

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 25, 2018.

Contributed Paper Sessions with Themes

Approaches to Mathematics Remediation in Baccalaureate-Granting Institutions, organized by **Michael Boardman**, Pacific University, **Helen E. Burn**, Highline College, and **Mary E. Pilgrim**, Colorado State University, Saturday morning. Mathematics programs in baccalaureate institutions increasingly offer developmental course work due to shifts in student demographics. Furthermore, a decade or more of research establishes the negative impact of such courses on student outcomes in the two-year context. As a result, mathematics programs at the baccalaureate level face increasing pressure to develop evidence-based models that effectively enable students to grow mathematically in developmental content areas while maintaining momentum towards degree attainment. This session seeks scholarly presentations that address developmental mathematics at the baccalaureate level from a variety of perspectives that inform program leadership around developmental mathematics curriculum in the baccalaureate context. Presentations may focus on developmental models at a single institution or system-wide efforts (e.g., technology-enhanced, co-requisite, pathways); organizational factors leading to effective implementation of curriculum (e.g., redesigning the learning space, onboarding graduate teaching assistants, leading departmental change). The session also encourages historical or policy research on current external influences on developmental mathematics curriculum in the baccalaureate context. Sponsored by the Committee on the Undergraduate Program in Mathematics.

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, Wednesday morning and afternoon. Discrete mathematics offers many accessible points of entry for students to engage in deep mathematical thinking. 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 characterize discrete mathematics broadly to encompass topics of sets, logic, proof techniques, recurrences, combinatorics, graph theory, relations, and more. We hope to facilitate communication between mathematics education researchers and those who teach these topics. 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**, Iowa State University, Thursday afternoon. 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 sub disciplines given by women involved with the EDGE program. For more information on the EDGE program, see <http://www.edgeforwomen.org/>.

Ethnomathematics: Ideas and Innovations in the Classroom, organized by **Janet Beery**, University of Redlands, **Antonia Cardwell**, Millersville University of Pennsylvania, **Ximena Catepillan**, Millersville University of Pennsylvania, and **Amy Shell-Gellasch**, Eastern Michigan University, Friday morning. Ethnomathematics, the study of mathematical aspects of the cultures of indigenous peoples, has been an active subject area for many decades. As more institutions strive to present multicultural offerings to their students, courses dedicated to or incorporating ethnomathematics are becoming more popular. This session features talks that present ideas for incorporating ethnomathematics into mathematics courses, ethnomathematics focused courses, ideas for undergraduate research in ethnomathematics, as well as new ethnomathematical research that can be brought into the classroom. Well-tested ideas and innovations in ethnomathematics for its use in teaching are welcome. Sponsored by the History of Mathematics SIGMAA.

Formative and Summative Assessment of Mathematical Communication and Conceptual Understanding, organized by **Jessica OShaughnessy**, Shenandoah University, and **Jana Talley**, Jackson State University, Thursday afternoon. The MAA's

Instructional Practices (IP) Guide was designed to inform effective teaching through evidence-based classroom, assessment, and course design practices. Relevant to the work of the MAA's Committee on Assessment, the document addresses several 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 insight on the use of formative and summative assessments in mathematics. Additionally, consideration is given to the need for proper assessment of each student's ability to communicate mathematics and demonstrate conceptual understanding. These assessment types allow for a wide variety of implementations and focus on students' general understanding of mathematics rather than only procedural knowledge. This session presents both preliminary and completed research reports on formative and summative assessment techniques that attend specifically to student communication skills and conceptual understanding. In addition to research reports, contributors are encouraged to submit anecdotal evidence of successful implementation of relevant assessment techniques in undergraduate classes. Sponsored by the Committee on Assessment.

Fostering Creativity in Undergraduate Mathematics Courses, organized by **Emily S. Cilli-Turner**, University of Washington Tacoma, **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, Saturday morning. 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.

