughout History

*Friday (1/8) morning*

The history of mathematics is filled with inspiring stories of mathematicians. This session will focus on the stories of minority mathematicians

(people of color, native peoples, women, and other peoples historically underrepresented in mathematics) of the distant and not-so-distant past and the impact they have had on mathematics and its teaching.

**Organizers:** Amy Shell-Gellasch, Montgomery College; and Lloyd Douglas, University of North Carolina  
**Sponsor:** HOM SIGMAA

### Incorporating the History of Mathematics into Developmental Math Courses

*Saturday (1/9) morning*

Developmental math courses and courses prerequisite to the calculus sequence, such as college algebra and precalculus, are challenging for many students. By incorporating the history of mathematics into these courses, a deeper level of understanding and interest may be achieved. The papers in this session offer ideas for incorporating the history of mathematics (generally or specifically) into these courses.

**Organizers:** Van Herd, University of Texas at Austin; and Amy Shell-Gellasch, Montgomery College  
**Sponsor:** HOM SIGMAA

### Integrating Research into the Undergraduate Classroom

*Saturday (1/9) afternoon*

Undergraduate research is a high-impact practice that inspires student learning, builds crucial skills, boosts retention and graduation rates,

and particularly benefits under-represented and at-risk students. Although students often engage in undergraduate research outside of the classroom, incorporating research projects into the classroom can bring this impactful experience to even more students. This session will focus on incorporating research into the undergraduate classroom, from introductory to upper-level mathematics courses. Presentations may describe a particular research project or activity, faculty experiences in mentoring undergraduate research in the classroom, or student experiences and feedback. All talks will emphasize why the project(s) being discussed is considered undergraduate research rather than a typical assignment. Participants will share the impact on the students involved if possible.

**Organizers:** Shannon R. Lockard, Bridgewater State University; and Timothy B. Flowers, Indiana University of Pennsylvania

### Graduate Students Teach Too: Ideas and Best Practices

*Saturday (1/9) morning*

Graduate teaching assistants (GTAs) make up a nontrivial portion of the teaching workforce at many universities. Though their duties vary, most are responsible for teaching introductory general education courses in some capacity. In fact, a 2010 AMS survey of four-year colleges and universities suggests that roughly 8 percent of introductory math courses (15 percent for statistics) are taught fully by graduate students. This responsibility may seem straightforward at first glance; however, there is a growing movement toward accountability for general education outcomes in such courses. Students in these classes deserve a positive, engaging experience—one that not only permits them to take future math courses (if desired), but also fosters gains in numeracy. In light of a GTA's workload and background, such an experience can be challenging to create. This



session is designed to encourage dialogue among both graduate programs and graduate instructors. Talks might include reports on innovative preparation methods for new instructors, accountability measures for GTAs, means for infusing quantitative literacy into GTA-led courses, as well as novel ideas or reports from graduate students themselves.

**Organizer:** Samuel L. Tunstall, Michigan State University

### Mathematical Modeling in the Undergraduate Curriculum

*Saturday (1/9) morning*

Both the MAA's 2015 CUPM Curriculum Guide and SIAM's Modeling Across the Curriculum Report emphasize the value in teaching mathematical modeling as a dynamic problem-solving process. In addition to courses dedicated to mathematical modeling and applied mathematics, many undergraduate mathematics programs have made an effort to infuse modeling into courses across their existing curriculum. Papers in the session will concern best practices, useful examples, or effective strategies in the design and teaching of undergraduate courses in which mathematical modeling makes up a significant activity or core learning objective. Collectively, the papers presented in this session will represent applications of mathematics to a broad range of fields.

**Organizers:** Jason Douma, University of Sioux Falls; and Rachel Levy, Harvey Mudd College

**Sponsors:** MAA CUPM Mathematics Across the Disciplines Subcommittee and the SIAM Education Committee

### Research in Undergraduate Mathematics Education

*Thursday (1/7) morning and afternoon*

This session presents research reports on undergraduate mathematics education. The session will feature research in a number of mathematical areas

including calculus, linear algebra, advanced calculus, abstract algebra, and mathematical proof. This session is intended to foster high-quality research in undergraduate mathematics education, to disseminate well-designed educational studies to the greater mathematics community, and to transform theoretical work into practical consequences in college mathematics. Examples of such types of research include rigorous and scientific studies about students' mathematical cognition and reasoning, teaching practice in inquiry-oriented mathematics classrooms, design of research-based curricular materials, and professional development of mathematics teachers, with intention to support and advance college students' mathematical thinking and activities. The presentations will report results of completed research that builds on the existing literature in mathematics education and employs contemporary educational theories of the teaching and learning of mathematics. The research will use well-established or innovative methodologies (e.g., design experiment, classroom teaching experiment, and clinical interview, with rigorous analytic methods) as they pertain to the study of undergraduate mathematics education. Papers may include preliminary reports on research projects in early stages of development or execution.

**Organizer:** Karen A. Keene, North Carolina State University

**Sponsor:** SIGMAA on RUME

### Origami in the Mathematics K-12 Classroom

*Saturday (1/9) afternoon*

Programs that take advantage of paper folding to teach mathematics are thriving in many parts of the world. Presenters in this session will describe their innovative strategies for exploring mathematics in the K-12 classroom and/or with future/in-service teachers using paper folding/origami as the means to reach the goals established by the Common Core.

The focus of the session will be on rich mathematical explorations that are based on or enhanced by paper folding. Presentations are expected to be scholarly in nature.

**Organizers:** Roger Alperin, San Jose State University; and Perla Myers, University of San Diego

### Contemplative Pedagogy and Mathematics

*Friday (1/8) afternoon*

Contemplative pedagogy aims to incorporate contemplative/introspective practices into the classroom to deepen the educational experience. Students are challenged to engage more fully with the material and their experience of learning. Common techniques include in-class mindfulness activities, deep listening or dialoguing, journaling, and beholding. As more and more data come in showing the efficacy and benefits of such practices in all aspects of life, the contemplative education movement has been gaining momentum, strengthening connections with established good pedagogy, and expanding to departments outside the humanities and social sciences. This contributed paper session solicits presentations from college-level educators with hands-on experience of contemplative pedagogy or contemplative practices. We welcome reports on successful, or unsuccessful, attempts at contemplative pedagogy, whether anecdotal or systematic. We also invite educators with personal out-of-class contemplative practices, to reflect on how that practice has informed their teaching.

**Organizers:** Luke Wolcott, Lawrence University; and Justin Brody, Goucher College

### Assessing Student Learning: Alternative Approaches

*Wednesday (1/6) morning*

Assessment is central to determining a student's level of mastery, yet traditional methods of assessment (such as exams, quizzes, and homework) may

not accurately and robustly measure student understanding. With the recent increase in the popularity of non-lecture-based course structures, techniques that assess deeper learning are coming to the forefront. This session invites presenters to describe innovative methods of assessment with which they have experimented in the attempt to accurately reflect the diversity of ways students learn and understand course material. Presenters will focus on practical issues of implementation and discuss the level of success of the method in the college classroom. Presenters may also share methods to determine the validity of their assessments, advice for others looking to implement or create alternative assessment methods, or how these methods can help instructors evaluate the effectiveness of a nontraditional classroom.

**Organizers:** David Clark, Grand Valley State University; Jane Butterfield, University of Victoria; Robert Campbell, College of St. Benedict/St. John's University; and Cassie Williams, James Madison University

### Quantitative Literacy in the K-16 Curriculum

*Wednesday (1/6) afternoon*

Because of its nature, quantitative literacy is referenced at almost all levels of the educational system. Traditional mathematical topics such as calculus have relatively well-defined prerequisites and outcomes and an established location in the traditional mathematical curriculum sequence. Quantitative literacy typically involves the use of a wide variety of pre-collegiate level mathematics to enable a deeper understanding within a nonmathematical context. As a result, changing requirements for K-12 mathematics can have a significant impact on what we do at the collegiate level. Papers in this session will focus on the interface between the K-12 curriculum and collegiate quantitative literacy, a very broad area. Insights on the following questions were explicitly invited: requirements for K-12 that

affect collegiate level QL, QL requirements for two-year colleges, the distinction between K-12 quantitative literacy standards and collegiate quantitative literacy standards, and the impact of changing requirements at the K-12 and two-year schools on four-year school curricula.

**Organizers:** Aaron Montgomery, Central Washington University; Gary Franchy, Southwestern Michigan College; Gizem Karaali, Pomona College; Andrew Miller, Belmont University; and Victor Piercey, Ferris State University

**Sponsor:** SIGMAA QL

### Innovative Approaches to One-Semester Calculus Courses

*Thursday (1/7) morning*

Students who major in such fields as agriculture, architecture, biology, business, economics, and liberal arts and human sciences often take a one-semester, terminal calculus course with a focus on applications. One approach to these courses are focused, targeted versions of calculus such as applied calculus, business calculus, or calculus for the life sciences. Some schools cannot offer a wide range of calculus courses and must design a single course to meet the needs of these students. This session invites presenters to share innovative course designs for a one-semester calculus course for students interested in a variety of disciplines, particularly those that involve mathematical modeling. Presenters will report their course design, how it meets the needs of students, and evidence for the effectiveness of their approach.

**Organizers:** Joel Kilty and Alex M. McAllister, Centre College

### Conversations with the Partner Disciplines: Collaborations to Improve the Mathematics Curriculum

*Saturday (1/9) afternoon*

The undergraduate mathematics curriculum is an essential component of the education of future scientists,

health professionals, engineers, computer scientists, business professionals, and social scientists, and supports the quantitative education of all students. Understanding and adapting to the evolving needs of the partner disciplines is critical to maintaining a vital and relevant mathematics curriculum. The 2013 NRC report "The Mathematical Sciences in 2025" revealed that "the educational offerings of typical departments in the mathematical sciences have not kept pace with the changes in how the mathematical sciences are used," and a "community-wide effort is needed . . . to make undergraduate courses more compelling to students and better aligned with the needs of user departments." One national effort to improve such communication over the past decade has been the MAA's "Curriculum Foundations Project: Voices of the Partner Disciplines." This session presents successful collaborations with partner disciplines to revise mathematics courses or programs. Talks identify the research basis for curricular change such as on-campus conversations, the Curriculum Foundations Project, or other professional reports or guidelines. Papers from the session may be considered for a special issue of *PRIMUS*.

**Sponsors:** Curriculum Renewal Across the First Two Years (CRAFTY) and Mathematics Across the Disciplines (MAD) subcommittees of CUPM and the journal *PRIMUS: Problems, Resources, and Issues in Undergraduate Mathematics Studies*  
**Organizers:** Victor Piercey, Ferris State University; Suzanne I. Dorée, Augsburg College; Jason Douma, University of Sioux Falls; and Susan Ganter, East Carolina University

### Bringing the Community into the College Mathematics Classroom

*Thursday (1/7) afternoon*

Colleges and universities are often involved in the surrounding communities, typically through partnerships and outreach. But how often are communities present in college

classrooms, in particular in mathematics classrooms? This session is concerned with collaborations between universities and the communities they serve that enhance student mathematical learning, while also building stronger ties with individuals and organizations based in these communities. Such collaborations can happen in any mathematics course, from liberal arts mathematics to the capstone; they can be implemented at any level, of an individual course or program-wide; and they can take many forms. For example, community members may share their expertise during a class visit; students may serve as consultants to a community-based organization; or course meetings can take place on-site in the community, to name a few. Proposals for this session should describe collaborations between mathematics courses or programs, and community members or organizations. These collaborations should be more than simple attempts to “fix” the communities and should view communities as sources of knowledge rather than as deficient. All proposals must provide rich descriptions of the collaboration and the mathematics learning that took place, and should provide evidence of the impact that the collaboration had on participants, both students and community members (if applicable). Accounts of internships will also be considered.

**Organizer:** Ksenija Simic-Muller, Pacific Lutheran University

### **Innovative Targeted Solutions in Teaching Introductory Statistics**

*Thursday (1/7) afternoon*

Statistics is a very rapidly growing field and enrollments in introductory statistics are expanding. The 2015 *MAA Curriculum Guide* recommends that all math majors learn effective data analysis. This is also a time of great innovation and change in the way introductory statistics is taught. This session invites papers on successful methods used in intro stats.

these methods can range from an innovative full course curriculum overhaul to a single effective in-class activity. All papers should provide participants with a clear take-away idea for use in introductory statistics.

**Organizers:** Patti Frazer Lock, St. Lawrence University; Randall Pruim, Calvin College; and Sue Schou, Idaho State University

**Sponsor:** SIGMAA on Statistics Education

### **New Ideas in Teaching Upper-Level Statistics Courses**

*Friday (1/8) afternoon*

Much attention has been paid recently to improving student learning in the Introductory Statistics course. This session is focused on the rest of the undergraduate statistics curriculum. We invite submissions that provide details about innovative learning activities, technologies, resources, or teaching methods that have been used effectively in Stat 2, mathematical statistics, or other statistics courses beyond the intro stat course. Submissions may range from single effective activities used in these courses to major curricular revisions or completely new courses. We welcome submissions that include partnerships with other disciplines. Presentations should explicitly address the objectives and effectiveness of the described activities.

**Organizers:** Patti Frazer Lock, St. Lawrence University; Randall Pruim, Calvin College; and Sue Schou, Idaho State University

**Sponsor:** SIGMAA on Statistics Education

### **Addressing the Needs of Mathematics and Computer Science Majors in Discrete Mathematics Courses**

*Saturday (1/9) afternoon*

The needs of mathematics and computer science majors in discrete mathematics courses differ: while a proof-based approach is typically desired for mathematics majors,

computer science majors need to understand the connection between the mathematics and concepts they encounter in computer science coursework. Yet all students can benefit from both approaches: computer science majors from more mathematical rigor, and mathematics majors from more programming applications. One possible approach to making discrete mathematics courses more meaningful to all students is through the use of technology, especially as computer software becomes more freely available (e.g. SAGE or Wolfram Alpha) and easier to use (e.g. newer versions of Maple and Mathematica). Other approaches include meaningful projects and activities.

For this session, we invite proposals that describe an activity, problem, assignment, or project that was successful in advancing the knowledge and engagement of students enrolled in a discrete mathematics course. Descriptions of entire courses are also welcome. While we are especially interested in proposals about courses that simultaneously serve computer science and mathematics majors by implementing computer software or programming, proposals describing other innovative approaches to teaching discrete mathematics in general will also be considered. Talks in this session should also describe outcomes, giving evidence of the success of the intervention.

**Organizers:** Ksenija Simic-Muller, Pacific Lutheran University; and Tom J. Edgar, Pacific Lutheran University

### **Proofs and Mathematical Reasoning in the First Two Years of College**

*Wednesday (1/6) morning*

As more students begin their college education at a two-year college before transferring to a bachelor's degree program, it is increasingly important to ensure that students choosing to major in mathematics are adequately prepared for the rigor of advanced mathematics courses. In particular,

they will need to read, comprehend and write proofs. Most standard calculus sequences do not or cannot provide the needed preparation because they must serve a significantly diverse set of majors. Therefore many bachelor degree programs in mathematics require an “Introduction to Proofs” style course that mathematics majors must take. This kind of course is not currently offered in most two-year college mathematics programs. We invite faculty from two and four-year institutions to share

- Introduction to Proofs and Mathematical Reasoning courses for students who have had a year of calculus and intend to take upper division mathematics courses especially as taught to students in two-year colleges;

- Methods of integrating the teaching and practice of proof-writing for mathematics majors into standard first and second-year mathematics courses; or

- Collaborative efforts between two and four-year institutions to create or facilitate transfer of Introduction to Proof and Mathematical Reasoning courses or course equivalents.

**Organizers:** Joanne Peeples, El Paso Community College; Chris Oehrlein, Oklahoma City Community College; and Dean Gooch, Santa Rosa Junior College

**Sponsor:** MAA Committee on Two Year Colleges

### Professional Development for Mathematicians: A Contributed Paper Session for MAA PREP Organizers and Participants

*Wednesday (1/6) afternoon*

MAA has supported professional development activities that have enhanced the mathematics profession through the PProfessional Enhancement Program (MAA PREP), funded by the National Science Foundation. A variety of professional development workshops have been conducted under the MAA PREP umbrella, and it would be beneficial for workshop

organizations and participants to share their experiences and insights. This session will provide a venue for organizers to share their ideas with one another, and for participants to share their experiences.

