# hio Focus

The MAA Ohio Section Newsletter

The Spring Meeting of the Ohio Section MAA will be held on

meeting will start at 1:30 p.m. on Friday, with the first invited lecture starting at 1:45 p.m. in Conaton Learning Commons, and will conclude on Saturday at 1:00 p.m. Major addresses will be given by Rachel Hall (St. Joseph's University), Aparna Higgins (University of Dayton), Jeffrey Lagarias (University of Michigan), and Jonathan Stadler (Capital University). In addition, Calculus: The Musical! will be performed on Friday evening. Meeting participants are encouraged to submit talks for the contributed paper sessions on Friday afternoon and Saturday morning. Graduate and undergraduate students in mathematics, mathematics education, or related fields are

April 13-14, at Xavier University in Cincinnati, Ohio.

Volume 9

Spring 2012

Number 8

The

# Spring Meeting at Xavier University April 13-14, 2012

Conaton Learning Commons: Registration Location

# Proposed Amendment to the Section Bylaws

At the business meeting on Friday of the Section meeting, the Section will be discussing the following proposed amendment to the Section bylaws. Any modifications to the amendment must be approved by a majority of those present at the According to the meeting. procedures outlined in our bylaws, the amendment will then be voted on via a mail-in ballot that will be distributed some time soon after the conclusion of the meeting. lf approved, the amendment will (Continued on page 12)

#### Meeting Registration

encouraged to attend.

Online registration is preferred. Visit the Section web site at www.maa.org/Ohio on or after Tuesday, March 6, for one-stop registration, banquet reservation, and abstract submission. The deadline for meeting pre-registration and banquet reservations is April 6. Abstracts for contributed papers must be submitted by March 30.

On-site meeting registration is always available, but last-minute banquet tickets cannot be guaranteed. Early registration helps those making the meeting

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# **Section Governor's Report**

Last month I attended the Joint Mathematics Meetings in Boston. As usual, it was a very successful meeting. The attendance at JMM set a new record of over 7200 participants. JMM is billed as the "largest annual mathematics meeting in the world", and I have no reason to doubt that claim. If you haven't been to JMM or MathFest, I would suggest that you consider going. The next meeting of the Association will be MathFest 2012, August 2-4, in Madison, Wisconsin.

If you haven't already done so, you should go to the MAA website (www.maa.org) and make sure that you are included in the MAA e-mail mailing list. On the MAA homepage, over to the right, there is a button labeled "Join Our Mailing List". I'm not entirely clear who needs to do this and why, but if you haven't been receiving email from the Association recently, I'd go to the website and "sign up". It can't hurt.

Even if you don't need to join the mailing list, visit the MAA website and just browse! The MAA offers meetings, textbooks, journals, other publications, SIGMAAS, NExT, SUMMA, Regional Undergraduate Math Conferences, PREP, grant programs, speaker programs, resources for teachers, and more. One way to find out what is available is to visit the website.

Much of the discussion at the national level continues to be related to financial matters and the effects of the economic slump. The MAA is in very sound financial condition, but times are tough. The association continues to look for ways to increase revenues and cut costs so that it can maintain its financial well-being. Each of us can help by encouraging other people to join the MAA, by using MAA Textbooks when we can, and by making a financial contribution to the MAA if possible. Specifically, I would remind you that the MAA is now offering steeply discounted memberships to high school teachers. Do what you can to encourage teachers in your area to take advantage of this opportunity.

Another ongoing issue is the impact of our societal transition from hard copy to "all digital". Electronic memberships continue to be popular, and the discussion about how memberships and subscriptions might be bundled in the future continues at the national level. Be sure to check all of your options when it comes time to renew your membership, because I expect that there will be a fair amount of change in this area over the next few years. In particular, look for the cost of an electronic membership to grow at a slower

pace than the cost for other memberships.