Good math from bad: crackpots, cranks, and progress, organized by **Elizabeth T. Brown**, James Madison University, and **Samuel R. Kaplan**, University of North Carolina Asheville, Friday afternoon. There are many purveyors of bad mathematics; people who have become so obsessed with a flawed or crackpot idea that they ignore evidence to the contrary are called cranks. Squaring the circle, doubling a cube and trisecting angles are just a few well-known ill-conceived pursuits. Crank mathematicians are not always amateurs and sometimes good ideas are generated on bad problems. There are also people who, knowingly or not, abuse mathematics to advance arguments outside of the mathematics. Finally, there are straightforward mathematical errors that are nevertheless useful in advancing mathematics. The study of crackpot and other erroneous math exposes the interesting history of classical problems as well as contemporary issues that arise from the ease of communication and proliferation of unsound math on the internet. This unusual session offers the opportunity to explore good problems and some good mathematics with

witty and sad stories of coincidence, pseudo-science, and eccentricity. All talks will be given in the context of learning without chiding or belittling those involved in these stories.

Humanistic Mathematics, organized by **Gizem Karaali**, Pomona College, and **Eric Marland**, Appalachian State University, Thursday morning. Humanistic mathematics is historical, going back about thirty years, and awakens many connotations in those who hear it. 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 it's aesthetic, cultural, historical, literary, pedagogical, philosophical, psychological, and sociological aspects. 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. Submissions on all humanistic aspects of mathematics are invited. We are especially looking for submissions that will stimulate discussion and further inquiry related to collegiate mathematics in the first two years. Submissions should be aimed at a broad mathematical audience. Sponsored by the MAA Curriculum Renewal Across the First Two Years (CRAFTY) and the Journal of Humanistic Mathematics.

Inclusive Excellence - Attracting, Involving, and Retaining Women and Underrepresented Groups in Mathematics, organized by **Francesca Bernardi**, University of North Carolina at Chapel Hill, **Meghan DeWitt**, St Thomas Aquinas College, **Semra Kilic-Bahi**, Colby-Sawyer College, and **Minah Oh**, James Madison University, Saturday morning. The disparities in mathematics in terms of gender, race, background, and ethnicity continue to remain problematic for the sustained prosperity of the field. Focused and intentional efforts are required to close the gap. For this session, we invite presentations describing programs that have been specifically developed to attract, involve, and retain women and underrepresented groups via innovations in the curriculum, outreach, extracurricular activities, and STEM community-building efforts both inside and outside the classroom. Moreover, we invite presentations focused on effective social and academic support structures and scholarly efforts aimed to raise awareness on the issues surrounding these disparities. Sponsored by the MAA Committee on the Participation of Women in Mathematics.

Incorporating Programming and Computing in the Math Major Curriculum, organized by **Holly Peters Hirst**, Appalachian State University, and **Gregory S. Rhoads**, Appalachian State University, Saturday morning. Programming and computing play an important role in mathematics. Many undergraduate math majors encounter programming and computing concepts during their coursework. Some faculty require students to learn computer math systems, programming languages, specialized computing software, etc. Some departments have developed “mathematical computing” courses. Students also take computer science and statistical computing courses as part of their major or as electives. Papers in this session will address ways that faculty have incorporated programming or computing knowledge into the undergraduate mathematics major curriculum at their

institutions. We hope to generate discussion of innovative approaches to exposing math majors to programming and computing concepts.

Inequalities and Their Applications, organized by **Titu Andreescu**, University of Texas at Dallas, and **Henry J. Ricardo**, Westchester Area Math Circle, Thursday morning. Since the 1934 publication of *Inequalities* by Hardy, Littlewood, and Pólya, the literature devoted to this subject and the importance of inequalities in various areas of mathematics and science have grown considerably. In addition, inequalities have become a staple of mathematical competitions on the secondary and college levels and in journal problem sections. This session solicits contributions related to mathematical inequalities (algebraic, analytic, geometric/trigonometric) and their applications. These include new inequalities, new proofs of old inequalities, expository presentations, and applications to various domains of science and mathematics. Talks in this session should be accessible to advanced undergraduate students, and descriptions of student research experiences in this area are particularly welcome.

Infusing Data Science and Big Data into the Statistics Classroom, organized by **Allen Harbaugh**, Boston University, Wednesday afternoon. Several schools around the world now have programs, both at the undergraduate as well as at the graduate levels, dedicated to Data Science education, and there have been many conference presentations about such programs. This session invites participants and attendees to examine how a statistics educator might introduce a subset of Data Science topics into a statistics course. We invite presentation proposals that showcase what Data Science topics a statistics instructor can incorporate into statistics courses of any level, how they accomplish this, and consequent assessments of impact on student learning. We encourage presentations on innovative classroom activities, curriculum plans, and external resources, that are accompanied by findings from having attempted to assess or evaluate the approaches that are advocated in the presentation. Sponsored by the SIGMAA on Statistics Education (SIGMAA STAT ED).

