JMM 2020 Call for MAA Contributed Papers

The MAA Committee on Sessions of Contributed Papers solicits papers pertinent to the sessions listed below. Any paper that fits the subject of one of the themed sessions should be submitted directly to that session. All others should be submitted to the general sessions, which will accept abstracts in all areas of collegiate mathematics, mathematical pedagogy, and the undergraduate mathematics curriculum. Presentations in the themed sessions are normally 15 minutes in length while presentations in the general sessions are limited to 10 minutes each.

Each participant may make *at most* one presentation in an MAA Contributed Paper Session, either a presentation in one of the themed sessions or a presentation in one of the general sessions (exclusive or). If a paper cannot be accommodated in the themed session for which it was submitted, it will automatically be considered for the general contributed paper sessions. The session rooms are equipped with computer projectors and screens. Please note that the dates and times scheduled for these sessions remain tentative. Questions concerning the submission of abstracts should be addressed to abs-coord@ams.org. Abstracts may be submitted electronically at http://jointmathematicsmeetings.org/meetings/abstracts/abstract.pl?type=jmm

The deadline for submission of abstracts is Tuesday, September 17, 2019.

Contributed Paper Sessions with Themes

Abstract Algebra: Teaching, Topics, and Techniques, organized by **Jessie Lenarz**, St. Catherine University and **Kristi Meyer**, Wisconsin Lutheran College. Abstract algebra is a core component of the mathematics curriculum. It is often one of the more theoretical courses taken by undergraduate students, making it challenging for students who are not familiar or comfortable with this level of abstraction. In this session, we invite papers and scholarly presentation which share and discuss innovative ideas and approaches to improve the teaching and learning of abstract algebra at the undergraduate or beginning graduate level. These innovative approaches may include, but are not limited to, inquiry-based learning, mathematical writing, integration of technology, projects, activities, and alternative methods of assessment. Reports on student outcomes and the effectiveness of the approaches presented are encouraged.

Active Learning in Introductory Courses: Insights from Math Departments in the Process of Change, organized by **Chris Rasmussen**, San Diego State University, **Wendy Smith**, University of Nebraska Lincoln, and **Matthew Voigt**, San Diego State University. Recent reports and studies indicate that mathematics departments across the US are interested in incorporating active learning to improve student outcomes in their introductory undergraduate courses, and would benefit from documented stories of ongoing change to inform their work. Published research about change efforts, however, do not usually describe the approach and implementation in sufficient detail for others to initiate similar efforts. We therefore seek scholarly presentations from departments who are implementing active learning in a systemic manner and who are in the beginning process of sustaining change efforts. In particular, we seek contributions that document shifts in departmental norms and practices for graduate student and faculty professional development, course coordination, the building of a community of practice among faculty, the role of department leaders and upper administrators, the role

of collaborative networks or partnerships, and/or the use of local data to inform and guide innovations. We encourage proposals that detail early wins and indicators of student success, challenges faced, and strategies employed to mitigate these challenges. Co-sponsored by IBL SIGMAA and the SIGMAA on RUME.

Best Practices and Considerations in Designing and Developing Online Math Courses, organized by **Sharon M. Mosgrove**, Western Governors University and **Doug Scheib**, Western Governors University. Online learning has become more prevalent over the past decade. As a result, the need to fully understand and utilize the online learning platform, and all that it entails, is of extreme importance. For this session, we invite presentations that will address any of the following topics: how online educators ensure a high quality educational experience for the student, in particular as it relates to the rigor of the course and the integrity of course activities, tests, and exams; how online educators ensure that the course is dynamic, fun, engaging and interactive, an important issue to consider in terms of keeping students self-motivated; how online educators ensure that students consistently engage in the course; the best forums for one to one, one to many, and/or student to student interactions, such as webinars, discussion boards, etc.; how online educators determine and ensure that their learning resources are effective and meet students' needs; how online educators develop a course that meets the desired objectives and how they measure those objectives.

Combining Technological Tools and Innovative Practices to Improve Student Learning Outcomes, organized by **Marianna Bonanome**, New York City College of Technology, **Manmohan Kaur**, Benedictine University, **Ariane M. Masuda**, New York City College of Technology, and **K. Andrew Parker**, New York City College of Technology. Experimentation in instructional methodologies is blooming. An increasing number of instructors are adapting more than one technological tool and combining them with active learning techniques to improve student learning both in and outside of the classroom. The number of institutions that recognize and support these efforts through grants and special programs also continues to grow. This session will provide a venue for exposition of recent initiatives, thereby disseminating results (positive and negative), reducing duplication of effort, promoting collaboration between instructors, as well as across institutions, and providing recognition for those on the front lines of experimental learning. Sponsored by MAA's Committee on Technologies in Mathematics Education (CTME).