**Organizers:** Jon Scott, Montgomery College; Barbara Edwards, Oregon State University; Nancy Hastings, Dickinson College; and Stan Yoshinobu, Cal Poly San Luis Obispo

**Sponsor:** MAA Committee on Professional Development

### Inquiry-Based Teaching and Learning

*Friday (1/8) morning*

The goal of Inquiry-Based Learning (IBL) is to transform students from consumers to producers of mathematics. Inquiry-based methods aim to help students develop a deep understanding of mathematical concepts and the processes of doing mathematics by putting those students in direct contact with mathematical phenomena, questions, and communities. Within this context, IBL methods exhibit great variety. Activities can take place in single class meetings and span entire curricula for students of any age; students can be guided to re-invent mathematical concepts, to explore definitions and observe patterns, to justify core results, and to take the lead in asking new questions. There is a growing body of evidence that IBL methods are effective and important for teaching mathematics and for fostering positive attitudes toward the subject. This session invites scholarly presentations on the use of inquiry-based methods for teaching and learning. We especially invite presentations that include successful IBL activities or assignments, that support observations about student outcomes with evidence, or that could help instructors who are new to IBL to try new methods.

**Organizers:** Brian Katz, Augustana College; and Victor Piercey, Ferris State University

### Recreational Mathematics: Puzzles, Card Tricks, Games, Game Shows, and Gambling

*Thursday (1/7) morning*

Puzzles, card tricks, games, game shows and gambling provide an excellent laboratory for testing mathematical strategy, probability, and enumeration. Pencil and paper puzzles, board games, game shows, card tricks and card games all provide opportunities for mathematical and statistical analysis. Submissions to this session are encouraged that look at new problems as well as novel approaches to old problems. Submissions by undergraduates or examples of the use of the material in the undergraduate classroom are encouraged.

**Organizers:** Paul R. Coe, Sara B. Quinn, and Marion Weedermaun, Dominican University

### Revitalizing Complex Analysis

*Saturday (1/9) morning*

Complex Analysis, despite its beauty and power, seems to have lost some of the prominence it once enjoyed in undergraduate mathematics, science, and engineering. Thanks to funding from NSF a national dialog has begun with the intention of remedying this situation. Two sessions at the 2015 San Antonio JMM focused on suggestions for curricular reform from a variety of perspectives: modifying the traditional course to include more modern ideas; including modules suitable for student investigation; and instituting a “transitions” course containing a meaty component of complex analysis. Papers at this session should likewise be scholarly, and focus on ways to enliven complex analysis as taught to undergraduates. The table is open to suggestions for technological innovation, pedagogical ideas, or other innovative approaches that seem promising.

**Organizers:** Russell Howell, Westmont College; Paul Zorn, St. Olaf College; and Alan Noell, Oklahoma State University

## The Development and Adoption of Open Educational Resources for Teaching and Learning

Friday (1/8) afternoon

"WSCC"

stands for  
Washington  
State  
Convention  
Center

This session will showcase the increasing popularity of open educational resources (OER) for courses in mathematics and the sciences. Examples of this may include, but are not limited to, the development, enhancement, or adoption of open source or open access course texts and related materials, the creation and/or implementation of course technological enhancements, such as instructional apps and video tutorials, and experiences with the inclusion of low or no-cost homework platforms or mathematics software systems in a particular course. Presenters should attempt to address the effectiveness (formally or informally assessed) of the adoption of such resources in their courses. Presenters from all educational levels and STEM-related fields are encouraged to submit abstracts, with preference awarded to those topics focusing on the high school, community college, and undergraduate levels.

**Organizers:** Benjamin Atchison, Framingham State University, and Jeremy Russell, the College of New Jersey

### GENERAL CONTRIBUTED PAPER SESSIONS

Wednesday, Thursday, Friday, and Saturday (1/6–1/9), morning and afternoon

**Organizers:** Bem Cayco, San Jose State University; Timothy Comar, Benedictine University; and T. James Reid, University of Mississippi  
The MAA's General Contributed Paper Session accepts contributions in all areas of mathematics, curriculum, and pedagogy. Papers will be grouped according to the following classifications.

- Assessment
- History or Philosophy of Mathematics
- Interdisciplinary Topics in

- Mathematics
- Mathematics and Technology
- Mentoring
- Modeling and Applications
- Outreach
- Teaching and Learning Developmental Mathematics
- Teaching and Learning Introductory Mathematics
- Teaching and Learning Calculus
- Teaching and Learning Advanced Mathematics
- Algebra
- Analysis
- Applied Mathematics
- Geometry
- Graph Theory
- Linear Algebra
- Logic and Foundations
- Number Theory
- Probability and Statistics
- Topology
- Other

## MAA Minicourses

### MINICOURSE 1

#### Introductory Proposal Writing Short Course for Grant Applications to the NSF EHR/ Division of Undergraduate Education

Tuesday (1/5), 9:00–11:00 a.m., and 2:00–3:00 p.m., WSCC Room 2A

**Presenters:** John Haddock, Teri Jo Murphy, and Lee Zia, Division of Undergraduate Education, National Science Foundation  
Presenters will describe the general NSF grant proposal process and consider particular details relevant to programs in the Division of Undergraduate Education. This course is geared toward those who have not submitted a proposal to NSF and are unfamiliar with the organization. If you believe you have an idea, project, or program worthy of federal support that will positively affect undergraduate education in mathematics you should attend this session. This two-part short course will provide information on the specific components

of an NSF proposal, demonstrate the NSF peer review process, provide access to previously funded proposals, and explicate the NSF merit review criteria by which proposals are reviewed. Participants should leave this minicourse with a draft of a project summary.

### MINICOURSE 2

#### Visual Topics in Undergraduate Complex Analysis

Part A. Wednesday (1/6), 4:45–6:45 p.m., WSCC Tahoma 5, Tahoma Level 3  
Part B. Friday (1/8), 3:30–5:30 p.m., WSCC Tahoma 5, Tahoma Level 3

**Presenters:** Michael Brilleslyper, U.S. Air Force Academy; and Michael Dorff, Brigham Young University  
Complex analysis is a staple of the undergraduate mathematics curriculum. It is a beautiful mathematical subject that unifies and extends many topics from other courses. The course readily pulls together the theories of polynomial equations, differentiation, integration, and series, while also including geometry and function theory. Unfortunately, many undergraduate courses end right where the cool stuff starts. In this minicourse, the proposers intend to expose the participants to two of the myriad of topics that are possible: (1) an introduction to minimal surfaces, and (2) the dynamics and locations of zeros of families of polynomials. Both of these topics are accessible to an audience having familiarity with the basics of complex analysis. The course is aimed at instructors of complex variables who are looking for some interesting topics for their courses, mathematicians who want to start learning something about the proposed areas, and instructors looking for potential undergraduate research projects to do with their students. Participants will need to bring their own computers with a current version of Mathematica, Maple, or Matlab. There will be limited support for Sage.

## MINICOURSE 3

**Designing and Implementing a Problem-Based Mathematics Course**

*Part A. Wednesday (1/6), 4:45–6:45 p.m., Metropolitan B, 3rd Floor, Sheraton*

*Part B. Friday, 3:30–5:30 p.m., Metropolitan B, 3rd Floor, Sheraton*

**Presenters:** Gail Burrill, Michigan State University; Bowen Kerins, Educational Development Center; and Darryl Yong, Harvey Mudd College

A problem-based math course, where students spend most of the time in an interactive, collaborative environment, working on problems connecting various mathematical domains, can simultaneously engage a broad range of students and enlarge their understanding of what it means to do math. The panelists will discuss the design of such a course, consider issues related to teaching the course, and describe how it might be implemented in a mathematics program. Such courses were originally developed for teachers at the Park City Mathematics Institute, but are applicable for undergraduate majors, prospective teachers, or as part of continuing education programs for experienced teachers. Discussion will be framed by asking what the mathematical goals of such a course might be, how these goals could contribute to a better student understanding of what it means to do mathematics and how such courses might be part of the offerings in a typical math department.

## MINICOURSE 4

**Teaching Mathematics with Sports Applications**

*Part A. Wednesday (1/6), 2:15–4:15 p.m., Metropolitan B, 3rd Floor, Sheraton*

*Part B. Friday, 1:00–3:00 p.m., Metropolitan B, 3rd Floor, Sheraton*

**Presenter:** Rick Cleary, Babson College

This minicourse is designed to help participants who wish to develop a course in mathematics and sports, or to incorporate sports applications

into existing courses. The depth of the problems will range from those that require little mathematical background (elementary probability, statistics, and combinatorics) that would be suitable in a first-year seminar or general education course, to more sophisticated topics (linear algebra, operations research, mathematics of finance) that can make up an elective for mathematics majors or minors. Examples will come from many different sports including baseball, basketball, football, figure skating, and distance running, depending on the interest of participants. Application topics will include strategy, ranking and judging, efficient scheduling, and optimization. Participants will find many of the issues are connected to essays in the MAA published book **Mathematics and Sports** edited by Joe Gallian.

## MINICOURSE 5

**Teaching Introductory Statistics for Instructors New to Teaching Statistics**

*Part A. Wednesday (1/6), 9:00–11:00 a.m., Metropolitan A, 3rd Floor, Sheraton*

*Part B. Friday, 9:00–11:00 a.m., Metropolitan A, 3rd Floor, Sheraton*

**Presenter:** Carolyn K. Cuff, Westminster College

This minicourse, intended for instructors new to teaching statistics, exposes participants to the big ideas of statistics and the ASA-endorsed Guidelines for Assessment and Instruction in Statistics Education (GAISE) report. It considers ways to engage students in statistical literacy and thinking, and contrast conceptual and procedural understanding in the first statistics course. Participants will engage in many of the classic activities that all statistics instructors should know. A set of approximately six to eight hands-on, classroom-ready activities will be given to participants. Parts of each activity will be done by the participants, other parts will be summarized by the presenter, and the main statistical ideas of the activity

will be explained to the participants.

The activities have been chosen so that they require minimal adaptation for a wide variety of classrooms and are easy to implement. Each activity includes goals, key ideas, prerequisite skills and concepts, connection to other statistical concepts, objectives, known student difficulties, and assessment questions. Internet sources of real data, activities, and best practices articles will be examined. Participants will find out how they can continue to learn about the best practices for the first course in statistics by becoming involved in statistics education–related conferences, newsletters, and groups.

## MINICOURSE 6

**Getting Started in the Scholarship of Teaching and Learning**

*Part A. Thursday, 9:00–11:00 a.m., WSCC Tahoma 5, Tahoma Level 3*

*Part B. Saturday, 9:00–11:00 a.m., WSCC Tahoma 5, Tahoma Level 3*

**Presenters:** Jacqueline M. Dewar and Curtis D. Bennett, Loyola Marymount University

This course will introduce participants to the scholarship of teaching and learning (SoTL) in mathematics and help them begin projects of their own. We describe a taxonomy of SoTL questions, provide examples of SoTL projects in mathematics, and discuss methods for investigation. Participants will learn about collecting and analyzing different types of evidence, dealing with human subjects requirements, and selecting venues for presenting or publishing their work. With the presenters' guidance, participants interactively select and transform a teaching problem of their own into a question for scholarly investigation and identify several types of evidence to gather.

## MINICOURSE 7

**Making Sense of Calculus with Mapping Diagrams**

*Part A. Thursday, 1:00–3:00 p.m., Metropolitan A, 3rd Floor, Sheraton*

*Part B. Saturday, 1:00–3:00 p.m., Metropolitan A, 3rd Floor, Sheraton*

**Presenter:** Martin Flashman, Humboldt State University

In this minicourse, participants will learn how to use mapping diagrams (MD) to visualize functions for many calculus concepts. For a given function,  $f$ , a mapping diagram is basically a visualization of a function table that can be made dynamic with current technology. The MD represents  $x$  and  $f(x)$  from the table as points on parallel axes, and arrows between the points indicate the function relation. The course will start with an overview of MDs and then connect MDs to key calculus definitions and theory including: linearity, limits, derivatives, integrals, and series. Participants will learn how to use MDs to visualize concepts, results, and proofs not easily realized with graphs for both single and multivariable calculus. Participants are encouraged to bring a laptop with wireless capability.

#### MINICOURSE 8

### Algebraic Geometry: A Problem-Based Course

*Part A. Wednesday (1/6), 2:15–4:15 p.m., WSCC Tahoma 5, Tahoma Level 3*

*Part B. Friday, 1:00–3:00 p.m., WSCC Tahoma 5, Tahoma Level 3*

**Presenters:** Thomas Garrity, Williams College; and Ryan Brown, Georgia College

Participants will learn how to structure an introductory undergraduate course in algebraic geometry that is problem based (and hence an inquiry-based learning course). As algebraic geometry is one of the core subjects of mathematics, such a course allows undergraduates to be introduced to a tremendous amount of material. Further, such a course can be and has been taught either with a linear algebra prerequisite or with an abstract algebra prerequisite. This type of course should be of interest to students who want to become secondary-school-teachers and also to those students who plan to pursue

graduate work in mathematics. People who want to teach an IBL algebraic geometry course or who just want a brief introduction to algebraic geometry are encouraged to attend.

#### MINICOURSE 9

### Increasing Student Engagement and Understanding through Active-Learning Strategies in Calculus

*Part A. Wednesday (1/6), 2:15–4:15 p.m., Metropolitan A, 3rd Floor, Sheraton*

*Part B. Friday, 1:00–3:00 p.m., Metropolitan A, 3rd Floor, Sheraton*

**Presenters:** Debbie Gochenaur, Shippensburg University; Larissa Schroeder, University of Hartford; Matt Boelkins, Grand Valley State University; Angie Hodge, University of Nebraska Omaha; Carrie Diaz Eaton, Unity College; and Dana Ernst, Northern Arizona University

Participants will learn curricular and cocurricular evidence-based, active-learning strategies to embed in a Calculus I course. Active learning is a process whereby students engage in activities, such as writing, discussion, or problem solving that promote analysis, synthesis, and evaluation of class content; positively affecting student success can begin with an increase in student engagement within the classroom. This minicourse, intended for the novice user, will include small group discussion and hands-on development of active-learning strategies. Participants should bring digital copies of their own curriculum material so that strategies can be embedded into personal material during the workshop. Bring a laptop with wireless capability.

**Sponsor:** MAA-NCTM joint Committee on Mutual Concerns

#### MINICOURSE 10

### Directing Undergraduate Research

*Part A. Thursday, 1:00–3:00 p.m., WSCC Tahoma 5, Tahoma Level 3*

*Part B. Saturday, 1:00–3:00 p.m.,*

*WSCC Tahoma 5, Tahoma Level 3*

**Presenter:** Aparna Higgins, University of Dayton

This minicourse will cover many aspects of facilitating research by undergraduates, such as getting students involved in research, finding appropriate problems, deciding how much help to provide, and presenting and publishing the results. Similarities and differences between research conducted during summer programs and research that can be conducted during the academic year will be discussed. The minicourse is designed for faculty who are new to directing undergraduate research. Although the examples used will be primarily in the area of discrete mathematics, the strategies discussed can be applied to any area of mathematics.

#### MINICOURSE 11

### Implementing Inquiry-Oriented Curricula for Linear Algebra, Differential Equations, and Abstract Algebra

*Part A. Wednesday (1/6), 9:00–11:00 a.m., Metropolitan B, 3rd Floor, Sheraton*

*Part B. Friday, 9:00–11:00 a.m., Metropolitan B, 3rd Floor, Sheraton*

**Presenters:** Estrella Johnson, Virginia Tech; Karen Keene, North Carolina State University; and Christy Andrews-Larson, Florida State University

This session is designed to inform and support instructors interested in implementing inquiry-oriented curriculum. By inquiry-oriented we mean that the students are engaging in authentic mathematical inquiry and the teachers are actively involved in inquiring into students' mathematical thinking. This minicourse will have two components. In the first component, participants will engage with mathematical tasks from three different research-based inquiry-oriented curricula that have been developed for linear algebra, differential equations, and abstract algebra. The goals of this component are to familiarize



“WSCC” participants with the curricular tasks, the nature of the instruction, and common ways of student thinking.