Innovative Curricular Strategies for Increasing Mathematics Majors, organized by **Stuart Boersma**, Central Washington University, **Eric Marland**, Appalachian State University, **Victor Piercey**, Ferris State University, and **Frank Savina**, University of Texas at Austin, Wednesday morning. Many colleges and universities are seeking information about new and strategic curricular efforts to increase the number of mathematics majors. Such curricular innovations may include alternate entry points to the mathematics major, alternate pathways to and through college level mathematics courses, first-year seminars aimed at STEM majors, and strategies to attract and retain specific populations (such as underrepresented groups or students with AP Calculus credit). This session seeks to identify such innovative practices where they exist and to share these successes with the MAA's Committee for the Undergraduate Program in Mathematics (CUPM) as well as the broader mathematical community. Ideally, papers should evaluate. Sponsored by the MAA Curriculum Renewal Across the First Two Years (CRAFTY).

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

Innovative Pathways to Quantitative Literacy, organized by **Catherine Crockett**, Point Loma Nazarene University, **Keith Hubbard**, Stephen F. Austin State University, and **Jennifer Nordstrom**, Linfield College, Saturday morning. In recent years, numerous organizations have proposed pathways outside of traditional Pre-Calculus, College Algebra, or Intermediate Algebra for entry-level college students. Much of the discussion has focused on the need for college students to improve their quantitative literacy. This session is dedicated to sharing examples of innovative curricula, innovative implementations of existing curricula, or research in the effectiveness of a particular curriculum in fostering quantitative literacy. Sponsored by the MAA Committee on Articulation and Placement MAA Subcommittee on Curriculum Renewal Across the First Two Year SIGMAA on Quantitative Literacy.

Inquiry-Based Learning and Teaching, organized by **Susan Crook**, Loras College, **Eric Kahn**, Bloomsburg University, **Brian Katz**, Augustana College, **Amy Ksir**, United States Naval Academy, **Victor Piercey**, Ferris State University, **Candice Price**, University of San Diego, and **Xiao Xiao**, Utica College, Friday morning and afternoon. 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 the SIGMAA on Inquiry-Based Learning (IBL SIGMAA).

Integrated STEM Instruction in Undergraduate Mathematics, organized by **Jeneva Clark**, University of Tennessee, Knoxville, and **Anant Godbole**, East Tennessee State University, Thursday afternoon. MAA's Common Vision project recommends that the mathematics community "articulate clear pathways between curricula driven by changes at the K-12 level and the first courses students take in college" (p.1), and one such significant curricular change is the integration of STEM disciplines. This session will focus on college courses that have injected multidisciplinary STEM content in a meaningful way into first and/or second year courses, including K-12 teacher preparation programs as well as preliminary mathematics coursework in STEM disciplines. For this session, we are soliciting talks on how faculty have injected integrated STEM content (that relies on an understanding of one or several fields of inquiry) into their first-year and/or second-year mathematics courses. Such augmented courses may be general education courses or not. We are thus looking for presenters to share pedagogical innovations from their implemented courses with evidence of impact. Artifacts might include relevant modules, units, learning objectives, and/or learning activities as well as assessment tools that lead to a broader understanding of both mathematics and the related and integrated science, technology, and/or engineering areas that are used to motivate the learning of the mathematics.

Integrating Research into the Undergraduate Classroom, organized by **Timothy B. Flowers**, Indiana University of Pennsylvania, and **Shannon R. Lockard**, Bridgewater State University, Wednesday afternoon. 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.

Introducing Mathematical Modeling through Competitions, organized by **Chris Arney**, United States Military Academy, **William C. Bauldry**, Appalachian State University, and **Amanda Beecher**, Ramapo College, Thursday morning. COMAP's (www.comap.org) Mathematical Contest in Modeling (MCM), Interdisciplinary Contest in Modeling (ICM), and High School Mathematical Contest in Modeling (HiMCM), and SIMIODE's (www.simiode.com) Student Competition Using Differential Equations Modeling (SCUDEM) are team competitions in which students apply the mathematics they

know to solve a real world problem. Students routinely report learning more in this 4-day period than any other during college, and find it one of the most rewarding experiences of their undergraduate careers. Students point to this experience in interviews as an example of working in a team environment, meeting a deadline, and as evidence of their problem-solving ability. The value of participating is worth much more than the four days of work, making this an impactful experience for faculty advisors as well. This session is aimed at faculty who wish to begin advising teams and for current advisors to share strategies for student success. We invite presentations from experienced advisors focused on building and supporting student teams, developing mentor relationships for faculty, and presentations elaborating the judging process in order to help advisors better prepare student teams. We especially encourage student teams who have achieved a “Meritorious” or higher rating to report on their contest experience. Sponsored by COMAP and SIMIODE.