Data Across the Curriculum, organized by **Alana Unfried**, California State University, Monterey Bay. As the data deluge continues, undergraduate mathematics students must prepare for careers that inevitably involve data. The Guidelines for Assessment and Instruction in Statistics Education (GAISE, 2016) discuss the importance of integrating real data into introductory statistics courses, but less attention has been given to mathematical probability/statistics courses and the mathematics major curriculum as a whole. This session invites presentations that discuss effective ways to integrate data and/or statistics into the undergraduate mathematics major curriculum. Presentations may include, for example, discussions of data and programming integrated into a calculus course, a linear algebra module highlighting connections to statistics and data analysis, or revisions of probability and statistics courses for mathematics majors to highlight authentic uses of data. Presentations might also include discussions of integrating statistical software into these courses. Co-sponsored by the SIGMAA on Statistics Education and the Committee on the Undergraduate Program in Mathematics.

Developments, Directions, and Experiences in Open Educational Resources, organized by **Benjamin Atchison**, Framingham State University, **Robert Beezer**, University of Puget Sound, and **Oscar Levin**, University of Northern Colorado. An increasing number of authoring tools, learning platforms, and

related technological enhancements continue to foster the creation of open educational resources (OER) in mathematics and across disciplines, as well as push the boundaries in such areas as accessibility and both online and mobile learning. This session will showcase recent developments in this area. Presentations will include, but are not limited to, newly authored or enhanced OER and technological improvements/innovations related to mathematics instruction and education. Sponsored by MAA's Committee on Technologies in Mathematics Education.

Discrete Mathematics in the Undergraduate Curriculum - Ideas and Innovations in Teaching, organized by **John Caughman**, Portland State University, **Oscar Levin**, University of Northern Colorado, and **Elise Lockwood**, Oregon State University. Discrete mathematics is a fundamental aspect of computer science, and it is increasingly relevant in our digital world. The aim of this session is for researchers and teachers to share ideas for how to improve the teaching and learning of discrete mathematics at all undergraduate levels. We welcome scholarly presentations that speak to pedagogical aspects of discrete mathematics, which may include, but are not limited to: research on student thinking about relevant concepts, research demonstrating effective instructional strategies, ideas for incorporating technology into the discrete mathematics classroom, innovative activities or pedagogical interventions, or philosophies toward teaching discrete mathematics.

The EDGE (Enhancing Diversity in Graduate Education) program: Pure and Applied talks by Women Math Warriors, organized by **Laurel Ohm**, University of Minnesota and **Shanise Walker**, University of Wisconsin-Eau Claire. Since its beginning in 1998, over two hundred and forty women have participated in the EDGE program. Approximately seventy are currently working towards a PhD, over one hundred and twenty have earned Masters and more than eighty have gone on to successfully complete PhDs. This session will be comprised of research talks in a variety of different subdisciplines given by women involved with the EDGE program. Presenters will include graduate students, early career mathematicians, and tenured faculty. For more information on the EDGE program see http://www.edgeforwomen.org/.

Effective Assessment Practices in Large-enrollment Classes or Non-traditional Classrooms, organized by **Beste Gucler**, University of Massachusetts Dartmouth, **Gulden Karakok**, University of Northern Colorado, **Jessica OShaughnessy**, Shenandoah University, **Jana Talley**, Jackson State University, and **Michael Tallman**, Oklahoma State University. The MAA's Instructional Practices (IP) Guide was designed to inform effective teaching through evidence-based classroom, assessment, and course design practices. Aligning with the work of the MAA's Committee on Assessment, the document outlines important aspects of assessment practices that are critical to the future of mathematics education at the undergraduate level. In particular, the MAA's IP Guide provides several assessment techniques for large-enrollment classes and non-traditional classrooms (e.g., independent study, industrial projects, undergraduate research, and online courses). These assessment techniques encompass effective and thoughtful use of formative or summative assessments, keeping student learning outcomes on the forefront. This session presents both preliminary and completed research reports on implementation of these assessment techniques or others that are inspired by them either for formative or summative assessment in large-enrollment classes or non-traditional classrooms. In addition to research reports, contributors are encouraged to submit anecdotal evidence of successful implementation of relevant assessment techniques in such settings. Sponsored by MAA committee on assessment.