The second component will focus on high-leverage teaching practices that can be used in any inquiry-oriented setting. Examples of such practices include leading whole class discussions and launching instructional tasks. The goals of this component are to provide instructors with opportunities to develop some of the necessary teaching practices needed to implement inquiry-oriented curricula.

The Conference Center is a different building.

### MINICOURSE 12

#### Humanistic Mathematics

Part A. Wednesday (1/6), 9:00–11:00 a.m., Conference Center, Tahoma 5, Tahoma Level 3

Part B. Friday, 9:00–11:00 a.m., Conference Center, Tahoma 5, Tahoma Level 3

**Presenters:** Gizem Karaali, Pomona College; and Eric Marland, Appalachian State University

The phrase “humanistic mathematics” is historical, going back about 30 years and awakens many connotations in those who hear it. Indeed, humanistic mathematics can include a broad range of topics; we use it in two distinct manners. First, as a scholarly perspective, humanistic mathematics describes an approach to mathematics that views it as a human endeavor and focuses on the paths of inquiry that study its aesthetic, cultural, historical, literary, pedagogical, philosophical, psychological, and sociological aspects.

Second, as a pedagogical stance, humanistic mathematics explores and builds on the relationship of mathematics with its nontraditional partners in the humanities, the fine arts, and social sciences, providing additional perspective for the role of mathematics in a liberal arts education. This minicourse will introduce participating mathematics faculty to the ideas and scholarship of humanistic mathematics, a body of literature that eschews disciplinary jargon (e.g.,

edu-speak) in favor of reaching a more diverse audience. As concrete outcomes, participants will

- Develop a viable plan for a liberal arts course that they can offer at their own campuses to invite many new students into the fascinating world of mathematics;
- Come up with ideas for possible scholarly projects in order to contribute to the ongoing conversations in the field;
- Connect with like-minded colleagues; and
- Get informed about possible venues of communication, collaboration, and dissemination of materials related to humanistic mathematics.

### MINICOURSE 13

#### Introduction to Process-Oriented Guided Inquiry Learning (POGIL) in Mathematics Courses

Part A. Thursday, 1:00–3:00 p.m., Metropolitan B, 3rd Floor, Sheraton

Part B. Saturday, 1:00–3:00 p.m., Metropolitan B, 3rd Floor, Sheraton

**Presenters:** Laurie Lenz, Marymount University, and Catherine Beneteau, University of South Florida  
This workshop will introduce faculty to the guided inquiry instructional method called POGIL (Process-Oriented Guided Inquiry Learning). Participants will use hands-on activities to learn the crucial elements in a successful guided inquiry classroom. The workshop will provide participants with a basic introduction to facilitation techniques and an opportunity to reflect on how facilitation can enhance or interfere with student learning as well as how facilitation strategies can be critical in the development of student process skills. The participants will have the opportunity to examine a POGIL calculus activity and be introduced to the way the learning structure that is integrated into all POGIL activities is implemented in a mathematics specific activity. By the end of the workshop, participants will be trained

to begin implementing guided inquiry activities in their own mathematics classrooms.

**Organizers:** Zdeňka Guadarrama, Rockhurst University; Jill E. Guerra, University of Arkansas Fort Smith; and Laurie Lenz, Marymount University

### MINICOURSE 14

#### Teaching Quantitative Reasoning with Common Sense and Common Knowledge

Part A. Thursday, 9:00–11:00 a.m.,

Metropolitan B, 3rd Floor, Sheraton

Part B. Saturday, 9:00–11:00 a.m.,

Metropolitan B, 3rd Floor, Sheraton

**Presenters:** Maura B. Mast, University of Massachusetts Boston; and Ethan D. Bolker, University of Massachusetts Boston

Ten years from now, what do you want or expect your Quantitative Reasoning students to remember? Our answers to those questions profoundly shaped our approach to the course. We realized that in 10 years, what matters will be how students approach a problem using the tools they carry with them—common sense and common knowledge—not the particular mathematics we chose for the curriculum. This has changed how and what we teach. In this minicourse we will provide hands-on experience with class activities using our approach and practice creating examples and exercises from current news.

### MINICOURSE 15

#### Teaching Statistics using R and RStudio

Part A. Thursday, 10:00 a.m.–noon,

Metropolitan A, 3rd Floor, Sheraton

Part B. Saturday, 10:00 a.m.–noon,

Metropolitan A, 3rd Floor, Sheraton

**Presenter:** Randall Pruium, Calvin College

R is a freely available language and environment for statistical computing and graphics that has become popular in academia and in many industries. But can it be used with students? This minicourse will introduce participants

to teaching applied statistics courses using computing in an integrated way. The presenter has been using R to teach statistics to undergraduates at all levels for the last decade and will share an approach and some favorite examples. Topics will include workflow in the RStudio environment, providing novices with a powerful but manageable set of tools, data visualization, basic statistical inference using R, and resampling. Much of this will be facilitated using the mosaic package. The minicourse is designed to be accessible to those with little or no experience teaching with R and will provide participants with skills, examples, and resources that they can use in their own teaching. Participants should bring a laptop to the session.

#### MINICOURSE 16

### Mobile Mathematics— Interactive Apps for Teaching and Learning

*Part A. Wednesday (1/6), 4:45–6:45 p.m., Metropolitan A, 3rd Floor, Sheraton*

*Part B. Friday, 3:30–5:30 p.m., Metropolitan A, 3rd Floor, Sheraton*

**Presenters:** Lila Roberts, Clayton State University; and Andrew G. Bennett, Kansas State University  
Mobile devices have made their way into our lives and our classrooms. In this minicourse, participants will learn about various ways to integrate tablets and other mobile devices into mathematics courses. The presenters will demonstrate interactive resources that they have developed as well as other applications/materials that are ready made and easily available. In addition, participants will learn how to use various ways to develop new and/or adapt existing resources for their face-to-face and online classrooms. Bring your own mobile device and/or a wireless-capable laptop computer.

## MAA Panel Sessions

### NSF Funding Opportunities for the Learning and Teaching of the Mathematical Sciences

**Part I: Undergraduate/Graduate Education, Department of Mathematics Infrastructure, and Human Resource Development (DUE/DGE/DMS/HRD)**

*Wednesday (1/6), 8:00–9:15 a.m., WSCC Room 609*

**Part II: The K-16 Continuum—Learning Science & Research and Pre- and Inservice Teachers (DUE/DRL)**

*Wednesday (1/6), 9:30–10:30 a.m., WSCC Room 609*

A number of NSF divisions offer grant programs that support innovations in learning and teaching in the mathematical sciences. These programs will be discussed along with examples of successful projects in two sessions. Anticipated budget highlights and other new initiatives for the next fiscal year, as appropriate, will also be presented.

**Organizers:** John Haddock and Lee Zia, Division of Undergraduate Education, NSF; Karen King, Division of Research on Learning, NSF; Tasha Inniss, Division of Human Resource Development, NSF; Jennifer Slimowitz Pearl, Division of Mathematical Sciences, NSF

**Sponsor:** MAA Committee on Professional Development

### MAA Session for Chairs: What Department Chairs Should Know about Teaching with Technology

*Thursday (1/7), 9:00–10:20 a.m., WSCC Room 609*

Based on their experience as developers and users of technology to support teaching, the panelists will address the following: the goals for learning outcomes and pedagogy, infrastructure and other resources needed for a new initiative, institutionalizing the results of

successful pilot programs, and ADA requirements. During the discussion following the panelists' presentations, attendees are invited to share their experiences as well as ask questions of the panelists.

**Organizers:** Catherine M. Murphy, Purdue University Calumet; and Daniel Maki, Indiana University  
**Panelists:** Michael Gage, University of Rochester; Gavin LaRose, University of Michigan; and Peter Turbek, Purdue University Calumet

### Advanced Placement Calculus Today: Opportunities and Challenges

*Wednesday (1/6), 9:35–10:55 a.m., WSCC Room 612*

There is a growing debate as to whether more students should take calculus in high school. The data suggest that the public believes they should, as more and more students enroll in Honors and Advanced Placement Calculus classes. This increased enrollment dramatically affects the AP Calculus Program and university course offerings. The panelists will discuss the AP Calculus Program, how it aligns to postsecondary calculus courses, recent changes in the course content and examination, the development of assessment items, and the exam scoring process. The discussion will also focus on mathematical practices for AP Calculus that engage students in developing conceptual understanding of core concepts, those ideas that are necessary to apply important techniques and procedures. As a consequence of expanding enrollment in high school calculus, participants will be asked to consider the prerequisite skills and knowledge for an AP Calculus course.

**Organizer:** Ben Hedrick, College Board

**Panelists:** Don King, Northeastern University; Dan Teague, North Carolina School of Science and Mathematics; Gail Burrill, Michigan State University; and Stephen Davis, Davidson University

## Career Options for Undergraduates

Thursday (1/7), 10:35–11:55 a.m.,  
WSCC Room 609

A common question for math majors to ask is, “What options are available for someone with a math degree?” In today’s global marketplace, employers are increasingly seeking candidates with a degree in mathematics, applied mathematics, or statistics. Panelists will showcase options for career paths in academia as well as settings such as industry, government, and nonprofits. They also will speak about their own career experiences.

**Organizers:** Thomas P. Wakefield, Youngstown State University; and Kristine Roinestad, U.S. Census Bureau

**Panelists:** Thomas Grandine, Boeing Corp.; Katie Oliveras, Seattle University; and Marcia A. Ciol, University of Washington

**Sponsor:** Young Mathematicians Network

## College Calculus and the Preparation Gap: Identified Problems and Models for Improvement

Friday (1/8), 8:00–9:20 a.m., WSCC Room 612

Mathematics departments and their faculty face the difficult task of providing effective introductory calculus courses for students with significantly different backgrounds in mathematics. Some students have completed high school calculus, in courses of varied quality, and others have never seen calculus before. Some have strong preparation for college calculus, while others have significant deficits in their backgrounds. Panelists will share results of recent research about the nature and impact of these challenges and will describe some models for success in dealing with this issue.

**Organizers:** Michael Boardman, Pacific University; Gail Burrill, Michigan State University; and David Bressoud, Macalester College

**Panelists:** David Bressoud, Macalester

College; Deborah Hughes Hallett, Harvard University; Robin Cruz, College of Idaho; Dave Dwyer, University of Evansville; and Chad Topaz, Macalester College

**Sponsors:** MAA/NCTM Joint Committee on Mutual Concerns, College Board/MAA Joint Committee on Mutual Concerns

## Creating a Meaningful Calculus I Experience for Students Entering with High School Calculus

Wednesday (1/6), 8:00–9:20 a.m.,  
WSCC Room 612

Jim McClure of Purdue once said, “Once a student has been exposed to calculus, it is hard to treat them.” With the sharp increase in the number of students enrolling in Calculus I who have had some calculus experience in high school (as high as 70 percent at some research universities, according to David Bressoud, CBMS talk on “Building for Success in Calculus,” October 2014), programs are struggling with the question of how to best serve these students in their introductory calculus courses. In this session, we will explore and discuss approaches used at different universities to address this concern.

**Organizer:** Alison Reddy, University of Illinois

**Panelists:** Michael Boardman, Pacific University; Randy McCarthy, University of Illinois; Robin Permante, University of Pennsylvania; and Uri Treisman, University of Texas

**Sponsors:** MAA/NCTM Joint Committee on Mutual Concerns, College Board/MAA Joint Committee on Mutual Concerns

## Developing Mathematical Concepts with Technology

Thursday (1/7), 10:35–11:55 a.m.,  
WSCC Room 612

Although technology is often used as a tool for doing mathematics—creating graphs and crunching numbers—it can also be a powerful tool for developing understanding of mathematical concepts. Interactive

dynamic technology can play a central role in helping students grapple with and come to understand ideas in mathematics. CAS technology, in particular, offers the potential for students to explore sophisticated and subtle mathematical concepts helping them develop some of the fundamentals needed for moving fluently among the ideas and making connections among concepts. The panelists will share examples from calculus, geometry, introductory statistics, linear algebra, and differential equations; discuss the affordances and limitations of technology; offer suggestions from research about how technology can be used effectively; and engage the audience in a discussion about the effective use of the technology. The discussion will focus on interactive dynamic technology but will also include a broader perspective on technologies available for use in teaching.

**Organizer:** Gail Burrill, Michigan State University

**Panelists:** Wade Ellis, West Valley Community College; Tom Dick, Oregon State University; Andrew Bennett, University of Kansas; and Gail Burrill, Michigan State University

## Developing the MAA Pedagogy Guide

Wednesday (1/6), 2:15–3:35 p.m.,  
WSCC Room 609

In revising the *Curriculum Guide*, the MAA Committee on the Undergraduate Program in Mathematics (CUPM) encountered questions related to “how we teach” instead of “what we teach.” As a result in September 2014, the MAA Committee on the Teaching of Undergraduate Mathematics (CTUM) was charged with developing a pedagogy guide to help faculty become more aware of research-based pedagogical approaches, course design, and assessment of student learning. Panel members will discuss various aspects of the pedagogy guide, including successful approaches for teaching various mathematics content areas,

instructional techniques such as inquiry-based learning and flipped classrooms, approaches to addressing student skills such as writing and other forms of communication, course design, classroom climate, and student motivation. The panel discussion also provides an opportunity for members of the mathematics community to provide input to the pedagogy guide as it is being developed.

**Organizer:** Martha Abell, Georgia Southern University

**Panelists:** Jacqueline Dewar, Loyola Marymount University; Gavin LaRose, University of Michigan; Carol Schumacher, Kenyon College; Lew Ludwig, Denison University; and Diana White, University of Colorado Denver

### Finding a Thesis Topic and Adviser

*Wednesday (1/6), 3:50–5:10 p.m., WSCC Room 609*

Your choice of graduate school is an important career decision, but equally important is your choice of thesis adviser and topic. An adviser and topic that is right for you can give you the jump-start you need for your career, while a poorly chosen one can be detrimental. In this panel, our experts will offer advice and tips on choosing both a thesis adviser and a topic, addressing such questions as: Do I have to come up with my own research problem? Does it matter if I like or get along well with my adviser? How much does my adviser's reputation in the mathematical community matter? What if I need to change my adviser or my adviser retires or changes schools? How much guidance should I expect from my adviser? Should I choose a graduate school based on a potential adviser? This panel is not only for graduate students, but also for undergraduates who are planning on attending graduate school.

**Organizers:** Nicholas Scoville, Ursinus College; and Emily Cilli-Turner, Salve Regina University

**Panelists:** Allison Henrich, Seattle

University; and Brooke Shipley, University of Illinois at Chicago

**Sponsor:** Young Mathematicians Network

### Guidelines for Statistics Education: MAA Curriculum Guide, ASA Guidelines, GAISE II, and SET

*Friday (1/8), 8:00–9:20 a.m., WSCC Room 609*

In recognition of the increasing importance of statistics and statistics education, there have been four major new reports on statistics education in the last year and a half. This panel focuses on these reports:

The MAA 2015 **Curriculum Guide** recommends that “every mathematical sciences major should have, at a minimum, . . . a command of data analysis and statistical inference at a level equivalent to that obtained in an applied data analysis course.” The *Curriculum Guide* links to a report giving recommendations for this course, as well as a report giving recommendations for statistics programs.

The American Statistical Association published its Curriculum Guidelines for Undergraduate Programs in Statistical Science in November 2014. These guidelines update previous guidelines published in 2000.

The original GAISE (*Guidelines for Assessment and Instruction in Statistics Education*) College Report was written in 2005 and endorsed by the ASA and AMATYC. These guidelines are being updated this year, and the GAISE 2016 report is expected in early 2016.