It’s Circular: Conjecture, Compute, Iterate, organized by **Thomas J. Clark**, Dordt College, and **James Taylor**, Math Circles Collaborative of New Mexico, Friday afternoon. Math Circles are a form of education outreach and enrichment through which mathematicians and mathematical scientists share their passion with K-12 teachers and students. Math Circles combine significant content with a setting that encourages a sense of discovery and excitement about mathematics through problem solving and interactive exploration. Great problems can often be solved by a variety of approaches working in concert. This session will focus on problems that are motivated, illuminated, or visualized through numerical computation or some form of computer modeling. For example, one might begin with a traditional math circle investigation—gaining insight into a problem, perhaps developing some conjectures—and follow it with computation or modeling, leading to greater insight and further analytical progress into the problem, or opening up new avenues for inquiry. Presentations in this session will generate new and interesting ideas providing a much-needed set of resources for circle organizers seeking problems unfolding the increasingly important topic of computation. Sponsored by SIGMAA-MCST.

MAA Session on Mathematical Experiences and Projects in Business, Industry, and Government (BIG), organized by **Robert Burks**, Naval Postgraduate School, and **Allen Butler**, Wagner Associates, Friday morning. 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. This session is sponsored by the SIGMAA on Business, Industry, and Government. Sponsored by the Business Industry

Government Special Interest Group of the Mathematical Association of America (BIG SIGMAA).

Mathematical Themes in a First-Year Seminar, organized by **Jennifer Bowen**, College of Wooster, **Mark Kozek**, Whittier College, **Pamela Pierce**, College of Wooster, and **Jennifer Schaefer**, Dickinson College, Friday afternoon. Does your college or university require students to take a first-year seminar? Often, these seminars include an introduction to college life and college-level academic culture through an emphasis on critical thinking, academic writing/research, information literacy, and collaborative learning. A mathematician tasked with teaching such a course may feel overwhelmed because the style of teaching and the assignments are typically different from those in our mathematics classes. At the same time, teaching such a seminar is a wonderful way to engage with students who may be open to learning more about the field. How can we, as mathematicians, engage students in mathematics or mathematically related themes? Speakers should share the theme/title of the seminar, the major learning goals of the course, the mathematical techniques and themes that were incorporated, and the degree to which these were successful.

Mathematics and the Arts, organized by **Karl Kattchee**, University of Wisconsin-LaCrosse, **Douglas Norton**, Villanova University, and **Anil Venkatesh**, Ferris State, Wednesday morning and afternoon. Learn, explore, and share interactions between mathematics and the arts. If you work in the arts with mathematical themes, if you use mathematics to create art, if you use mathematics and art together in your classrooms, if you explore interactions between mathematics and the arts in some of the usual or in some completely unexpected contexts, or if you want to hear reports of those who do any of the above, you are invited to this session. Just as "mathematics" includes any aspect of the mathematical sciences, "the arts" may be paint, sculpture, fiber arts, print, music, dance, architecture, poetry -- from Escher to Oulipo, perspective to origami, fugues to fractals. Sponsored by SIGMAA-ARTS.

Mathematics and the Life Sciences: Initiatives, Programs, Curricula, organized by **Timothy D. Comar**, Benedictine University, **Carrie Diaz Eaton**, Unity College, and **Raina Robeva**, Sweet Briar College, Thursday morning. In the 2015 CUPM Curriculum Guide to Majors in the Mathematical Sciences, the life sciences were clearly identified as a key path through the mathematics major to graduate programs and the workforce. This account echoed many prior high-profile reports (e.g., Bio 2010 (2003), A New Biology for the 21st Century (2009), Vision and Change (2011), The Mathematical Sciences in 2025 (2013), and the SIAM white paper Mathematics: An Enabling Technology for the New Biology (2009)) that had previously discussed the changing landscape at the interface of mathematics and biology and had issued urgent calls for broadening students' exposure to mathematical methods for the life sciences. It appears that a wider array of curricular ideas, programs, and materials that can be scaled, modified, and assessed in a wide range of different institutions is still needed. 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 successfully at institutions of

higher education. Speakers will be invited to submit their work for consideration in the upcoming *PRIMUS Special Issue: Mathematics and the Life Sciences: Initiatives, Programs, Curricula*. Sponsored by the SIGMAA on Mathematical and Computational Biology (BIO SIGMAA).