Fostering Creativity in Undergraduate Mathematics Courses, organized by **Emily Cilli-Turner**, University of La Verne, **Houssein El Turkey**, University of New Haven, **Gulden Karakok**, University of Northern Colorado, **Milos Savic**, University of Oklahoma, and **Gail Tang**, University of La Verne. Creativity is an

integral part of practicing mathematicians' work, but it is seldom explicitly valued or fostered in undergraduate mathematics courses. While research into the promotion of mathematical creativity exists in the K-12 literature, studies at the undergraduate level are sparse. As such, theoretical frameworks, pedagogical techniques, tasks, and classroom environments that promote mathematical creativity for undergraduate students have not been extensively studied. For this session, we invite proposals that describe either a theoretical framework, an activity/ assignment/project, or teaching practices that faculty believe can be successful in producing creative results from students in an undergraduate mathematics course. Talks in this session should describe outcomes and give evidence of success of the intervention.

A History of Mathematics in the United States and Canada: A session in Honor of Math Historian David Zitarelli, organized by **Colin McKinney**, Wabash College and **Amy Shell-Gellasch**, Eastern Michigan University. Just two months before the publication of his two-volume *A History of Mathematics in the United States and Canada*, historian of mathematics, David Zitarelli, passed away in his sleep. His four-decade career in mathematics and the history of mathematics added seminal work to the field, including seven text books! And his perpetually joyous demeanor made history of mathematics meetings filled with warmth and comradery. David's historical research focused on the history of mathematics in America, with a seminal work on the history of the EPaDel section of the MAA. This session honors the work and legacy of Dr. Zitarelli by presenting papers on the history of mathematics in American and Canada, to include educational practices, biographies, history of the MAA and its sections, and other related work. Sponsored by HOM SIGMAA.

Inclusive Excellence for the Mathematical Sciences, organized by **Naiomi Cameron**, Lewis & Clark College, **Rachelle DeCoste**, Wheaton College, **Chris Goff**, University of the Pacific, and **Semra Kilic-Bahi**, Colby-Sawyer College. The disparities in the field of mathematics in terms of gender, race, background, and ethnicity continue to remain problematic for its sustained prosperity. Focused and intentional efforts are required to close the gap. For this session, we invite presentations describing programs that have been developed to attract, involve, and retain women and underrepresented groups. We also encourage presentations on studies that have been designed to identify and address challenges faced in the mathematics community relating to gender identity and sexual orientation. We invite presentations focused on innovations in the curriculum, outreach and extracurricular activities, STEM community-building efforts both inside and outside the classroom, effective social and academic support structures, and scholarly efforts aimed to identify and raise awareness of these issues. Organized by MAA Committee on the Participation of Women in Mathematics and Joint Committee on Women in Mathematical Sciences.

Incorporating Realistic Applications of Mathematics Through Interdisciplinary Collaborations, organized by **Mary Beisiegel**, Oregon State University, **Suzanne Doree**, Augsburg University, **Mary R. Parker**, University of Texas Austin, and **Rebecca Segal**, Virginia Commonwealth University. Finding realistic applications of mathematics from other disciplines that can be included in mathematics courses is challenging. Many of us have benefitted from our interactions with faculty and practitioners from other disciplines. Others of us realize that this would be useful, but are unsure how to begin such a collaboration. Papers in this session will highlight the process of the collaboration (how it began, the eventual results, and a summary of "lessons learned") as well as showcasing a particular example of an application of mathematics that was added to the curriculum as a result of the collaboration. Examples at any level of the mathematics curriculum are welcome. All presentations should include evidence of success in the collaboration process as well as evidence of impact on students, for example on student engagement, sense of belonging, student learning, persistence in math/STEM, etc. In the abstract,

please identify the partner discipline(s), mathematics course(s), and the nature of examples developed. Sponsored by Math Across the Disciplines subcommittee of CUPM.