The Statistics Education of Teachers (SET) report came out in early 2015 and gives specific recommendations for the statistics education of preservice K-12 teachers. The Conference Board of the Mathematical Sciences (CBMS) identified the statistical preparation of teachers as an area of concern in their document, Mathematics Education of Teachers 2 (MET2). The SET report addresses this concern.

We will have four panelists, each an

author on one of these four reports. The panelists will share the results of the different reports and will discuss implications of the reports for programs in mathematics, statistics, and mathematics education.

**Organizers:** Patti Frazer Lock, St. Lawrence University; Sue Schou, Idaho State University; and Randall Pruim, Calvin College

**Panelists:** Patti Frazer Lock, St. Lawrence University; Michelle Everson, Ohio State University; Chris Franklin, University of Georgia; and Beth Chance, Cal Poly San Luis Obispo

**Sponsor:** SIGMAA STAT ED

### Improving the Preparation of Graduate Students to Teach Mathematics: An NSF-Funded Project

*Wednesday (1/6), 3:50–5:10 p.m., WSCC Room 612*

The mathematics community's responsibility for preparing graduate students to teach is an issue of increasing concern. While there are many departments and faculty who would like to provide teaching-related professional development (PD) for their graduate students (Austin, 2002; Blair, Kirkman, Maxwell, 2013), there is no central clearinghouse that makes the resources broadly visible and easily accessible to the mathematics community.

A second barrier to the development of PD programs for TAs is the limited interaction and collaboration between researchers of undergraduate mathematics teaching and those who prepare graduate students to teach, all of whom share a common interest in improving the teaching of undergraduate mathematics. A recently funded NSF IUSE project aims to develop stronger connections and support networks between three groups: (1) those who conduct research on teaching assistant professional development; (2) those who create professional development materials for TAs; and (3) those who deliver the professional development in their departments.

Panelists will discuss background work that led to the development of the project as well as project components, including, an online Resources Suite, workshops for those who wish to provide TA PD, networks for those involved in all aspects of TA PD, and distance delivery of PD for mathematics TAs.

**Organizer:** Jessica Deshler, West Virginia University

**Panelists:** Jack Bookman, Duke University; Robin Gottlieb, Harvard University; Shandy Hauk, WestEd; Sarah Schott, Duke University; and Natasha Speer, University of Maine

**Sponsor:** MAA Committee on Professional Development

### Instructional Strategies That Can Make a Difference

*Friday (1/8), 9:35–10:55 a.m., WSCC Room 612*

Research has suggested some ways of supporting learning can make a difference in what students learn and what they remember. The NCTM's recent publication, *Principles to Action*, describes what these could look like in K-12 classrooms, for example, facilitating productive discussion, posing meaningful questions, using and connecting mathematical representations. Are there counterparts for instruction at the postsecondary level? Panelists will talk about what these might be and how they can look in postsecondary classrooms.

**Organizer:** Gail Burrill, Michigan State University

**Panelists:** Tom Dick, Oregon State University; Diane Briars, National Council of Teachers of Mathematics; Brian Hopkins, St. Peters University; and Darryl Yong, Harvey Mudd College

**Sponsor:** MAA/NCTM Joint Committee on Mutual Concerns

### Interdisciplinary Modeling Experiences for Undergraduates

*Thursday (1/7), 1:00–2:20 p.m., WSCC Room 609*

This panel will feature faculty

discussing the opportunities and challenges of developing interdisciplinary modeling experiences for undergraduates. Ideas for how to develop these experiences inside (courses or projects) or outside (contests, learning communities, community service experiences) the classroom will be presented. Each of the panelists will focus on advantages and disadvantages faced while developing interdisciplinary modeling opportunities, including time, resources, and institutional support. This panel is designed for faculty teaching or leading any form of modeling or problem solving. Significant time will be reserved for questions from the audience and between the panelists.

**Organizers:** Amanda Beecher, Ramapo College of New Jersey; and Chris Arney, U.S. Military Academy

**Panelists:** Heidi Berger, Simpson College; Jessica Libertini, Virginia Military Institute; Gary Olson, University of Colorado Denver; and Robert Wooster, College of Wooster

### Is Online Inquiry-Based Learning (IBL) Possible?

*Thursday (1/7), 2:35–3:55 p.m., WSCC Room 609*

Inquiry-based learning (IBL) is insistent on having students do mathematics: the pedagogy is based on challenging students to create, discover, produce solutions to problems, conjecture, experiment, explore, interact, opine, and prove or disprove claims. IBL encourages students to engage so students cannot simply sit and “absorb.” Faculty cannot figuratively open heads and pour in the knowledge. Students are to conjecture, experiment, explore, and solve problems. Socratic inquiry via IBL is not a process where there is information exchanged. There are a number of types of IBL methods across the full range of schooling and ranges from active learning to discovery learning through to the Moore method. A fundamental part of IBL is students are guided through well-crafted notes

in mathematical discovery. This panel discussion will focus on whether IBL can be achieved in an online course. Panelists will discuss their successes, or lack thereof, with IBL for online courses or hybrids (a way that augments face-to-face class) that do not sacrifice depth for breadth, that foster discussion, and that support authentic inquiry. We also shall include panelists who will justify why they opine such cannot be achieved within the framework of IBL.

**Organizers:** Padraig McLoughlin, Kutztown University of Pennsylvania; and Perry Y. C. Lee, Kutztown University of Pennsylvania

**Panelists:** TBD

### Learning from Each Other: International Perspectives on the Mathematical Education of Teachers

*Friday (1/8), 1:00–2:20 p.m., WSCC Room 612*

Every country has its own ways of educating its teachers, because of a combination of historical factors and the way the country is organized. So we cannot simply look at another country and say, “Wow, they do so much better than us on the TIMSS (or PISA)—let's do what they do.” For example, some countries are less concerned about including students with disabilities than we are. However, there is still value in looking at what other countries do and considering whether some aspects of their approaches might be worthwhile for us to modify and adopt. There have been several studies of what is being done in other countries: China, Korea, and Germany, among others. Panelists will speak on aspects of mathematical education of teachers in other countries that perhaps are worth discussing in the United States.

**Organizers:** Bonnie Gold, Monmouth University; and David C. Carothers, James Madison University

**Panelists:** Tad Watanabe, Kennesaw State University; Catherine B. Kessel, Mathematics Education Consultant,

Berkeley, California; and William Schmidt, Michigan State University  
**Sponsor:** MAA Committee on the Mathematical Education of Teachers (COMET)

### Midcareer Faculty: Charting the Next Half of Your Career

Thursday (1/7), 1:00–2:20 p.m., WSCC Room 612

Mentoring programs often focus on new faculty but midcareer faculty can benefit from mentoring too. While they have issues and interests that differ from faculty just starting their career, they also have a wider spectrum of opportunities open to them. This panel session features several successful midcareer faculty who have taken different paths after tenure. They will share some of their wisdom for charting an interesting second half of one's career.

**Organizer:** Jenna P. Carpenter, Louisiana Tech University

**Panelists:** Jonathan K. Hodge, Grand Valley State University; Judith Covington, Louisiana State University at Shreveport; Annalisa Crannell, Franklin and Marshall College; Brigitte Lahme, Sonoma State University; and Ronald Taylor, Berry College

**Sponsor:** MAA Committee on Professional Development

### Perspectives on IBL Teaching: Novice, Experienced, and Master

Friday (1/8), 9:35–10:55 a.m., WSCC Room 609

Panelists will share their experiences in getting started with inquiry-based learning (IBL) and perspectives on maintaining these techniques over time. They will share a quick thought on the opportunities and challenges of IBL courses, but a large fraction of the time will be reserved for questions from the audience. Our panelists include someone new to IBL teaching, someone with enough experience to feel comfortable designing a new course, and an acknowledged master teacher who has mentored others in

IBL teaching.

**Organizers:** Judith Covington, Louisiana State University at Shreveport; and Theron Hitchman, University of Northern Iowa

**Panelists:** Angie Hodge, University of Nebraska Omaha; Mitchel T. Keller, Washington and Lee University; and Carol Schumacher, Kenyon College

### Summer Research Programs

Thursday (1/7), 2:35–3:55 p.m., WSCC Room 612

The MAA has sponsored Summer Research Programs with funding from NSF and NSA since 2003. Each program consists of a small research group of at least four minority undergraduates mentored by a faculty member. About 130 sites have been funded as of summer 2015. Yunus Zeytuncu of the University of Michigan–Dearborn, Brett Sims of the Borough of Manhattan Community College, and Min-Lin Lo of California State University, San Bernardino, will discuss their programs. There will be ample time for questions and discussion. It is expected that funding will be available for summer 2016. Additional information can be found on the NREUP website at [maa.org/programs/faculty-and-departments/underrepresented-groups/nreup](http://maa.org/programs/faculty-and-departments/underrepresented-groups/nreup).

**Organizers:** Lloyd E. Douglas, Independent Consultant; William A. Hawkins Jr., MAA and University of the District of Columbia; and Robert Megginson, University of Michigan

**Sponsor:** MAA Committee on Minority Participation and the MAA Office of Minority Participation

### Undergraduate Research as a Capstone Course

Friday (1/8), 1:00–2:20 p.m., WSCC Room 609

Undergraduate research in the mathematical sciences has flourished over the past decade. The number of undergraduates engaging in mathematical sciences research has increased dramatically over the past few years. Indicators of this growth

include the size of the undergraduate poster session at the Joint Mathematics Meetings (e.g., over 300 posters at the 2014 meeting), the number of mathematics Research Experience for Undergraduates programs (now close to 70), and the recent creation of journals devoted to mathematics undergraduate research (e.g., *Involve* at UC Berkeley). Undergraduate research is now a major factor in preparing students for graduate school and industrial careers. There are many models of undergraduate research in the mathematical sciences, such as semester-long projects that are completed for honors or thesis credit, nationally funded summer REUs, and research projects that engage students over a longer period, usually two to four semesters. All these models have one thing in common: the research experience is not targeting all students in a class or institution. At many institutions, mathematics majors fulfill a capstone course. Usually such courses are nonstandard courses and/or interdisciplinary and are not normally offered as part of the undergraduate curriculum. Students are expected to read research articles, write expository reports, and make presentations. In this panel, we seek examples of models that have incorporated undergraduate research as a component of a capstone course. The panel will discuss strategies for selecting appropriate projects, mentoring students for successful outcomes, and assessment of students' work.

**Organizers:** Aklilu Zeleke, Michigan State University; James Solazzo, Coastal Carolina University; Michael Karls, Ball State University

**Panelists:** Anant Godbole, East Tennessee State University; Keshav Jagannathan, Coastal Carolina University; Rebecca Garcia, Sam Houston State University; and Sergio Loch, Grand View University

**Sponsor:** MAA Subcommittee on Research by Undergraduates

For updated material, visit the website <http://jointmathematicsm meetings.org/>

## Renewing the First Two Years Curriculum: Calculus, Quantitative Reasoning, Statistics, Precalculus, and Developmental Mathematics

Friday (1/8), 2:35–3:55 p.m., WSCC Room 612

This broad array of mathematics courses taught in the first two years is key to student success in college, both for prospective majors in STEM and as part of the general education for all majors. National efforts to renew the first two years' curriculum are under way with the goal that introductory courses be interesting and engaging for students, reflect modern workforce use of mathematics, and prepare students for subsequent coursework and their lives as citizens.

To accomplish these lofty goals, we all need to revise our curriculum—updating standard courses and reconsidering courses that no longer work. Where is your department in this effort? A great place to start is to learn more about successful programs that you might easily adapt to your needs. Whether you are just getting started or already renewing your curriculum, come learn more about what's happening on the national scene.

Panelists will describe innovative trends and resources for renewing calculus, building quantitative reasoning courses, modernizing introductory statistics, improving courses that prepare students for calculus, and restructuring developmental mathematics.

Department chairs, academic leaders, and faculty engaged in curriculum renewal of mathematics courses in the first two years are especially encouraged to attend.

**Organizer:** Suzanne I. Dorée, Augsburg College

**Panelists:** Michael Axtell, University of St. Thomas; Caren Diefenderfer, Hollins University; Patti Frazer Lock, St. Lawrence University; Rebecca Hartzler, Seattle Central College; and Bruce Yoshiwara, Pierce College

**Sponsor:** MAA Committee on

Curriculum Renewal Across the First Two Years (CRAFTY)

## Starting a New Track: Actuarial Science, Biomathematics, Environmental Science, Climate Studies

Saturday (1/9), 9:00–10:20 a.m., WSCC Room 609

Mathematicians that have successfully implemented either a track within the mathematics major, a double major, or a fully integrated major in actuarial science, biomathematics, or environmental science and climate studies will briefly describe the necessary components of such a program, including the opportunities and the obstacles to implementation in a mathematics department. For each such program, there will be ample time to consult with the experts so as to determine how one's own department might encourage the professional development of its mathematics faculty and/or the cooperation within an institution to allow for implementation of some level of interdisciplinary tracks in these three areas.

**Organizers:** Julie Barnes, Western Carolina University; Martha Siegel, Towson University; and Linda McGuire, Muhlenberg College

**Panelists:** Jim Daniel, University of Texas at Austin; Tim Comar, Benedictine University; and Ben Galluzzo, Shippensburg University

**Sponsors:** MAA Committee on the Undergraduate Program in Mathematics (CUPM) and MAA Committee on Professional Development

## A Common Vision for the Undergraduate Mathematics Program in 2025

Friday (1/8), 2:35–3:55 p.m., WSCC Room 609

Each year approximately 50 percent of students fail to pass college algebra with a grade of C or better. Failure rates under traditional lecturing are 55 percent higher than the rates observed under active learning. Challenges like these are highlighted in reports such

as *The Mathematical Sciences in 2025* (NRC) and *Engage to Excel* (PCAST), and have led to differentiated responses from different groups in the mathematical sciences. The Common Vision project [NSF DUE-1446000] has brought together leaders from five professional associations in the mathematical sciences—AMATYC, AMS, ASA, MAA, and SIAM—to provide a snapshot of the current thinking about undergraduate mathematics.

The Common Vision report reflects a consensus that failure rates in traditional entry-level courses at two- and four-year institutions are unacceptably high and that other pathways to college-credit-bearing courses are needed. The five associations are working closely together for the first time, and work growing out of this project should guide progress to incrementally improve education in the mathematical sciences. Panelists will update the community on the project.

**Organizer:** Karen Saxe, Macalester College

**Panelists:** Tara Holm, Cornell University; Helen Burn, Highline College; Rachel Levy, Harvey Mudd College; and Matthew Ando, University of Illinois Urbana–Champaign

## International Engagement in Research and Education in the Mathematical Sciences

Saturday (1/9), 1:00–2:20 p.m., WSCC Room 609

This session will showcase international programs involving research and education. Speakers will discuss unique features and goals of their programs and will give examples of their activities including specific collaborative research projects. Activities and research collaborations can involve faculty, graduate students and/or undergraduate students. Programs where U.S. faculty and students visit other countries and vice versa will be discussed. Speakers will also share opportunities, challenges, and lessons learned in developing, implementing,

and sustaining such programs. The Southern Africa Mathematical Sciences Association's Masamu Program is one example that will be presented.

**Organizer:** Overtoun Jenda, Auburn University

**Panelists:** Neal Koblitz, University of Washington; Overtoun Jenda, Auburn University; Suzanne Lenhart, University of Tennessee; Yuan Lou, Ohio State University; Fred Roberts, Rutgers University

### Actuarial Science: Change Is the Norm!

*Friday (1/8), 5:00–7:00 p.m., WSCC Room 609*

To meet expectations of students intending actuarial careers, changes are needed faster than the usual deliberative academic pace. There is constant need for curriculum modification. Possibly the most important discussions for this, the 24th in this series of JMM actuarial sessions, will center on changes and initiatives not yet announced as it is planned. The outside-class activity of a strong program can stress both students and actuarial advisers. Sessions seek to support faculty involved with actuarial science offerings; they are organized by faculty from a variety of such programs. Presentations feature Seattle area actuaries and include representatives from professional and publishing organizations. Comments from actuaries at differing career stages and paths will touch on “what I wish I had known before I began working.” One of the career demands these actuaries mention is certain to be about credentialing. This major commitment is sometimes undertaken by faculty, and the resulting demands will be described by recently credentialed faculty members.