This is my final report your Section as Governor, and ľm amazed at how quickly my 3-year term has passed. We are electing а new Governor this spring. By now, you should have received an e-mail notice from the



national MAA with instructions for voting in that election. It has been a privilege and an honor to represent all of you on the Board of Governors. The Ohio Section is held in high esteem at the national level, and I hope that we will all work to keep it that way in the future.

I'll see you at the Spring Meeting of the Section at Xavier in April. It promises to be an interesting meeting. You can look over the program elsewhere in this newsletter. And don't forget: Bring a colleague to the meeting!

> AI Stickney Wittenberg University Section Governor

#### **OHIO FOCUS**

The newsletter of the Ohio Section of the Mathematical Association of America first appeared in 1973 and is published twice yearly, in time to reach members before the fall and spring meetings. Newsletters are published online at www.maa.org/Ohio. Notification postcards are sent using labels provided by the MAA.

Editor: Barbara D'Ambrosia 216-397-4682 bdambrosia@jcu.edu Dept. of Math & Computer Science John Carroll University University Heights, OH 44118

The deadline for the next newsletter is **August 29**, **2012**. E-mail copy is preferred. Early submission is appreciated. Please send copy to the new newsletter editor, David Stuckey (dstuckey@defiance.edu) and also to the Section Webmaster, Darren Wick (dwick@ashland.edu), for posting on the web.

# **President's Message**

It's hard to believe that the academic year is now more than half over! Even the spring term is passing along at quite a clip. I hope your term is off to a smooth start.

A lot is happening in the Section these days. Thanks again to Judy McCrory at the University of Findlay for a wonderful fall meeting, and thanks also to David Singer for preparing a great program. Dick Little, George Francis, Sergei Tabachnikov, and Mark Meckes each gave outstanding talks.



There were also nineteen contributed talks. The Committee on Section Activities (CONSACT) hosted their first fall workshop, led by Barbara D'Ambrosia who shared her expertise on GeoGebra. The fall workshop model is something new we are trying because the summer short courses were not drawing the number of participants that they once did. If the attendance and response from GeoGebra workshop is any indication, we have a successful alternative to the short courses. Thank you to all who provided input as we made this transition. Watch for details about next fall's workshop!

Please join us in Cincinnati on April 13<sup>th</sup> and 14<sup>th</sup> at Xavier University for the 96<sup>th</sup> annual meeting of the We are privileged to have Jeffery Ohio Section. Lagarias from the University of Michigan, who is an MAA Pólya Lecturer. The other invited speakers (for whom we are equally excited to have speak!) include Rachel Hall from Saint Joseph's University and Aparna Higgins from the University of Dayton. There is even a rumor that I might speak as the retiring president. As a new twist, in place of the usual after-dinner speaker, Matheatre's Calculus: The Musical, will be performed. I have heard wonderful things about the show and am looking forward to the laughs it promises, being billed as "a comic 'review' of the concepts and history of Calculus."

In Section news, I am pleased to announce that Carl Spitznagel from John Carroll has stepped into Wiebke Diestelkamp's shoes as the Section Liaison Coordinator. This comes at an opportune time since she will be inducted as president at the conclusion of the Xavier meeting. Thank you, Wiebke, for your years of service as the Coordinator and good luck next year! I know we will be in good hands. The section is also excited that David Stuckey from Defiance College has agreed to serve as the Newsletter Editor. Thanks to Barbara D'Ambrosia for the many years you have devoted to this position.

In addition to our typical elections, we will be voting on an amendment to the bylaws at the yearly business meeting. The duties and compositions of all section committees are delineated in the bylaws with one exception – the Teaching Award Committee. The amendment will address this exclusion. Please look for more information about

the amendment elsewhere in this issue of the Ohio Focus. You should also have received an email from the National MAA about voting for Section Governor. Our candidates are Barbara D'Ambrosia and Dick Little. Voting for Governor runs through March 14<sup>th</sup>.

As president, I must say that I am humbled by the devotion and hard work that I see from so many of you who serve the Section. It has truly been an honor to be given this responsibility. If you are ever interested in serving the section, I and the many others who have held positions can tell you how rewarding it is. There are almost always ways to get involved and the best way to do so is contact the president or one of the committee chairs.