Innovations in Complex Analysis, organized by **Mike Brilleslyper**, United States Air Force Academy, **Russell W. Howell**, Westmont College, and **Beth Schaubroeck**, United States Air Force Academy. Proposals for this session of the JMM should be scholarly in nature, but can come from a wide range of topics such as: surveying an episode in complex analysis that is of particular historical interest, demonstrating the use of complex analysis in art, elaborating on a new approach to a standard theorem, describing research projects suitable for undergraduate or graduate students, and presenting an atypical idea that could be worked into the standard curriculum.

Innovative and Effective Ways to Teach Linear Algebra, organized by **Sepideh Stewart**, University of Oklahoma, **Gil Strang**, MIT, **David Strong**, Pepperdine University, and **Megan Wawro**, Virginia Tech. 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.

Inquiry-Based Learning and Teaching, organized by **Brian Katz**, Augustana College, **Carl Mummert**, Marshall University, and **Victor I. Piercey**, Ferris State University. 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. Among these and other topics, talks related to assessment are strongly encouraged. Sponsored by IBL SIGMAA.

Integrating Research into the Undergraduate Classroom, organized by **Timothy B. Flowers**, Indiana University of Pennsylvania and **Shannon R. Lockard**, Bridgewater State University. Undergraduate Research is a high-impact practice that inspires student learning, builds crucial skills, boosts retention and graduation rates, and particularly benefits underrepresented and at-risk students. While 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 should emphasize why the project(s) being discussed is considered undergraduate research rather than a typical assignment. Participants are encouraged to share the impact on the students involved if possible.

Making Business Calculus Relevant, organized by **Britney Hopkins**, University of Central Oklahoma and **Leslie Jones**, University of Tampa. Business calculus is a service course in high demand for many mathematics departments. We seek presentations on the following:

- Topics from business calculus used in advanced business courses (a curriculum map of concepts from business calculus to advanced business courses)
- Practical professional development ideas for mathematics faculty to facilitate an increase in knowledge of applications of concepts taught in business calculus
- Innovative course designs that speak to collaboration with business faculty or business professionals
- Survey data to provide insight into the perspectives of the course's stakeholders
- Incorporation of technology into business calculus with a clear explanation of the learning objectives taught with the enhanced computational/ visual ability.

Mathematical Experiences and Projects in Business, Industry, and Government (BIG), organized by **Robert Burks**, Naval Postgraduate School**.** The extraordinary growth of problems facing business, industry, and government seems overwhelming. It should not! As mathematicians, operations research analysts, and engineers, including those within academia, we experience and tackle these problems with experience, knowledge, and technological tools. We solve applied mathematics problems in business, industry, and government, including military applications, almost daily. We seek presenters to share examples of this type of problem solving. These may include problems where you have no clue how to proceed and are seeking ideas from our audience. Your talks will serve as inspiration to solve and tackle the real problems that we may face in the future. You do not have to be a BIG SIGMAA member to attend or present. Sponsored by the SIGMAA on Business, Industry, and Government.

Mathematical Knowledge of Teachers as an Integrated Application in Core Mathematics Courses, organized by **Elizabeth Arnold**, James Madison University, **Wesley Calvert**, Southern Illinois University, **Elizabeth Fulton**, Montana State University, **Yvonne Lai**, University of Nebraska - Lincoln, and **April Strom**, Chandler/Gilbert Community College. Core courses in the math curriculum often include problems attending to specific application areas such as science, engineering, and business. These problems serve to emphasize the utility of the mathematics in the areas, to legitimize the application area as requiring deep mathematical thinking, and to help students understand the breadth of career opportunities for mathematicians. The MAA META Math project (NSF 1726624) is focused explicitly on

adding "secondary teaching" to the list of legitimate application areas of mathematics by creating resources and training on the integration of curriculum materials for every math major course. In this session, participants will share course materials that can be integrated into traditional undergraduate major courses with the goal of inspiring future teachers to engage in deep thinking about how the undergraduate mathematics connects to high school content. The audience will consist of instructors who teach core math major courses, such as calculus, discrete math, statistics, and abstract algebra, and who wish to have a positive impact on the mathematics training of future teachers. We also encourage presentations by researchers who have examined the nature of these courses, including instruction, learning outcomes, and development. Sponsored by MAA COMET and SIGMAA-MKT.

Mathematics and the Arts: in the Classroom and Beyond, organized by **Douglas Norton**, Villanova University. This session explores the intersections of mathematics with various fiber, paint, sculpture, dance, literature, film, poetry, architectural, and other arts. Presentations on creative engagements, historical or biographical surveys, and particularly classroom experiences are welcome. Sponsored by SIGMAA Arts.