**Organizers:** Patrick Brewer, Lebanon Valley College; Robert Buck, Slippery Rock University; Bettye Case, Florida State University; Kevin Charlowood, Washburn University; Michelle Guan, Indiana University Northwest; Steve Paris, Florida State University; and

Sue Staples, Texas Christian University

**Panelists:** Steve Armstrong, Casualty Actuarial Society; Robert Buck, Slippery Rock University; Robert Fisette, Milliman; Caitlin Hendricks, Liberty Mutual; Stuart Klugman, Society of Actuaries; John Leo, Regence Group; and Steve Paris, Florida State University

### What's Beyond the Curriculum?

*Saturday (1/9), 10:35–11:55 a.m., WSCC Room 609*

The 2015 CUPM Curriculum Guide to Majors in the Mathematical Sciences has been available for about one year. CUPM presents some important ways to use the guide to craft some or all of a mathematics major program and expands on its recommendations for managing the elements beyond the curriculum that will contribute to success.

**Organizer:** Martha Siegel, Towson University

**Sponsor:** MAA Committee on the Undergraduate Program in Mathematics

### Other MAA Sessions

#### MAA Department Liaisons Meeting

*Wednesday (1/6), 9:30–11:00 a.m., Kirkland, 3rd Floor, Sheraton*

#### MAA Section Officers Meeting

*Wednesday (1/6), 4:00–5:00 p.m., Willow, 2nd Floor, Sheraton*

**Chair:** Betty Mayfield, Hood College  
Section officers will meet with members of the Committee on Sections and MAA staff to share information and discuss current initiatives.

#### Radical Dash!

*Kickoff Meeting: Wednesday (1/6), 5:15–6:00 p.m., WSCC Room 608*

*Radical Dash Activity: Thursday (1/7), 5:30–6:30 p.m., Conference Center Room 305*

The Radical Dash is a daily scavenger hunt filled with math challenges and creativity for teams of undergraduates. Every day up to five clues will be released via Instagram including a code to break, a mathematical brainteaser, a number of Instagram targets to find throughout the meeting, creative math artwork to fashion, and math to find in everyday objects. So, how quick are you on your feet at solving math problems? Can you picstitch? Would you like to create mathematical art? How about your brain being puzzled by a mathematician? If any of this sounds like fun to you, join us at the 2016 Joint Meetings of the MAA and AMS for the Radical Dash. Individuals are welcome and encouraged to participate; they will be formed into teams on site.

#### SIGMAA Officers Meeting

*Thursday (1/7), 10:30 a.m.–noon, Willow, 2nd Floor, Sheraton*

**Chair:** Karen A. Marrongelle, Portland State University

#### Presentations by MAA Teaching Award Recipients

*Friday (1/8), 2:30–3:50 p.m.*

Winners of the Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching will give presentations on the secrets of their success.

**Organizers:** MAA Secretary Barbara Faires, Westminster College; and MAA President Francis Su, Harvey Mudd College

#### Project NExT Reception

*Friday (1/8), 8:00–10:00 p.m.*

All Project NExT fellows, consultants, and other friends of Project NExT are invited.

**Organizers:** Julia Barnes, West Carolina University; Alissa Crans, Loyola Marymount University; Matt DeLong, Taylor University; David Kung, St. Mary's College of Maryland; and Anthony Tongen, James Madison University



**MAA Business Meeting**

*Saturday (1/9), 11:10–11:40 a.m.,  
Ballroom 6BC, Convention Center*

**Chair:** MAA President Francis Su,  
Harvey Mudd College

**Mathematically Bent Theater**

*Friday (1/8), 6:00–7:00 p.m.*

**Performers:** Colin Adams and the  
Möbiusbandaid Players

Is laughter the body's attempt to eject  
excess phlegm? Why did Plato write  
dialogues instead of monologues?  
Who walked off with my copy of  
"Quasi-Linear Perturbations of  
Hamiltonian Klein-Gordon Equa-  
tions on Spheres" at the AMS Fellows  
Reception at the San Antonio Joint  
Meetings? These are just a few of the  
questions we will not answer in this  
theatrical presentation of several short  
mathematically inclined humorous  
pieces.

**Poetry+Art+Math**

*Thursday (1/7), 5:30–7:00 p.m., WSCC  
Room 608*

In the last few years, JMM attendees  
have enjoyed eclectic poetry readings.  
This year's reading will be augmented  
by a guest lecture by Seattle mathe-  
matical artist/poet Michael Schultheis,  
whose art will be displayed during the  
session. Come to share your poetry or  
simply enjoy the poetry+art+math!  
Though we can often accommodate  
last-minute decisions to participate,  
we encourage poets to submit poetry  
(up to three poems, totaling no  
longer than five minutes) and a bio  
in advance—and, as a result, be listed  
on our printed program. Submissions  
(by December 1) and inquiries may  
be made to Gizem Karaali (gizem.  
karaali@pomona.edu).

**Organizers:** Gizem Karaali, Pomona  
College; Lawrence M. Lesser, Univer-  
sity of Texas at El Paso; and Douglas  
Norton, Villanova University

**Sponsors:** *The Journal of Humanistic  
Mathematics* and SIGMAA ARTS

**Backgammon!**

*Friday (1/8), 8:00–10:00 p.m.*

Learn to play backgammon from  
expert players. It's a fun and exciting  
game where players with a good math-  
ematics background have a decisive  
advantage. Boards and free lessons  
will be provided by members of the  
U.S. Backgammon Federation. Stop by  
anytime!

**Organizer:** Arthur Benjamin, Harvey  
Mudd College

**Find a Research Collaborator  
Social Hour**

*Thursday (1/7), 3:15–4:15 p.m., WSCC  
Room 608*

As freshly graduated PhDs will start  
their research career at a new institu-  
tion, one of the obstacles observed  
is finding (1) collaborators in other  
departments or institutions, and (2)  
finding topics to work on. This event  
will consist of small group discussions  
based on research interests, with the  
goal of sharing ideas of how to find  
collaborators and topics, as well as  
possibly finding a collaborator during  
the event.

**Organizers:** Jacob White, Texas A&M  
University; and Timothy Goldberg,  
Lenoir-Rhyne University

**Sponsor:** Young Mathematicians  
Network

**Managing Your Own Course  
Social Hour**

*Friday (1/8), 4:00–5:00 p.m., WSCC  
Room 2A*

One of the many challenges facing  
new faculty members (and sometimes  
advanced teaching assistants) is man-  
aging their own courses. This event  
will consist of small group discussions  
based on types of courses and perhaps  
types of institutions, with the goal of  
sharing ideas and experiences about  
managing one's own course. This may  
also include discussions on creating a  
new course.

**Organizers:** Jacob A. White, Texas

A&M University; and Timothy Gold-  
berg, Lenoir-Rhyne University

**Sponsor:** Young Mathematicians  
Network

**Pure and Applied Talks  
by Women Math Warriors  
Presented by EDGE (Enhancing  
Diversity in Graduate Education)**

*Friday (1/8), 8:00–10:55 a.m., WSCC  
Room 608*

Since its beginning in 1998, nearly  
200 women have participated in the  
EDGE program. Approximately 70  
are working toward a PhD, over 100  
have earned master's degrees, and  
57 have gone on to complete PhDs.  
This session will comprise research  
talks in various subdisciplines, given  
by women involved with the EDGE  
program. For more information on  
the EDGE program, see [edgefor-  
women.org](http://edgefor-women.org).

**Organizers:** Candice R. Price, Sam  
Houston State University; and Amy L.  
Buchmann, Tulane University

**SIGMAA Sessions****SIGMAA Officers Meeting**

*Thursday (1/7), 10:30 a.m.–noon*

**Chair:** Karen A. Marrongelle, Port-  
land State University

**SIGMAA for Business, Industry,  
and Government**

- **Contributed Paper Session: Math-  
ematics Experiences and Projects  
in Business, Industry, and Govern-  
ment:** *Friday (1/8) afternoon*
- **Guest Lecture: Genetha Gray,  
Intel Corporation:** *Friday (1/8),  
6:15–7:05 p.m., WSCC Room 2B*
- **Reception:** *Friday (1/8), 7:05–7:45  
p.m., WSCC Room 2B*
- **Business Meeting:** *Friday (1/8),  
7:45–8:15 p.m., WSCC Room 2B*

**SIGMAA on Statistics Education  
(SIGMAA STAT-ED)**

- **Reception (joint with SIGMAA  
QL):** *Thursday (1/7), 5:30–6:00 p.m.,*

For updated material, visit the website <http://jointmathematicsm meetings.org/>

Conference Center, Yakima 1

- **Business Meeting:** *Thursday (1/7), 6:00–6:45 p.m., Conference Center, Yakima 1*
- **Guest Lecture, Tim Hesterburg, Google:** *Thursday (1/7), 6:50–7:00 p.m., Conference Center, Yakima 1*
- **Panel Session: Guidelines for Statistics Education:** *Friday (1/8), 8:00–9:20 a.m., WSCC Room 609*
- **Contributed Paper Session: Innovative Targeted Solutions in Teaching Introductory Statistics:** *Thursday (1/7) afternoon*
- **Contributed Paper Session: New Ideas in Teaching Upper-Level Statistics Courses:** *Friday (1/8) afternoon*

### SIGMAA on Quantitative Literacy (SIGMAA QL)

- **Reception (joint with SIGMAA STAT-ED):** *Thursday (1/7), 5:30–6:00 p.m., Conference Center, Yakima 1*
- **Business Meeting:** *Thursday (1/7), 6:00–6:45 p.m., Conference Center, Yakima 2*
- **Contributed Paper Session: Quantitative Literacy in the K-16 Curriculum:** *Wednesday (1/6) afternoon*

### SIGMAA on the History of Mathematics (HOM SIGMAA)

- **Business Meeting and Reception:** *Wednesday (1/6), 5:30–6:20 p.m., WSCC, Room 607*
- **Guest Lecture: James Evans, University of Puget Sound:** *Wednesday (1/6), 6:30–7:20 p.m., WSCC, Room 607*
- **Contributed Paper Session: The Contributions of Minorities to Mathematics throughout History:** *Friday (1/8) morning*
- **Contributed Paper Session: Incorporating the History of Mathematics into Developmental Math Courses:** *Saturday (1/9) morning*

### SIGMAA on Mathematics Instruction Using the WEB (WEB SIGMAA)

- **Business Meeting and Reception:** *Friday (1/8), 5:30–6:00 p.m., WSCC, Room 2A*
- **Guest Lecture: Matthew Leingang, New York University:** *Friday (1/8), 6:00–6:50 p.m., WSCC, Room 2A*
- **Poster Session: Me and My Gadgets—Teaching with Technology**

### SIGMAA on the Philosophy of Mathematics (POM SIGMAA)

- **Contributed Paper Session: Using Philosophy to Teach Mathematics:** *Thursday (1/7) morning*
- **Reception:** *Thursday (1/9), 5:30–5:50 p.m., WSCC Room 617*
- **Business Meeting:** *Thursday (1/7), 6:00–6:20 p.m., WSCC Room 617*
- **Guest Lecture: Bonnie Gold, Monmouth University:** *Thursday (1/7), 6:30–7:20 p.m., WSCC Room 617*

### SIGMAA on Undergraduate Research (UR SIGMAA)

- **Business Meeting:** *Thursday (1/7), 5:30–6:30 p.m., WSCC Room.* All are invited to the first meeting of the MAA's newest SIGMAA! Members and friends of the SIGMAA on Undergraduate Research (UR SIGMAA) will gather to meet each other, discuss our first elections, and plan our first year as a SIGMAA. Those who are considering joining as especially welcome!

### SIGMAA on Mathematical and Computational Biology (BIO SIGMAA)

- **Invited Paper Session: Current Trends in Mathematical and Computational Biology:** *Thursday (1/7), 9:00–11:20 a.m., WSCC Room 607*
- **Reception and Business Meeting:** *Thursday (1/7), 6:00–6:50 p.m., WSCC 304*
- **Guest Lecture: Leah Edelstein-Keshet, University of British Columbia:** *Thursday (1/7), 7:00–7:50 p.m., WSCC 304*
- **Contributed Paper Session: Trends in Undergraduate Mathematical**

**Biology Education:** *Friday (1/8) morning*

### SIGMAA on Mathematics and the Arts (SIGMAA ARTS)

- **Poetry+Art+Math:** *Thursday (1/7), 5:30–7:00 p.m.*
- **Contributed Paper Session: Mathematics and the Arts:** *Wednesday (1/6) morning and afternoon*

### SIGMAA on Math Circles for Students and Teachers (SIGMAA MCST)

- **Math Circle Demonstration:** *Saturday (1/9), 11:00–11:50 a.m., WSCC Room 612*
- **Math Wrangle:** *Saturday (1/9), 1:00–2:30 p.m., WSCC Room 612*
- **Contributed Paper Session: The Broad Impact of Math Circles:** *Thursday (1/7) afternoon*

### SIGMAA on Teaching Advanced High School Mathematics (SIGMAA TAHSM)

- **Contributed Paper Session: Helping Students See beyond Calculus:** *Saturday (1/9) afternoon*

### Research in Undergraduate Mathematics Education (SIGMAA on RUME)

- **Contributed Paper Session: Research in Undergraduate Mathematics Education:** *Thursday (1/7) morning and afternoon*

## AMS Special Sessions

Some sessions are cosponsored with other organizations. These are noted within the parentheses at the end of each listing, where applicable.

- Advances in Free Analysis: The Theory and Applications of Non-commutative Functions, Inequalities, and Domains
- Advances in the Theory and Application of Reaction Diffusion Models
- Algebraic Theory of Differential and Functional Equations
- Algebraic and Topological Methods in Combinatorics
- Analysis and Geometry in Nonsmooth Metric Measure Spaces
- Analysis, Geometry, and Data
- Analytic Function Spaces and Operators on Them
- Analytic Methods in Geometry
- Applications of Logic, Model Theory, and Theoretical Computer Science to Systems Biology
- Applied and Computational Topology
- Arithmetic Dynamics
- Big Demand for Big Data: How Do We Create the Big Supply?
- Classification Problems in Operator Algebras
- Combinatorial Design Theory
- Commutative Algebra (AMS-AWM)
- Commutative Algebra and Its Interactions with Algebraic Geometry (AMS-AWM)
- Commutative Algebra, I (a Mathematics Research Communities Session)
- Current Areas of Interest in the Mathematical Sciences of Medieval Islam
- Data-Intensive Modeling in Ecology
- Difference Equations and Applications
- Differential Equations, Probability, and Sea Ice, I (a Mathematics Research Communities Session)
- Distribution of Zeros of Entire Functions
- Early-Career Female Mathematicians in Algebra and Topology
- Equations of Fluid Motion
- Essential Mathematical Structures and Practices in K-12 Mathematics
- Financial Mathematics, I (a Mathematics Research Communities Session)
- Fractal Geometry and Dynamical Systems
- Geometric and Categorical Methods in Representation Theory
- Global Harmonic Analysis
- Graduate Mathematics Courses and Programs for Secondary Mathematics Teachers
- Graph Products
- Higher Genus Curves and Fibrations of Higher Genus Curves in Mathematical Physics and Arithmetic Geometry
- Innovative Ideas in Enhancing Success in Mathematics Classes (AMS-MAA)
- Integrable Systems, Painlevé Equations, and Random Matrices
- Interactions between Noncommutative Algebra, Algebraic Geometry, and Representation Theory
- Knots in Washington (State)
- Mathematical Information in the Digital Age of Science
- Mathematical Programming on Integral Invexity
- Mathematics and Public Policy
- Mathematics in Natural Resource Modeling
- Metrical and Topological Fixed Point Theory with Applications
- Modular Forms, q-Series, and Mathematics Inspired by Ramanujan
- Moduli Spaces in Algebraic Geometry
- Moduli Spaces in Symplectic Geometry
- Nonlinear Algebra
- Nonlinear Waves and Coherent Structures
- Number Theory and Cryptography
- Operators, Function Spaces, and Models
- Origami Methods and Applications
- Parabolic Geometries, Twistor Theory, and the AdS/CFT Correspondence
- Partial Differential Equations in Complex Analysis
- Problems and Challenges in Financial Engineering and Risk Management
- Problems in Geometry and Design of Materials
- Pseudorandomness and Its Applications
- Quantum Walks, Quantum Markov Chains, Quantum Computation, and Related Topics
- Random and Complex Dynamics of Reaction-Diffusion Systems
- Recent Advances in Dynamical Systems and Mathematical Biology
- Recent Advances in Orthogonal Polynomials and Special Functions
- Recent Developments in Dispersive Partial Differential Equations and Harmonic Analysis
- Representation Theory of Algebraic Groups
- Research by Postdocs of the Alliance for Diversity in Mathematics
- Research from the 2014 and 2015 Rocky Mountain–Great Plains Graduate Research Workshop in Combinatorics
- Research in Mathematics by Undergraduates and Students in Postbaccalaureate Programs (AMS-MAA-SIAM)
- Set-Valued Optimization and Variational Problems with Applications
- Special Functions and q-Series

Stochastic Effects in Models for Mathematical Biology and Ecology

Stochastic Models in Population Biology

Surreal Numbers (AMS-ASL)

Tensor Decompositions and Secant Varieties

The History of Mathematics (AMS-MAA)

The Mathematics of Computation

Topological Graph Theory: Structure and Symmetry

Topological Representation Theory

Water Waves

What's New in Group Theory?