Mathematics and Sports, organized by **John David**, Virginia Military Institute, and **Drew Pasteur**, College of Wooster, Wednesday afternoon. 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 undergrads are particularly encouraged for submission. Sponsored by the Sports SIGMAA.

Meaningful Modeling in the First Two Years of College, organized by **William C. Bauldry**, Appalachian State University, and **Mary R. Parker**, Austin Community College, Saturday afternoon. Most major mathematical organizations, including the MAA in its 2015 CUPM Curriculum Guide, have encouraged programs to incorporate modeling at all levels of the mathematics curriculum, including the first two years of undergraduate coursework. There are good reasons to include modeling experiences in the first two years. These opportunities allow students majoring in mathematics to gain experience with an important (and often challenging) approach to problem-solving that will benefit them later in their coursework and careers, and all students—regardless of major—may find that they appreciate the role and value of mathematics more deeply by applying it to meaningful situations. This session welcomes papers that describe substantive mathematical modeling experiences for students who would typically be in their first two years as an undergraduate student, including (but not limited to) courses for non-majors and courses that do not have calculus as a prerequisite. Ideally, papers should also evaluate the effectiveness of the approach being taken. Sponsored by the MAA Mathematics Across the Disciplines (MAD) Subcommittee and the MAA Curriculum Renewal Across the First Two Years (CRAFTY) Subcommittee.

Open Educational Resources: Combining Technological Tools and Innovative Practices to Improve Student Learning, organized by **Benjamin Atchison**, Framingham State University, **Marianna Bonanome**, New York City College of Technology, **Margaret Dean**, Borough of Manhattan Community College, **Michael Gage**, University of Rochester, and **Annie Han**, Borough of Manhattan Community College, Friday morning. Experimentation in classroom methodologies is blooming. An increasing number of instructors are adapting more than one OER technological tool and combining them with active learning techniques to improve student learning in their classrooms. This session will provide a venue for exposition of these experiments thereby disseminating results (positive and negative), reducing duplication of effort, promoting collaboration between instructors and providing recognition for those on the front lines of experimental

learning. Sponsored by the MAA Committee on Technologies in Mathematics Education (CTiME).

Philosophy of Mathematics, organized by **Jeffrey Buechner**, Rutgers University – Newark, and **Bonnie Gold**, Monmouth University (retired), Friday morning. This session invites talks on any topic in the philosophy of mathematics. Our special theme this year is “Do Choices of Mathematical Notation (and Similar Choices) Affect the Development of Mathematical Concepts?” Once mathematical concepts have gelled, they tend to feel “natural” to mathematicians. But in the process of exploring and developing new concepts, mathematicians make choices, including of notation and terminology that affect how the nascent concept solidifies. For example, to what extent does our decimal notation affect our understanding of numbers? Are there concepts and mathematical practices that can be understood in one notational framework and not in another? This session invites talks that look at this process, and the philosophical implications of the effect of our choice of mathematical notations on the development of mathematical concepts. Talks on the special theme will be given highest priority, but all talks on the philosophy of mathematics are welcome. Sponsored by POMSIGMAA.

Research in Undergraduate Mathematics Education (RUME), organized by **Stacy Brown**, California State Polytechnic University, **Megan Wawro**, Virginia Tech, and **Aaron Weinberg**, Ithaca College, Thursday morning and afternoon, and Friday morning and afternoon. 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.