Mathematics and the Life Sciences: Initiatives, Programs, Curricula, organized by **Timothy D. Comar**, Benedictine University, **Carrie Diaz Eaton**, Bates College, and **Raina Robeva**, Sweet Briar College. The 2015 CUPM Curriculum Guide to Majors in the Mathematical Sciences identified the life sciences as a key path through the mathematics major to graduate programs and the workforce. Topics include scholarly contributions addressing initiatives, programs, curricula, and course materials at the interface of mathematics and the life sciences that have been implemented and tested at institutions of higher education. Sponsored by BIO SIGMAA.

Mathematics and Sports, organized by **Diana Cheng**, Towson University and **John David**, Virginia Military Institute. The expanding availability of play-by-play statistics and video-based spatial data have led to innovative research using techniques from across the mathematical sciences, with impacts on strategy and player evaluation. Other areas of interest include ranking methods, predictive models, physics-based analysis, etc. Research presentations, expository talks, and contributions related to curriculum or pedagogy are all welcome. With a broad audience in mind, talks should be accessible to undergraduate mathematics majors, and projects involving undergraduate students are particularly encouraged for submission. Sponsored by the Sports SIGMAA.

Modeling-First Inquiry-Based Course Activities, organized by **Ben Galluzzo**, Clarkson University and **Brian Winkel**, SIMIODE. Mathematical modeling is widely used to motivate student learning in courses across the mathematical curriculum. Implementation of the modeling process through inquiry-based activities varies by course as well as background of the professor, majors of the students, departmental constraints, and type of institution. Models come in many forms, from conservation laws in differential equations to regression analysis in statistics, but each model is a chosen representation for a particular purpose. Students develop mathematical reasoning through inquiry, as results of a model depend upon the questions asked in forming it. This motivates students to learn needed content and makes them aware of assumptions as they revise their model. We invite scholarly presentations of in-class activities, projects, and/or data collection experiences that generate active, inquiry-oriented learning across the mathematics curriculum. The diversity of presented modeling implementations benefits the community through shared resources, support, and new perspectives. Presenters are encouraged to discuss the value of modeling to themselves as teachers and to their students as learners, as well as assessment techniques and pedagogical successes and challenges.

Quantitative Literacy and Social Justice: An Ongoing Dialogue, organized by **Mark A. Branson**, Stevenson University, **Catherine Crockett**, Point Loma University, **Jason Douma**, University of Sioux Falls, **Gizem Karaali**, Ponoma College, **Victor Piercey**, Ferris State University, and **Samuel L. Tunstall**, Trinity University. In an era of alternative facts, dueling memes, and politically charged classrooms, mathematics (including statistics) has much to contribute to an understanding of how information can be collected, analyzed, and interpreted to reflect reality and to inform opinions involving values and commitments. Mathematical models and structures can yield powerful insights in exploring, understanding, and even resolving a range of complex social issues and challenges. But at the same time that one can use mathematics to study social issues, though, the teaching of mathematics itself may be viewed as a social justice issue. Here, by social justice we mean the fair distribution of wealth, opportunities, and privileges in society.

This session invites a variety of papers that attend to the complex relationship between mathematics, mathematics teaching, and social change or social justice. For example, papers in this session might address the following: the mathematical exploration of topics involving social change or social justice; teaching quantitative literacy or other mathematics or statistics courses for social justice; and issues of pedagogy or policy related to mathematics and social justice. Sponsored by SIGMAA-QL and MAA Subcommittee on Mathematics Across the Disciplines (MAD).

Recreational Mathematics: Puzzles, Card Tricks, Games, and Gambling, organized by **Paul R. Coe**, Dominican University, **David A. Nash**, Le Moyne College, **Andrew Niedermaier**, Jane Street Capital, and **Sara B. Quinn**, Dominican University. Puzzles, card tricks, board games, game shows, and gambling provide an excellent laboratory for testing mathematical strategy, probability, and enumeration. The analysis of such diversions is fertile ground for the application of mathematical and statistical theory. Solutions to new problems as well as novel solutions to old problems are welcome. Submissions by undergraduates or examples of the use of the solutions of these problems in the undergraduate classroom are encouraged. Sponsored by the SIGMAA on Math Rec.