#### AMS Sessions for Contributed Papers

There will be sessions of 10-minute contributed talks. Although an individual may present only one contributed paper at a meeting, any combination of joint authorship may be accepted, provided no individual speaks more than once on the program. Contributed papers will be grouped together by related subject classifications into sessions.

### MAA Poster Sessions

#### Project NExT-YMN Poster Session

*Wednesday (1/6), 2:15–4:15 p.m., WSCC Hall 4A*

**Organizers:** Thomas Wakefield, Youngstown State University; and Jonathan Needleman, LeMoyne College

This session is intended to highlight the research activities, both mathematical and pedagogical, of recent or future master's/PhDs in mathematics and related fields. The organizers seek to provide an open venue for people who are near completion, or have finished their graduate studies in the last five years, to present their work and make connections with other same-stage professionals, in

much the same spirit as YMN and Project NExT. The poster size will be 48" wide by 36" high. Poster boards and materials for posting pages on the posters will be provided on site. We expect to accept about forty posters from different areas within the mathematical sciences. To apply, send a poster abstract, when and where you have or will receive your Ph.D. or master's degree, and your current college or university affiliation to the organizers. Potential applicants should send a poster abstract to one of the organizers, Thomas Wakefield, [tpwakefield@ysu.edu](mailto:tpwakefield@ysu.edu), or Jonathan Needleman, [needlejs@lemoyne.edu](mailto:needlejs@lemoyne.edu), to apply for the session. The deadline for submissions is December 15.

**Sponsors:** Young Mathematicians Network and Project NExT

#### Mathematical Outreach Programs

*Thursday (1/7), 10:00 a.m.–noon, WSCC Hall 4A*

**Organizer:** Betsy Yanik, Emporia State University

This poster session is designed to highlight special programs that have been developed to encourage students to maintain an interest in and commitment to succeeding in mathematics. These programs might include such activities as after-school clubs, weekend activities, one-day conferences, mentoring opportunities, and summer camps. This poster session encompasses a wide variety of outreach efforts for a variety of age groups. For example, programs might be designed to reach out to underrepresented groups. The projects supported by MAA Tensor and Summa grants will find this an ideal venue in which to share the progress of their funded projects. Another possible type of outreach might involve mathematical enrichment programs. For example, recipients of Dolciani Mathematics Enrichment Grants might wish to highlight their programs. Other examples might include innovative programs to motivate undergraduates to study mathematics.

We encourage everyone involved with offering mathematical outreach activities to consider submitting an abstract to the session organizer, Betsy Yanik ([eyanik@emporia.edu](mailto:eyanik@emporia.edu)).

**Sponsor:** MAA Committee on the Participation of Women

#### Projects Supported by the NSF Division of Undergraduate Education

*Thursday (1/7), 2:00–4:00 p.m., WSCC Hall 4A*

**Organizer:** Jon Scott, Montgomery College

This session will feature principal investigators (PIs) presenting progress and outcomes from various NSF-funded projects in the Division of Undergraduate Education. The poster session format will permit ample opportunity for attendees to engage in small group discussions with the PIs and to network with each other. Information about presenters and their projects will appear in the program.

#### MAA Student Poster Session

*Friday (1/8), 4:30–6:00 p.m., WSCC Hall 4A*

**Organizer:** Joyati Debnath, Winona State University

This session features research done by undergraduate students. First-year graduate students are eligible to present if their research was completed while they were still undergraduates. Research by high school students can be accepted if the research was conducted under the supervision of a faculty member at a postsecondary institution. Posters will be judged during the session, and award certificates will be mailed to presenters with the highest scores. Judging will begin at 3:30 p.m., and general viewing will begin at 4:30 p.m. Judges' results will be available at the MAA Pavilion in the exhibit hall the following day until the exhibits close.

#### Me and My Gadgets—Teaching with Technology

*Saturday (1/9), 10:00–11:55 a.m.*

“WSCC”  
stands for  
Washington  
State  
Convention  
Center

Constantly changing technology presents an exciting and shifting opportunity to engage students and improve learning. This electronic poster session will consist of live, interactive demonstrations of applets, widgets, or other technology for teaching mathematics. Rather than preparing a traditional printed poster, presenters will showcase how students engage mathematics through their application using some electronic device such as a tablet, smartphone, or laptop. Preference will be given to presenters demonstrating their own or new applications or to novel approaches in using existing ones. In addition to the active displays, all participants will give a three- to five-minute “Lightning Talk” to demonstrate their application, highlighting where it fits into a mathematics curriculum. These will be scheduled in the middle of the session and included in the program. Potential presenters must submit a detailed description of their application to [jmm2016-gadgets@googlegroups.com](mailto:jmm2016-gadgets@googlegroups.com) and receive approval from the organizers for inclusion in this session. The deadline for submission is December 15.

**Organizer:** John Travis, Mississippi College; Karl Schmitt, Valparaiso University; Tom Hagedorn, College of New Jersey; and Michael Scott, California State University Monterey Bay

**Sponsors:** MAA Committee on Technology in Mathematics Education and WEB SIGMAA

## MAA Sessions for High School Students and Teachers

### How to Think Brilliantly and Creatively in Mathematics: A Guide for K-12 Educators and Their Students

*Saturday (1/9), 8:00–8:50 a.m., WSCC Room 612*

**Speaker:** James Tanton, MAA  
This lecture is a guide for thinking

brilliantly and creatively in mathematics for K-12 educators, their students, and all seeking joyful mathematics doing. How do we model and practice uncluttered thinking and joyous doing in the classroom? Pursue deep understanding over rote practice and memorization? Develop the art of successful flailing? Our complex society demands of its next generation not only mastery of quantitative skills, but also the confidence to ask new questions, explore, wonder, flail, persevere, innovate, and succeed. Let’s not only send humans to Mars—let’s teach our next generation to solve problems and get those humans back if something goes wrong! In this talk, James Tanton will explore five natural principles of mathematical thinking. We will all have fun seeing how school mathematical content is the vehicle for ingenuity and joy. All are so welcome to attend!

**Organizer:** Deanna Haunsperger, Carleton College  
**Sponsor:** MAA Council on Outreach

### High School Quadratics: How to Think about and Do Everything about Them Brilliantly and Creatively

*Saturday (1/9), 9:15–10:45 a.m., WSCC Room 612*

**Presenter:** James Tanton, MAA  
James Tanton will now put brilliant and creative thinking practices into an actual high school topic: the study of quadratics in Algebra II. Let’s see how to bring the light of ease and joyful doing into this standard classroom unit. By letting go of a focus on jargon and memorization, we can help our students develop the confidence to “nut their way” through questions and challenges, to engage in problem solving, and to develop the confidence to persevere. We can teach our students to be confident and agile thinkers and still master the curriculum content they are required to know. This workshop will model the presentation of the entire standard quadratics content, illustrating how

doing less leads to more!

**Organizer:** Deanna Haunsperger, Carleton College  
**Sponsor:** MAA Council on Outreach

### Math Circle Demonstration

*Saturday (1/9), 11:00–11:50 a.m., WSCC Room 612*

**Presenter:** Zvezdelina Stankova, Mills College, Berkeley Math Circle Director

A math circle is an enrichment experience that brings mathematics professionals in direct contact with precollege students and/or their teachers. Circles foster passion and excitement for deep mathematics. This demonstration session offers the opportunity for conference attendees to observe and then discuss a math circle experience designed for local students. While students are engaged in a mathematical investigation, mathematicians will have a discussion focused on appreciating and better understanding the organic and creative process of learning that circles offer, and on the logistics and dynamics of running an effective circle.

**Organizers:** Zvezdelina Stankova, Mills College; Tatiana Shubin, San Jose State University; and Paul Zeitz, University of San Francisco  
**Sponsor:** SIGMAA MCST

### Math Wrangle

*Saturday (1/9), 1:00–2:30 p.m., WSCC Room 612*

Math Wrangle will pit teams of students against each other, the clock, and a slate of great math problems. The format of a Math Wrangle is designed to engage students in mathematical problem solving, promote effective teamwork, provide a venue for oral presentations, and develop critical listening skills. A Math Wrangle incorporates elements of team sports and debate, with a dose of strategy tossed in for good measure. The intention of the Math Wrangle demonstration at the Joint Mathematics Meetings is to show how teachers, schools, circles, and clubs can get students

started in this exciting combination of mathematical problem solving with careful argumentation via public speaking, strategy, and rebuttal.

**Organizers:** Mark Saul, MAA American Math Competitions; and Ed Keppelmann, University of Nevada Reno

**Sponsors:** SIGMAA-MCST and MAA American Mathematics Competitions

### MAA Ancillary Workshops

#### National Research Experiences for Undergraduates Workshop

*Tuesday (1/5), 9:00 a.m.-4:30 p.m.*

This workshop will teach participants how to write a competitive grant proposal. This workshop is a hands-on experience where participants write a summary of a proposal and rate an NSF-awarded proposal in a mock panel review. Participants will also learn many helpful hints and fatal flaws to proposal writing. This workshop is appropriate for current principal investigators of MAA's NREUP grants and for those who were denied funding for an MAA grant. Advanced registration is required. Send an email to the organizer at [dennis.davenport@howard.edu](mailto:dennis.davenport@howard.edu) to register for the workshop.

**Organizer:** Dennis Davenport, Howard University

#### Bringing Passion to your Introductory Statistics Classroom: A Supportive, Multidisciplinary Project-Based Approach

*Monday (1/4), 9:00 a.m.-4:30 p.m.*

This one-day workshop will support instructors who teach an introductory statistics or quantitative research course in designing or redesigning any or all portions of their course to engage students in the rich, complicated, decision-making process of real statistical inquiry. Core features of this passion-driven, flipped-classroom approach include providing

opportunities for students to flexibly apply their statistical knowledge in the context of real data, the use of computing as a window to core statistical concepts, supporting students with varying levels of preparation, and attracting and inspiring students from underrepresented groups. The workshop will include very brief presentations focused on the nuts and bolts of supporting project-based experiences, followed by ample hands-on opportunities that will be supported by experienced faculty and students. Similar to the approach that will be presented, your experience in the workshop will be individualized to your own interests, background, and needs. Advance registration (but no fee) is required. Go to [causeweb.org/workshop/](http://causeweb.org/workshop/) to register.

**Presenter:** Lisa Dierker, Wesleyan University

**Organizers:** Lorey Burghard, Pennsylvania State University; Lisa Dierker,

Wesleyan University; and Dennis Pearl, Pennsylvania State University

**Sponsor:** Consortium for the Advancement of Undergraduate Statistics Education (CAUSE)

#### Teaching the Statistical Investigation Process with Randomization-Based Inference

*Tuesday (1/5), 9:00 a.m.-4:30 p.m.*

The goals of this workshop are to help participants to revise their introductory statistics course in two ways: (1) Using randomization-based methods, as opposed to methods based on the normal distribution, to introduce concepts of statistical inference, and (2) emphasizing the overarching process of conducting statistical investigations, from formulating a question and collecting data through exploring data and drawing inferences to communicating results, throughout the course. The workshop will provide direct experience with

#### Navajo Math Circles

*Wednesday (1/6), 6:30-7:50 p.m.*

Hundreds of Navajo children in recent years have found themselves at the center of a lively collaboration with mathematicians from around the world. The children stay late after school and assemble over the summer to study mathematics, using a model called math circles, which originated in Eastern Europe and which has proliferated across the United States. This notion of student-centered learning puts children in charge of exploring mathematics to their own joy and satisfaction, with potentially long-lasting results.

*Navajo Math Circles* is a one-hour film that is documenting the meeting of two worlds: that of some of the country's most-accomplished mathematicians and math educators, with the children and teachers in the underserved, largely rural Navajo educational system. An eight-minute trailer gives a taste of the film.

The project is supported by the Mathematical Sciences Research Institute (MSRI) in Berkeley, California, with a generous grant from the Simons Foundation, and by Vision Maker Media (VMM), Lincoln, Nebraska, and by the Corporation for Public Broadcasting (CPB). Following this premiere screening at the 2016 Joint Mathematics Meeting, Vision Maker Media will work with the Corporation for Public Broadcasting to schedule a national broadcast.

hands-on activities that introduce students to fundamental concepts of inference using randomization-based methods. The learning activities involve using freely available applets to explore concepts and analyze real data from genuine research studies. The presenters will also offer implementation and assessment suggestions during these activity-based sessions and discussion sessions based on presenters' experiences with randomization-based curricula in their own classrooms. More information about the project on which this workshop is based can be found at [math.hope.edu/isi](http://math.hope.edu/isi). Advance registration (but no fee) is required. Go to [causeweb.org/workshop/](http://causeweb.org/workshop/) to register.

**Presenters:** Nathan Tintle, Dordt College; Todd Swanson, Hope College; and Robin Lock, St. Lawrence University

**Organizers:** Lorey Burghard, Pennsylvania State University; and Dennis Pearl, Pennsylvania State University

**Sponsor:** Consortium for the Advancement of Undergraduate Statistics Education (CAUSE)

## Social Events

All events listed are open to all registered participants. For any event requiring a ticket, tickets should be purchased through advance registration. Only a very limited number of tickets, if any, will be available for sale on site. If you must cancel your participation in a ticketed event, you may request a 50 percent refund by returning your tickets to the Mathematics Meetings Service Bureau (MMSB) by January 2, 2016. After that date, no refunds can be made. Special meals are available at banquets upon advance request, but this must be indicated on the Advanced Registration/Housing Form.

### 2016 AMS Dinner Celebration

*Saturday (1/9), 6:30 p.m.*

Reception at 6:30 p.m. and doors open

at 7:30 pm. Tickets are \$69 including tax and gratuity. The student ticket price is \$29.

### Association of Christians in the Mathematical Sciences (ACMS) Reception and Lecture

*Thursday (1/7), 5:30–7:30 p.m.*

**Speaker: John Roe**, Penn State University; title: "Math. Love. Danger." See [acmsonline.org](http://acmsonline.org).

### Association of Lesbian, Gay, Bisexual, and Transgendered Mathematicians Reception

*Thursday (1/7), 6:00–8:00 p.m.*

We are affiliated with NOGLSTP, the National Organization of Gay and Lesbian Scientists and Technical Professionals, [www.noglstp.net/qmath](http://www.noglstp.net/qmath).