Revitalizing Complex Analysis, organized by **Michael Brilleslyper**, United States Air Force Academy, **Russell Howell**, Westmont College, and **Beth Schaubroeck**, United States Air Force Academy, Thursday afternoon. Complex Analysis, despite its beauty and power, seems to have lost some of the prominence it once enjoyed in undergraduate STEM fields. Growing out of an NSF grant, the Revitalizing Complex Analysis project seeks to remedy this situation. It has held successful contributed paper sessions at the past four Joint Mathematics Meetings. Proposals for the Baltimore JMM should be scholarly in nature, and collectively address a wide-range of questions: What are the essential components of an undergraduate complex analysis class from mathematical and scientific

standpoints? What technologies seem to be promising? What pedagogical ideas have borne fruit? What interesting projects have worked well for student investigation? What novel connections have been made with other standard mathematics courses? What are some interesting applications to other disciplines? In general, what innovative approaches might be suggested in teaching the subject? Presentations that include evidence of success or failure in the classroom are especially welcomed.

The Scholarship of Teaching and Learning in Collegiate Mathematics, organized by **Tom Banchoff**, Brown University, **Curtis Bennett**, California State University, Long Beach, **Pam Crawford**, Jacksonville University, **Jacqueline Dewar**, Loyola Marymount University, **Edwin Herman**, University of Wisconsin-Stevens Point, and **Lew Ludwig**, Denison University, Wednesday morning & afternoon. 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.

The Teaching and Learning of Undergraduate Ordinary Differential Equations, organized by **Christopher S. Goodrich**, Creighton Preparatory School, and **Beverly H. West**, Cornell University, Friday afternoon. 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; and
4. 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 (Consortium of Ordinary Differential Equations Educators).

Technology and Resources in Statistics Education, organized by **Stacey Hancock**, Montana State University, and **Karl RB Schmitt**, Valparaiso University, Friday afternoon. One of the five skill areas in the American Statistical Association's curriculum guidelines is "Data Manipulation and Computation" (pg. 9), embracing the need for students to be competent with programming languages, simulation techniques, algorithmic thinking, data management and manipulation, as well as visualization techniques. Additionally, the emphasis on using real data and problems and their inherent complexity means that technology is often necessary outside of specifically prescribed computational courses. This session invites instructors to contribute talks exploring the use of any software or technology in statistics education. Talks may include effective instructional or pedagogical techniques for linking programming to statistics, interesting classroom problems and the use of technology to solve them, or more. If you are unsure if your idea fits, please feel free to contact the organizers before submitting. Sponsored by the Committee on Technology in Mathematics Education SIGMAA- Statistics Education.

Touch it, Feel it, Learn it: Tactile learning activities in the undergraduate mathematics classroom, organized by **Chris Oehrlein**, Oklahoma City Community College, **Ann Trenk**, Wellesley College, and **Laura Watkins**, Glendale Community College, Thursday afternoon. This session invites presentations describing activities that use tactile teaching methods in any mathematics classes. Examples of tactile methods could include props or manipulatives that students can touch to understand concepts better, projects where students create physical models that represent a concept, and in-class activities in which students work together to create hands-on demonstrations of their understanding of a particular concept. This session seeks presentations that focus on engaging students through interaction with props, use of manipulative materials, or even inviting students to physically become a part of a function or concept; this does not include technology demonstrations such as computer visualizations. We seek innovative and creative ways for physically involving students in mathematics. Presentations detailing how to integrate a particular activity into class, student reactions, educational benefits, difficulties to avoid, and possible modifications of the activity are desired. Sponsored by the Professional Development committee and the Committee on Two-Year Colleges.

Undergraduate Student TAs in Mathematics, organized by **Aaron Peterson** and **Ursula Porod**, Northwestern University, Wednesday afternoon. Many mathematics departments around the country run undergraduate student teaching assistant (UGTA) programs. Roles of UGTAs vary from department to department. They range from behind-the-scenes graders to independent discussion section leaders, comparable in their TA duties to graduate student TAs. Proper training and mentoring of UGTAs are important parts of a successful program. However, while many departments run substantial professional training programs for their graduate students, UGTAs tend to receive far less teaching training. Reasons may include UGTAs' time limitations due to their own course work and limited departmental resources. We especially, but not exclusively, invite contributions of

ideas for effective UGTA training and mentoring. More broadly, this session will be a forum for sharing current practices and critical evaluations of all aspects of existing UGTA programs.

General Contributed Paper Sessions

General Contributed Paper Sessions, organized by **Emelie Kenney**, Sienna College, and **Melvin Royer**, Indiana Wesleyan University, *Wednesday, Thursday, Friday, and Saturday, mornings and afternoons*. The MAA's General Contributed Paper Sessions accept 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.