Re-Envisioning the Calculus Sequence, organized by **Robin Cruz**, College of Idaho, **Tom Halverson**, Macalester College, **Joel Kilty**, Centre College, **Alison Marr**, Southwestern University, **Alex M. McAllister**, Centre College, and **Chad Topaz**, Williams College. The MAA's 2015 report "A Common Vision for Undergraduate Mathematical Sciences Programs in 2025" summarized the findings of seven curriculum guides from AMATYC, AMS, ASA, MAA, and SIAM. The unanimous conclusion of all these guides is that "*The status quo is unacceptable*." The report goes on to offers a compelling call to action for mathematicians to: update curricula; articulate clear pathways; scale up the use of evidence-based pedagogical methods; remove barriers facing students at critical transition points; encourage student persistence; and establish stronger connections with other disciplines. While all aspects of this call are challenging, the prospect of updating the calculus curriculum and the pathways into the calculus sequence are particularly challenging. This session invites presenters to share their approaches to "re-envisioning" calculus, how they are rethinking the critical transition into and through a calculus sequence, and a candid assessment of both the advantages and disadvantages of their choices.

Research in Undergraduate Mathematics Education (RUME), organized by **Nicole Engelke Infante**, West Virginia University, **Shiv Smith Karunakaran**, Michigan State University, and **Megan Wawro**, Virginia Tech. The goals of this session are to promote high quality research in undergraduate mathematics education, to disseminate well-designed educational studies to the greater mathematics community, and to facilitate a productive impact of research findings on pedagogy in college mathematics. Presentations may be based on research in areas such as calculus, linear algebra,

differential equations, abstract algebra, and mathematical proof. Examples 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 instructors that supports college students' mathematical thinking. Presentations should report on 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 should use well-established or innovative methodologies as they pertain to the study of undergraduate mathematics education. Sponsored by SIGMAA RUME.

Role of Explanation in Mathematical Proofs, organized by **Jeff Buechner**, Rutgers University Newark, **Sally Cockburn**, Hamilton College, and **Kevin Iga**, Pepperdine University. Mathematical proofs are a form of argument. We can say of arguments in general - and mathematical proofs specifically - that, when sound, they show us that the claim made is true. But often some arguments - and this includes some mathematical proofs - do more. They also explain to us why it is true. Proposed talks might discuss (but are not limited to) the following topics. What is it to explain why a mathematical theorem is true? Which mathematical proofs explain why the theorem proved is true? Some doubt that proofs by mathematical induction can. Is mathematical explanation different from, say, scientific explanation (which does not involve the use of mathematics)? Is it different from historical explanation? Or is there a unified sense of 'explanation' which is common to its use in all subjects, including mathematics? Are there instances of mathematical theorems which have multiple proofs, some of which are elegant and simple, but not explanatory, while the others are neither elegant nor simple, but explanatory? If so, does being explanatory count as a good reason to prefer one kind of proof over the other? Is a shorter proof always explanatory than a longer proof? All proposals to discuss the role of explanation in mathematical proofs will be considered. Sponsored by POM SIGMAA.

The Scholarship of Teaching and Learning in Collegiate Mathematics, organized by **Tom Banchoff**, Brown University, **Curtis Bennett**, California State University Long Beach, **Jacqueline Dewar**, Loyola Marymount University, **Edwin Herman**, University of Wisconsin-Stevens Point, and **Lew Ludwig**, Denison University; Wednesday, 8:00-10:55 am and 2:15-5:55 pm. In the scholarship of teaching and learning, faculty bring 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 inquiries into student understanding. The session goals are to: (1) feature scholarly work 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. Appropriate for this session are preliminary or final reports of investigations of post-secondary teaching methods, student learning difficulties, curricular assessment, or insights into student (mis)understandings. Abstracts should: (1) have a clearly stated question that was or is under investigation and (2) indicate the type of evidence that has been or will be gathered and presented. For example, abstracts might refer to evidence such as student work, participation or retention data, pre/post tests, interviews, surveys, think-alouds.