### Association for Women in Mathematics Reception and Awards Presentation.

**Reception**, which is open to all JMM attendees: 9:30 p.m. following the AMS Gibbs Lecture. **Recognition of prize winners:** 10:00 p.m.

### Backgammon!

**Organizer:** Arthur Benjamin, Harvey Mudd College

*Friday (1/8), 8:00–10:00 p.m.*

Learn to play backgammon from expert players. It's a fun and exciting game where players with a good mathematics background have a decisive advantage. Boards and free lessons will be provided by members of the U.S. Backgammon Federation. Stop by anytime on Friday evening.

### Budapest Semesters in Mathematics Annual Alumni Reunion

*Friday (1/8), 6:00–7:30 p.m.*

Informational Session, Friday, noon–1:00 p.m. BSME is a semester-long program in Budapest, Hungary, designed for American and Canadian undergraduates (and recent graduates) interested in teaching middle school or high school mathematics. Participants will study the Hungarian

approach to learning and teaching, in which a strong and explicit emphasis is placed on problem solving, mathematical creativity, and communication. Come learn more about this exciting new program.

### University of Chicago, Mathematics Alumni Reception

*Thursday (1/7), 6:00–7:00 p.m.*

### Reception for Graduate Students and First-Time Participants

*Wednesday (1/6), 5:30–6:30 p.m.*

Graduate students and first-timers are especially encouraged to come and meet some old-timers to pick up a few tips on how to survive the environment of a large meeting. Light refreshments will be served.

**Sponsors:** AMS and MAA

### Knitting Circle

*Thursday (1/7), 8:00–9:30 p.m.*

Bring your needlework and come knit (crochet, cross-stitch, etc.) with us while talking about math or other relaxing subjects. Catch up with your friends and meet new ones during this fun social event.

### MAA/Project NExT Reception

*Friday (1/8), 8:00–10:00 p.m.*

All Project NExT Fellows, consultants, and other friends of Project NExT are invited.

**Organizers:** Julia Barnes, Western Carolina University; Alissa Crans, Loyola Marymount University; Matt DeLong, Taylor University; Dave Kung, St. Mary's College of Maryland; and Anthony Tongen, James Madison University.

### MAA Two-Year College Reception

*Thursday (1/7), 5:45–7:00 p.m.*

Open to all meeting participants, particularly two-year faculty members. This is a great opportunity to meet old friends and make some new ones. There will be hot and cold refreshments and a cash bar.

### Mathematical Reviews Reception

Friday (1/8), 6:00–7:00 p.m.

All friends of the *Mathematical Reviews* (MathSciNet) are invited to join reviewers and *MR* editors and staff (past and present) for a special reception in honor of all of the efforts that go into the creation and publication of the *Mathematical Reviews* database. Refreshments.

### Mathematical Institutes Open House

Wednesday (1/6), 5:30–8:00 p.m.

Members of the AMS and MAA who are attending the Joint Mathematics Meetings are warmly invited to come to the Mathematical Institutes Open House reception, sponsored by several of the mathematical sciences institutes in North America. This reception precedes the Gibbs Lecture. <https://icerm.brown.edu/events/mioh/2016>.

### MSRI Reception for New and Prospective MSRI Donors

Thursday (1/7), 6:30–8:00 p.m.

Why private support matters—MSRI thanks its supporters who are ensuring MSRI's well being today and in the future. MSRI is thankful for the many mathematicians who support MSRI's programs and workshops through their membership in the Archimedes Society or the Gauss Society. Not a member yet? Come and learn about why your support matters. Archimedes Society members support MSRI with annual gifts. Gauss Society members support MSRI with a planned gift through arrangements in their will and estates. David Eisenbud, MSRI's director, and Hélène Barcelo, MSRI's deputy director, will speak about current events at MSRI. For more information, please contact: Heike Friedman, director of development, [hfriedman@msri.org](mailto:hfriedman@msri.org); 510-643-5056.

### National Association of Mathematicians Banquet

Friday, 6:00–8:40 p.m.

A cash bar reception 6:00 p.m. and dinner at 6:30 p.m. Tickets are \$63 each, including tax and gratuity. The Cox-Talbot Invited Address will be given after the dinner.

### NSA Women in Mathematics Society Networking Session

Thursday (1/7), 6:00–8:00 p.m.

All participants are welcome to this annual event. Please stop by the NSA booth in the exhibit hall for information and the location of the event.

### Pennsylvania State University Mathematics Alumni Reception

Thursday (1/7), 5:30–7:30 p.m.

Please join us for hors d'oeuvres, beverages, and mingling, with math alumni, faculty, and College of Science representatives.

### SIMIODE Reception

Friday (1/8), 7:00–9:00 p.m.

Open to All, SIMIODE-Systemic Initiative for Modeling Investigations and Opportunities with Differential Equations at [simiode.org](http://simiode.org), a free and open community for using modeling to motivate the study of differential equations, sponsors this mixer. All are encouraged to meet colleagues interested in using SIMIODE to bring motivational modeling to their differential equations classroom and learn how the SIMIODE community can provide support. Engage in conversations while enjoying light refreshments and door prizes.

### Student Hospitality Center

Wednesday–Friday (1/6–1/8), 9:00 a.m.–5:00 p.m., and Saturday (1/9), 9:00 a.m.–3:00 p.m.

**Sponsor:** MAA Committee for Undergraduate Student Activities

### Reception for Undergraduates

Wednesday (1/6), 4:00–5:00 p.m.

## Registering in Advance

The importance of registering for the meeting cannot be overemphasized. Advanced registration fees are considerably lower than on-site registration fees. Badges are required to enter the Joint Mathematics Meetings (JMM) Exhibits, the Employment Center, and to obtain discounts at the AMS and MAA book sales and cash a check with the Joint Meetings cashier.

Participants who register by November 17 may receive their badges, programs, and tickets (where applicable) in advance by U.S. mail approximately three weeks before the meetings. Those who do not want their materials mailed should check the appropriate box on the Registration and Housing Form. Materials cannot be mailed to Canada, Mexico, or other countries outside of the United States. Participants from these countries must pick up their materials at the Joint Meetings Registration Desk on the fourth floor of the Washington State Convention Center. A replacement fee of \$5 will be charged for programs and badges that were mailed but not brought to the meeting.

**Online Registration:** The form to register for the meeting and to reserve a hotel room online is located at [www.jointmathematicsmeetings.org/meetreg?meetnum=2181](http://www.jointmathematicsmeetings.org/meetreg?meetnum=2181). VISA, MasterCard, Discover, and American Express are the only methods of payment accepted for online registrations, and charges to credit cards will be made in U.S. funds. All registration acknowledgments will be sent by email to all email addresses provided.

**Paper Form Registration:** The form to register for the meeting and to reserve a hotel room by paper is at [jointmathematicsmeetings.org/meetings/national/jmm2016/jmm16\\_regform.pdf](http://jointmathematicsmeetings.org/meetings/national/jmm2016/jmm16_regform.pdf). Forms must be mailed or faxed to the MMSB at MMSB, P.O. Box 6887, Providence, RI 02940 or 401-455-4004. For security reasons, credit card numbers by email



or fax cannot be accepted. If a participant is registering by paper form and would like to pay for the registration or guarantee your hotel reservation by credit card, he or she should indicate this on the form and someone from the MMSB will call that person.

#### **Participant Lists and Mailing**

**Lists:** If any participant would like to opt-out of any mailing lists or participant lists that are generated for the meeting, he or she should check the appropriate box on the Registration and Housing Form. All participants who do not opt-out will be included in all mailing lists and participant lists that are generated and distributed for the meeting.

**Cancellation Policy:** Participants who cancel their registration for the meetings, minicourses, or short course by December 31 will be eligible to receive a 50 percent refund of fees paid. Participants who cancel their banquet tickets by January 2, 2016, will be eligible for a 50 percent refund. No refunds will be issued after these deadlines.

**Registration Fees and Category Definitions online at [http://joint-mathematicsmetings.org/meetings/national/jmm2016/2181\\_regfees](http://joint-mathematicsmetings.org/meetings/national/jmm2016/2181_regfees).**

#### **are online at**

Full-Time Students  
Graduate Student Member  
Undergraduate Student Member  
Emeritus  
Librarian  
Unemployed  
Developing Country Participant  
Temporarily Employed  
Nonmathematician Guest  
Commercial Exhibitor

#### **Registration Deadlines**

ORDINARY meeting registration (hotel reservations, materials mailed): November 17.

FINAL meeting registration (advanced registration, short course, minicourses, and banquets): December 22.

#### **Ordinary Registration:**

Participants who register after November 2 and by the ordinary deadline of November 17 may use the housing services offered by the MMSB but are not eligible for the free room drawing. They may also elect to receive their badges and programs by mail in advance of the meeting (US participants only).

**Final Registration:** Participants who register after November 17 and by the final deadline of December 22 must pick up their badges, programs, and any tickets for social events at the meeting. Unfortunately, it is sometimes not possible to provide final participants with housing, so everyone is strongly urged to make their hotel reservations by November 17. The final deadline of December 22 is firm. Any forms received after that date will be returned with full refunds. Registration materials may be picked up at the Meetings Registration Desk on the the fourth floor of the Washington State Convention Center.

#### **Miscellaneous Information**

**Audio-Visual Equipment:** A projection screen is included as standard equipment in all session rooms. Invited 50-minute speakers are automatically provided with an ELMO visual presenter (document camera/projector), and a laptop projector; AMS Special Sessions and Contributed Papers, and MAA Invited and Contributed Paper Sessions, are provided with a screen and a laptop projector. Blackboards are not available, nor are Internet connections in session rooms. Any request for additional equipment should be sent to [meet@ams.org](mailto:meet@ams.org) and received by November 1.

Equipment requests made at the meetings most likely will not be granted because of budgetary restrictions. Unfortunately no audiovisual equipment can be provided for committee meetings or other meetings or gatherings not on the scientific program.

**Child Care:** The AMS and the MAA will provide reimbursement

grants of \$250 per family to help with the cost of child care for a number of registered participants at JMM2016. The funds may be used for child care that frees a parent to participate more fully in JMM.

Information about child care grants and deadlines for requesting support will be available prior to the opening of advance registration in September; watch the website at [jointmathematicsmetings.org/meetings/national/jmm2016/2181\\_childcare](http://jointmathematicsmetings.org/meetings/national/jmm2016/2181_childcare).

**Email Services:** Limited email access for all Joint Meetings participants will be available in an email center located near the JMM Registration Desk, Atrium Lobby, on the fourth level in the Washington State Convention Center. The hours of operation will be published in the program. Participants should be aware that complimentary Internet access will be available in the networking center in Skybridge (Hall 4D), fourth level of the convention center.

**Information Distribution:** Tables are set up in the exhibit area for dissemination of general information of possible interest to the members and for the dissemination of information of a mathematical nature not promoting a product or program for sale. Information must be approved by the AMS director of meetings and conferences.

If a person or group wishes to display information of a mathematical nature promoting a product or program for sale, they may do so in the exhibit area at the Joint Books, Journals, and Promotional Materials exhibit for a fee of \$50 (posters are slightly higher) per item. Please contact the exhibits coordinator, MMSB, P.O. Box 6887, Providence, RI 02940, or by email at [cpd@ams.org](mailto:cpd@ams.org) for further details.

The administration of these tables is in the hands of the AMS-MAA Joint Meetings Committee, as are all arrangements for Joint Mathematics Meetings.

**Local Information:** For information about the city, see [visitseattle.org](http://visitseattle.org).

**Photograph and Video Policy:**

The videotaping of any AMS or joint sponsored events, talks, and sessions is strictly forbidden without the explicit written permission of the AMS director of meetings and conferences. The policy for videotaping of any MAA events, talks, and sessions is posted at [www.maa.org/about-maa/policies-and-procedures/recording-or-broadcasting-of-maa-events](http://www.maa.org/about-maa/policies-and-procedures/recording-or-broadcasting-of-maa-events).

Photographs and videos of meeting interactions will be taken by professional photographers hired by the Joint Mathematics Meetings or by AMS and MAA staff. These photographs and videos may occasionally be used for publicity purposes. By participating in the Joint Mathematics Meetings, attendees acknowledge that their photograph or a video that includes them may be published in material produced by the Joint Meetings, AMS or MAA. AMS and MAA are not responsible for unauthorized photographs or other images not taken by professional photographers hired by the Joint Mathematics Meetings or AMS and MAA staff.

**Telephone Messages:** It will be possible to leave a message for any registered participant at the meetings registration desk from January 6 through 9 during the hours that the desk is open. These messages will be posted on the Mathematics Meetings Message Board in the networking center; however, staff at the desk will try to locate a participant in the event of a bona fide emergency. The telephone number will be published in the program and daily newsletter.

**Travel/Transportation**

Seattle is on Pacific Time. The principal airport is the Seattle-Tacoma International Airport (SEA, frequently referred to as Sea-Tac) which is served by all major airlines. The website for Seattle-Tacoma International airport is [portseattle.org/Sea-Tac/Pages/default.aspx](http://portseattle.org/Sea-Tac/Pages/default.aspx), and the street address is 17801 International Boulevard, Seatac, WA, 98158. It is approximately 12 miles from downtown Seattle.

The 2016 Joint Mathematics Meetings will be held in the Washington State Convention Center, 800 Convention Place, Seattle, WA, 98101. The main entrance is on Eighth Avenue between Pike and Seneca.

**Airline**

The official airline for this meeting is Delta. Participants are encouraged to book their flights for the meeting, if possible, with Delta and receive special pricing (in most cases, a 5 percent discount) on scheduled service to Seattle. Discounts are applicable to U.S.- and Canada-originating passengers. This discount is not valid with other discounts, certificates, coupons, or promotional offers.

To make a reservation, go to [delta.com](http://delta.com), and click on the box that says "Book a Trip." At the bottom of the drop-down, click on "Advanced Search" (includes Flexible Airport and Meeting Event Code). On the reservation screen, please enter the Meeting Event Code NMLNH. It is located to the right of "Number of Passengers." Reservations can also be made by calling Delta Meeting Network Reservations at 800-328-1111 and citing the meeting event code. A direct ticketing charge will apply for booking by phone.

**Ground Transportation**

**Car Rental:** All major rental car companies have offices at the Sea-Tac airport. There is a separate rental car facility with dedicated shuttle buses operating on a 24-hour-a-day schedule. Two passenger pick-up areas are located outside baggage claim at the north and south ends of the main terminal. Proceed to the baggage claim level and pick up your checked bags. Exit the sliding glass doors near either carousel #1 or #15 and walk to one of the two designated shuttle bus pick-up areas for transportation to the rental car facility.

Hertz is the official car rental company for the meeting. A brochure with the information for this meeting is located at [jointmathematicsm meetings.org/Hertz-info-Seattle.pdf](http://jointmathematicsm meetings.org/Hertz-info-Seattle.pdf).

To access the JMM special meeting rates at [www.hertz.com](http://www.hertz.com), enter the standard information (pickup location, dates, etc.) and then click the box that says "Enter a discount or promo code" and enter 04N30006 as the convention number (CV#). Reservations can also be made by calling Hertz directly at 800-654-2240 (US and Canada) or 405-749-4434.

Meeting rates include unlimited mileage and are subject to availability. Advance reservations are recommended and blackout dates may apply. Government surcharges, taxes, tax reimbursement, airport-related fees, vehicle licensing fees and optional items are extra. Standard rental conditions and qualifications apply. Vehicles must be returned to the renting location. Minimum rental age is 20 (age differential charge for 20–24 applies).

Weekend rentals are available in the continental US and Canada for pickup between noon Thursday and noon Sunday and must be returned no later than Monday at 11:59 p.m. Thursday pick-up requires a minimum three-day keep. Friday pick-up requires a minimum two-day keep, and Saturday and Sunday pick-up require a one-day keep. Weekly rentals are from five to seven days. Extra day rate for weekly rentals will be one-fifth the Weekly Rate.