See you in Cincinnati!

Jon Stadler Capital University Ohio Section MAA President

#### Increase in Meeting Registration Fees

At its meeting last fall, the Ohio Section Executive Committee voted to increase meeting registration fees by \$5 for all registration categories except students. The additional \$5 per person will be given to the host institution to help defray the cost of hosting the meeting. The last time the Ohio Section increased meeting registration fees was in Spring 2006. For a two-day event, Ohio Section meetings are still one of the best deals around!

#### **Call for Contributed Papers**

Fifteen-minute presentations on any topic of general interest in mathematics or related areas are encouraged for the Contributed Paper Sessions on Friday afternoon and Saturday morning at the spring Ohio Section meeting. Reports on projects, research announcements, or anything you believe would be of interest to those in attendance are welcome. Undergraduate and graduate students in mathematics or mathematics education are strongly encouraged to submit talks.

There will be a special session of contributed papers highlighting prominent mathematicians from Cincinnati, sponsored by the Centennial Committee on history of mathematics in Ohio.

Online submission with your meeting registration is strongly preferred, but if necessary, you may submit your title and abstract to the chair of the Program Committee, David Singer, by e-mail at david.singer@case.edu. Abstracts should be between 25 and 75 words in length and should employ proper English grammar and spelling. Please use only plain text in your title and abstract as the abstract submittal system cannot process TeX or other graphics code.

Each presentation room will have a whiteboard or chalkboard, computer projector, and laptop connections. Presenters can either plug their laptops into the overhead projection system or plug a flash drive into the resident computer. If internet access or an overhead projector is needed, please mark the appropriate box when submitting your abstract online. Speakers with specific questions about technology availability should contact Danny Otero, at otero@xavier.edu.

Due to time and space restrictions, we may not be able to accommodate all talks. Submit abstracts online at the Section web page: www.maa.org/Ohio, by Friday, March 30.

#### **About Xavier University**

Founded in 1831, Xavier University is a Jesuit, Catholic university in Cincinnati, Ohio. Its three colleges offer 83 undergraduate majors, 52 minors and 11 graduate programs to 7,019 total students, including 4,368 undergraduates. The University is the sixth-oldest Catholic university in the nation and one of 28 Jesuit colleges and universities nationwide. It has been recognized as one of the top 10 universities in the Midwest for the last 16 years by *U.S. News & World Report*, including a rank of third for 2011.

Xavier University has had a major in mathematics since 1916. While the program continues to evolve, the primary goal remains unchanged. The department provides an educational environment in which students can develop their abilities to undertake intellectually demanding tasks in mathematics. Their programs support Xavier's mission by emphasizing critical thinking, logical reasoning, and the precise expression of ideas in the language of the discipline.

#### **Ohio NExT Workshop**

Ohio Project NExT (New Experiences in Teaching) is a program for new faculty members. Its goal is to help newer faculty to network with colleagues, to share ideas and experiences that promote professional growth, and to encourage faculty to become involved in the Ohio Section.

On Thursday evening, April 12th, the night preceding the Ohio Section Spring Meeting, members of Ohio Project NExT will gather for a banquet beginning at 7:00 p.m. in room 309 of the Conaton Learning Commons at Xavier University. This is a great opportunity to meet old friends and make new ones. After the banquet, the NExTers will spend approximately an hour discussing a topic related to the profession.

Then, on Friday morning, April 13th, the Ohio NExT program will continue on the Xavier University campus. The program will feature two workshops, with Barbara Margolius leading a special extended workshop on using WebWork, and contributed talks by Ohio NExTers. At last fall's meeting, the NExT workshop at the University of Findlay featured George Francis of the University of Illinois and Kimberly Roth of Juniata College for the fifty-minute workshops. Thomas Wakefield of Youngstown State University and Muhammad Usman of the University of Dayton presented 15-minute talks.