Scholarship on Teaching and Learning Statistics, organized by **Lisa Carnell**, High Point University. Statistics education is an expanding field that has grown out of several disciplines including mathematics education and educational psychology. It is a field devoted to the improvement of teaching and learning statistics at all educational levels. Research in statistics education is both qualitative and quantitative and ranges from classroom studies of new pedagogical methods to multi-institution research projects investigating how students learn statistics to the development of theoretical learning models. This

session invites presentations on research and scholarship in the teaching and learning of statistics at all levels from K-12 through postsecondary to the training of professionals. Presentations may include current research projects in the classroom or across institutions, including research on attitudes, beliefs, and dispositions toward statistics. Reviews of the statistics education research literature are also welcome. Research projects should be approved by the presenter's Institutional Review Board. Sponsored by the SIGMAA on Statistics Education, SIGMAA on Research in Undergraduate Mathematics Education.

Tangents to Math Circles, organized by **Amanda K. Serenevy**, Riverbend Community Math Center and **James Taylor**, Math Circles Collaborative of New Mexico. Many members of the Math Circle community bring their enthusiasm for mathematics to other kinds of math outreach settings. Presenters in this themed session will share ideas for adapting specific topics to some of these "Math Circle tangents". These settings might include adaptations of Math Circle topics to classrooms, public festivals, MESA competitions, STEM/STEAM rallies, family math nights, or mentoring math-centered student projects for Science or STEM Fairs or computational science competitions. Sponsored by SIGMAA MCST.

The Teaching and Learning of Undergraduate Ordinary Differential Equations, organized by **Christopher S. Goodrich**, Creighton Preparatory School and **Beverly H. West**, Cornell University. 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 the ODEs course; (2.) strategies for teaching both differential equations and linear algebra simultaneously; (3.) the inclusion of technology in the ODEs course; (4.) examples of interdisciplinary lessons such as, for example, those that connect to social justice and environmental concerns; and (5.) descriptions of applications or nonstandard topics and how such topics can lead to student engagement and interest. In addition, contributors should include some discussion of the success of their methods, such as in what ways the activity or method under discussion has improved student learning, retention, or interest in the differential equations course. Sponsored by CODEE.

Teaching Mathematics with Humor or Pop Culture, organized by **Sarah J. Greenwald**, Appalachian State University**, Semra Kilic-Bahi**, Colby-Sawyer College, and **Cesar Martínez-Garza**, Pennsylvania State University at Berks.   Humor is a powerful teaching tool. Popular culture that is familiar to students, including known shows, movies, books, music, and more, can be too. They both can be used to make a course more interesting, to introduce a topic or a concept, to emphasize a misconception, or to help recall learned material. Furthermore, they can help build relationships and classroom communities by easing stressful situations, reducing anxiety levels, enhancing communication, and meeting students where they are. This session will showcase presentations on how humor or popular culture can be combined with mathematics to enhance learning. We particularly encourage submissions about ideas and techniques that have been tested in the classroom and have had a demonstrated effect on student learning and attitudes, though more theoretical or tentative approaches are also welcome. This session specifically emphasizes the place of humor and popular culture in the mathematics classroom, but outstanding submissions about other facets of the relationship of mathematics and humor or mathematics and popular culture will also be considered.

Tell Me a Story: Connections between Mathematics and Performed or Print Narrative, organized by **Kristin Camenga**, Juniata College, **Judith Covington**, Northwestern State University of Louisiana, and **Sharon K. Robbert**, Trinity Christian College. This session invites presentations that incorporate stories that capture our interest in literature, drama, and film into college-level mathematics. Most mathematicians know how the novel *Flatland* illustrates higher dimensions and how the film *The Man Who Knew Infinity* describes the work of mathematicians. What other gems are hidden in our cultural narratives that mathematics can assimilate? Presentations might consider connections to narratives that intentionally incorporate mathematics as an integral part of the plot or to stories whose applications to mathematics are ripe for exploitation. Both scholarly explorations of mathematics embedded in a lesser-known story or pedagogical connections to visual or written literature that promote student learning are desired. Pedagogical connections should incorporate evaluation of implementation and effectiveness. We seek innovative and creative connections between mathematics and story that humanize mathematics and embody mathematical concepts involving students in mathematics. Sponsored by MAA Committee on Professional Development and MAA Committee on Two-Year Colleges.

GENERAL CONTRIBUTED PAPER SESSIONS

GENERAL CONTRIBUTED PAPER SESSIONS, Organized by **Holley Friedlander**, Dickinson College, **Cathy Erbes**, Hiram College, and **Steven McKay**, Brigham Young University. The MAA's General Contributed Paper Session accepts contributions in all areas of mathematics, curriculum, and pedagogy. When you submit your abstract, you will be asked to classify it according to the following scheme: 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; and Other Topics.