**Taxi:** The taxi stand is on the third floor of the airport garage. The phone number for Seattle Yellow Cab is 206-622-6500, and the website is [seattleyellowcab.com/seatac-taxi-rides/](http://seattleyellowcab.com/seatac-taxi-rides/). One-way fare to the downtown area is approximately \$45.

**Seattle Sound Transit Link Light Rail:** The SeaTac/Airport Station is connected to the fourth floor of the airport parking garage by a covered walkway. Wheelchair service is available. Take the train at SeaTac/Airport station and go to the end of the line at Westlake Center. Westlake Center is located at 4th Avenue and Pine Street. To go to the Sheraton Seattle from Westlake Center, go 1/2 block east on Pine Street, and 2 blocks south on

Sixth Avenue. Trains run every 8–15 minutes from 5:00 a.m. to 1:00 a.m. on weekdays, and every 15 minutes on Saturday. On Sunday, the trains run from 6:00 a.m. to midnight. One way fare is currently \$2.75. The trip takes approximately 35 minutes. The schedule and more information is located at [soundtransit.org/Schedules/Link-light-rail](http://soundtransit.org/Schedules/Link-light-rail).

**Downtown Airporter Shuttle:** The Downtown Airporter/Shuttle Express picks up and drops off at the inner drive curb on the third floor of the airport garage. It departs twice an hour from 6:30 a.m. to 9:00 p.m., with service to and from many downtown Seattle hotels, including the Crowne Plaza, Fairmont Olympic, Grand Hyatt, Renaissance Seattle, Seattle Sheraton, and the Westin Hotel. Online reservations are required. The fare is approximately \$19 one way, and the trip can take up to an hour, depending on traffic. Share ride and private service is also available. Call 425-981-7000 or go to [shuttleexpress.com/seattle/airport/downtown-airporter](http://shuttleexpress.com/seattle/airport/downtown-airporter) for more detail.

**Parking:** The Washington State Convention Center operates two parking garages, the WSCC Garage and the Freeway Park Garage. The WSCC Garage entrance is on Eighth Avenue between Pike and Seneca, and it is open daily between 5:30 a.m. and midnight. The entrance to the Freeway Park Garage is on Hubbell Place between Pike and Seneca. It is open Monday–Friday, 5:30 a.m. to 8:00 p.m. Directions to the parking garages and rates are at [wscc.com/parking-directions](http://wscc.com/parking-directions). The parking map is located at [wscc.com/sites/default/files/find-it/files/2014.09.09\\_FIND\\_IT\\_Parking\\_map.pdf](http://wscc.com/sites/default/files/find-it/files/2014.09.09_FIND_IT_Parking_map.pdf).

See hotel page for details on parking at the hotels.

## Welcoming Environment Policy

The AMS and MAA strive to ensure that participants in the Joint Mathematics Meetings enjoy a welcoming environment. In all JMM activities, the two organizations seek to foster an atmosphere that encourages the free expression and exchange of ideas. The AMS and MAA support equality of opportunity and treatment for all participants, regardless of gender, gender identity or expression, race, color, national or ethnic origin, religion or religious belief, age, marital status, sexual orientation, disabilities, or veteran status.

Harassment is a form of misconduct that undermines the integrity of JMM activities as well as the AMS and MAA missions. The AMS and MAA will make every effort to maintain an environment that is free of harassment, even though they do not control the behavior of third parties. A commitment to a welcoming environment is expected of all attendees at JMM activities, including mathematicians, students, guests, staff, contractors and exhibitors, and participants in scientific sessions and social events.

To this end, the AMS and MAA will include a statement concerning their expectations toward maintaining a welcoming environment in registration materials, and have put in place a mechanism for reporting violations. Violations may be reported confidentially and anonymously to 855-282-5703 or at [mathsociety.ethicspoint.com](http://mathsociety.ethicspoint.com). The reporting mechanism ensures the respect of privacy while alerting the AMS and MAA to the situation.

# 2016 Joint Mathematics Meetings Advance Registration/Housing Form



Name \_\_\_\_\_  
(please write name as you would like it to appear on your badge)

Mailing Address \_\_\_\_\_  
\_\_\_\_\_

Telephone \_\_\_\_\_ Fax: \_\_\_\_\_

In case of emergency (for you) at the meeting, call: Day # \_\_\_\_\_ Evening #: \_\_\_\_\_

Email Address \_\_\_\_\_ Additional email address for receipt \_\_\_\_\_

Acknowledgment of this registration and any hotel reservations will be sent to the email address(es) given here. **Check this box to receive a copy in U.S. Mail:**

Affiliation for badge \_\_\_\_\_ (company/university) Nonmathematician guest badge name: \_\_\_\_\_ (Note fee of US\$18)

**I DO NOT want my program and badge to be mailed to me on 12/11/15. (Materials will be mailed to the address listed above unless you check this box.)**

## Registration Fees

**Membership** please  all that apply. First row is eligible to register as a member.

For undergraduate students, membership in PME and KME also applies.

- AMS  MAA  ASL  CMS  SIAM  
 Undergraduate Students Only:  PME  KME  
 Other Societies:  AWM  NAM  YMN  AMATYC

| Joint Meetings  | by Dec 22 | at mtg   | Subtotal |
|---|-----------|----------|----------|
| <input type="checkbox"/> Member AMS, MAA, ASL, CMS, or SIAM                                   | US\$ 282  | US\$ 371 |          |
| <input type="checkbox"/> Nonmember  | US\$ 448  | US\$ 571 |          |
| <input type="checkbox"/> Graduate Student Member (AMS, MAA, ASL, CMS, or SIAM)                | US\$ 63   | US\$ 74  |          |
| <input type="checkbox"/> Graduate Student (Nonmember)   | US\$101   | US\$ 112 |          |
| <input type="checkbox"/> Undergraduate Student (Member AMS, ASL, CMS, MAA, PME, KME, or SIAM) | US\$ 63   | US\$ 74  |          |
| <input type="checkbox"/> Undergraduate Student (Nonmember)                                    | US\$101   | US\$ 112 |          |
| <input type="checkbox"/> High School Student  | US\$ 6    | US\$ 12  |          |
| <input type="checkbox"/> Unemployed   | US\$ 63   | US\$ 74  |          |
| <input type="checkbox"/> Temporarily Employed   | US\$ 230  | US\$ 263 |          |
| <input type="checkbox"/> Developing Countries Special Rate                                    | US\$ 63   | US\$ 74  |          |
| <input type="checkbox"/> Emeritus Member of AMS or MAA  | US\$ 63   | US\$ 74  |          |
| <input type="checkbox"/> High School Teacher  | US\$ 63   | US\$ 74  |          |
| <input type="checkbox"/> Librarian  | US\$ 63   | US\$ 74  |          |
| <input type="checkbox"/> Press  | US\$ 0    | US\$ 0   |          |
| <input type="checkbox"/> Exhibitor (Commercial)   | US\$ 0    | US\$ 0   |          |
| <input type="checkbox"/> Artist Exhibitor (work in JMM Art Exhibit)                           | US\$ 0    | US\$ 0   |          |
| <input type="checkbox"/> Nonmathematician Guest of registered mathematician                   | US\$ 18   | US\$ 18  |          |

\$ \_\_\_\_\_

**AMS Short Course: Rigorous Numerics in Dynamics (1/4-1/5)**

- Member of AMS US\$ 110 US\$ 144  
 Nonmember US\$ 165 US\$ 195  
 Student, Unemployed, Emeritus US\$ 58 US\$ 79

\$ \_\_\_\_\_

### MAA Minicourses (see listing in text)

I would like to attend:  One Minicourse  Two Minicourses

Please enroll me in MAA Minicourse(s) # \_\_\_\_\_ and # \_\_\_\_\_

Price: US\$ 85 for each minicourse.

(For more than 2 minicourses, call or email the MMSB.) \$ \_\_\_\_\_

### Graduate School Fair

- Graduate Program Table US\$ 75 US\$ 75  
 (includes table, posterboard & electricity) \$ \_\_\_\_\_

### Receptions & Banquets

- Graduate Student/First-Time Attendee Reception (1/6) (no charge)  
 NAM Banquet (1/8) US\$63 # \_\_\_\_\_Chicken # \_\_\_\_\_Vegetarian  
 # \_\_\_\_\_Kosher

- AMS Dinner (1/9) Regular Price # \_\_\_\_\_US\$ 69  
 Student Price # \_\_\_\_\_US\$ 29

(Additional fees may apply for Kosher meals.) \$ \_\_\_\_\_

**Total for Registrations and Events** \$ \_\_\_\_\_

Registration for the Joint Meetings is not required for the short course but it

## Payment

Registration & Event Total (total from column on left) \$ \_\_\_\_\_

Hotel Deposit (only if paying by check) \$ \_\_\_\_\_

**Total Amount To Be Paid** \$ \_\_\_\_\_

### Method of Payment

**Check.** Make checks payable to the AMS. For all check payments, please keep a copy of this form for your records.

**Credit Card.** All major credit cards accepted. For your security, we do not accept credit card numbers by postal mail, email or fax. If the MMSB receives your registration form by fax or postal mail, it will contact you at the phone number provided on this form. For questions, contact the MMSB at mmsb@ams.org.

Signature: \_\_\_\_\_

**Purchase Order #** \_\_\_\_\_ (please enclose copy)

## Other Information

Mathematical Reviews field of interest # \_\_\_\_\_

- I am willing to serve as a judge for the MAA Undergraduate Student Poster Session  
 For planning purposes for the MAA Two-year College Reception, please check if you are a faculty member at a two-year college.  
 I am a mathematics department chair.  
 Please do not include my name and postal address on any promotional mailing lists. (The JMM does not share email addresses.)  
 Please do not include my name on any list of JMM participants other than the scientific program if I am, in fact, making a presentation that is part of the meeting.  
 Please  this box if you have a disability requiring special services.



## Deadlines

|  |                       |
|--|-----------------------|
| Eligible for the complimentary room drawing:   | <b>Nov. 2, 2015</b>   |
| Receiving badges/programs in the mail:   | <b>Nov. 17, 2015</b>  |
| Housing reservations, changes/cancellations through the JMM website:                 | <b>Dec. 14, 2015</b>  |
| Advance registration for the Joint Meetings, short course, minicourses, and tickets: | <b>Dec. 22, 2015</b>  |
| 50% refund on banquets, cancel by  | <b>Jan. 2, 2016*</b>  |
| 50% refund on advance registration, minicourses, and short course, cancel by         | <b>Dec. 31, 2015*</b> |

**\*no refunds issued after this date**

## Mailing Address/Contact:

**Mathematics Meetings Service Bureau (MMSB)**

# 2016 Joint Mathematics Meetings Hotel Reservations – Seattle, WA

(Please see the hotel page in the announcement or on the web for detailed information on each hotel.) To ensure accurate assignments, please rank hotels in order of preference by writing 1, 2, 3, etc. in the column on the left and by circling the requested bed configuration. If your requested hotel and room type is no longer available, you will be assigned a room at the next available comparable rate. Please call the MMSB for details on suite configurations, sizes, availability, etc. All reservations, including suite reservations, must be made through the MMSB to receive the JMM rates. Reservations made directly with the hotels before **December 14, 2015** may be changed to a higher rate. All rates are subject to a room tax plus Seattle Tourism Assessment Fee totalling 15.6%. **Guarantee requirements: First night deposit by check (add to payment on reverse of form) or a credit card guarantee.**

- Deposit enclosed (see front of form)
- Hold with my credit card. For your security, we do not accept credit card numbers by postal mail, email or fax. If the MMSB receives your registration form by postal mail or fax, we will contact you at the phone number provided on the reverse of this form.

Date and Time of Arrival \_\_\_\_\_ Date and Time of Departure \_\_\_\_\_ Number of adult guests in room \_\_\_\_\_ Number of children \_\_\_\_\_

Name of Other Adult Room Occupant (s) \_\_\_\_\_ Arrival Date \_\_\_\_\_ Departure Date \_\_\_\_\_

**Housing Requests:** (example: rollaway cot, crib, nonsmoking room, low floor) \_\_\_\_\_

- I have disabilities as defined by the ADA that require a sleeping room that is accessible to the physically challenged. My needs are: \_\_\_\_\_
- I am a member of a hotel frequent-travel club and would like to receive appropriate credit. The hotel chain and card number are: \_\_\_\_\_
- I am not reserving a room. I am sharing with \_\_\_\_\_, who is making the reservation.

| Order of choice | Hotel                                   | Single      | Double 1 bed-2 people | Double 2 beds- 2 people | Triple 3 adults-2 beds | Quad 4 adults-2 beds | Rollaway Cot Fee (add to special requests if reserving online)                          |
|-----------------|---|-------------|-----------------------|-------------------------|------------------------|----------------------|---|
|                 | Sheraton Seattle (headquarters)         | US\$ 166    | US\$ 166              | US\$ 166                | US\$ 191               | US\$ 216             |   |
|                 | Deluxe Rate                             | US\$ 186    | US\$ 186              | US\$ 186                | US\$ 211               | US\$ 236             | Rollaways available only in king-bedded rooms at no charge                              |
|                 | Club Level                              | US\$ 206    | US\$ 206              | US\$ 206                | US\$ 231               | US\$ 256             |   |
|                 | Student Rate                            | US\$ 124.50 | US\$ 124.50           | US\$ 124.50             | US\$ 149.50            | UD\$ 174.50          |   |
|                 | Grand Hyatt                             | US\$ 159    | US\$ 159              | US\$ 159                | US\$ 184               | US\$ 209             | Rollaways available only in king-bedded rooms only for a nightly charge of US\$15       |
|                 | Student Rate                            | US\$ 125    | US\$ 125              | US\$ 125                | US\$ 150               | US\$ 175             |   |
|                 | Fairmont Olympic Hotel Seattle          | US\$ 152    | US\$ 152              | US\$ 152                | US\$ 182               | US\$ 212             | Rollaways available only in king-bedded rooms for a one-time \$15 fee                   |
|                 | The Westin Seattle                      | US\$ 139    | US\$ 139              | US\$ 139                | US\$ 169               | US\$ 199             | Rollaways available only in king-bedded rooms at no charge; sleeper sofas in some rooms |
|                 | Student Rate                            | US\$ 104    | US\$ 104              | US\$ 104                | US\$ 134               | US\$ 164             |   |
|                 | Renaissance Seattle Hotel               | US\$ 139    | US\$ 139              | US\$ 139                | US\$ 159               | US\$ 179             | Rollaways available only in king-bedded rooms at no charge                              |
|                 | Student Rate                            | US\$ 129    | US\$ 129              | US\$ 129                | US\$ 149               | US\$ 169             |   |
|                 | The Paramount Hotel Seattle             | US\$ 130    | US\$ 130              | US\$ 130                | US\$ 150               | US\$ 170             | Rollaways available only in king-bedded rooms at no charge                              |
|                 | Student Rate                            | US\$ 120    | US\$ 120              | US\$ 120                | US\$ 140               | US\$ 160             |   |
|                 | Hyatt Olive 8 Seattle                   | US\$ 125    | US\$ 125              | US\$ 125                | US\$ 150               | US\$ 175             | Rollaways available only in king-bedded rooms at no charge                              |
|                 | The Inn at the Washington Athletic Club | US\$ 125    | US\$ 125              | US\$ 125                | US\$ 145               | US\$ 165             | Rollaways are extremely limited, inquire directly with the MMSB                         |
|                 | Crowne Plaza Seattle Downtown           | US\$ 125    | US\$ 125              | US\$ 125                | US\$ 145               | US\$ 165             | Rollaways available only in king-bedded rooms for a one-time \$25 fee                   |
|                 | Student Rate                            | US\$ 115    | US\$ 115              | US\$ 115                | US\$ 135               | US\$ 155             |   |
|                 | The Roosevelt Hotel                     | US\$ 120    | US\$ 120              | US\$ 120                | US\$ 140               | US\$ 160             | Sofa beds are available in all rooms  |

People interested in suites should contact the MMSB directly by email at [mmsb@ams.org](mailto:mmsb@ams.org) or by calling 800-321-4267, ext. 4137 or 4144 (401-455-4137 or 401-455-4144).