Ohio Project NExT is open to anyone in the Ohio Section who is in his/ her first five years of teaching in Ohio. If this applies to you, please consider joining us this spring for our NExT Banquet and Workshop, as well as the Ohio Section Meeting that follows. Contact Chris Swanson (cswanson@ ashland.edu) for membership information and details.

Ohio Project NExT is coordinated by Katie Cerrone, University of Akron (kc24@uakron.edu); John Prather, Ohio University Eastern Campus (prather@ohiou.edu); and Chris Swanson, Ashland University (cswanson@ashland.edu).

#### Leo Schneider Student Mathematical Competition

Undergraduate students from institutions of the Ohio section are invited to participate in the second annual Leo Schneider Student Mathematics Competition. This will be the ninth year for the Ohio MAA student team competition, but its name now honors the memory of our late colleague and friend.

This year's competition will take place on Friday from noon until 1:20. Rules and registration information, as well as copies of previous years' problems and their solutions, can be found on the Ohio Section Student Member website, http://constum.ohiomaa.org/. Cash prizes will be awarded on Saturday to the top three teams. We encourage student participation in the entire meeting, including student talks, the student pizza party, and the "awards ceremony" on Saturday. Any questions about the competition or other student activities can be addressed to Tom Wakefield at tpwakefield@ysu.edu.

#### **Talks by Students**

Undergraduates and graduate students are encouraged to submit abstracts for 15 minute talks at the Spring Meeting. Topics may be drawn from any area of mathematics or a related discipline. The presentation may be an expository talk, a recounting of a mathematical internship or a co-op experience, or the results of a research project. It is expected that each talk will be delivered by a single speaker. Each student speaker will receive a certificate acknowledging their contribution to the meeting.

Contributed talks by students, faculty, and others will be given on Friday afternoon and Saturday morning. Talks will be scheduled primarily according to topic and audience level. Student talks are an integral part of the meeting and should be an enjoyable and rewarding experience for all who participate.

See the Call for Contributed Papers on page 4 for submission information.

#### **Resources for Speakers**

Speakers are encouraged to check out these resources that provide tips and strategies for giving good math and science presentations:

- "Technical Speaking," funded by the NSF and hosted by Denison University, at http://techspeaking.denison.edu/.
- "Advice on Giving a Good Power Point Talk," *Math Horizons* article by Joe Gallian (April 2006), at www.d.umn.edu/~jgallian/ goodPPtalk.pdf.

#### **Student Pizza Party**

A student pizza party will be held on Friday evening at 6:30. There is no charge but meeting registration is necessary. See the Section webpage at www.maa.org/Ohio for online registration. To warm up for *Calculus: The Musical!*, there will be an integration bee during the pizza party. Come prepared to integrate!

Exercise your brain with these problems from the 2011 Leo Schneider Student Mathematics Competition. Solutions are available at the CONSTUM website, http://constum.ohiomaa.org/.

Problem 4: Points *A* and *B* are 5 units apart. How many lines in a given plane containing *A* and *B* are 2 units from *A* and 3 units from *B*.

Problem 5: Find a function f(x) such that for all  $x \le 0$ ,

$$f(x) = \sqrt{\int_0^x \left(f(t)^2 + f'(t)\right) dt + 9}.$$

# **Spring Meeting Program**

Events will take place in Conaton Learning Commons (CLC), Smith Hall (SMH), McDonald Library, and the Cintas Center at Xavier University. These buildings can be found on the campus map on page 11.

	Friday, April 13		
12:00-4:00	Registration	CLC S. Lobby	8
12:00–1:20	Student Competition	McDonald 130	8
12:00-1:00	Committee Meetings CONCUR CONSACT CONTEAL Centennial Committee	CLC 215 CLC 214 CLC 417 CLC 423	8
12:00-4:00	Book Vendors and Exhibits	CLC 413	
1:30–1:45	Welcome & Announcements	Kennedy Auditorium (CLC 414)	8
1:45–2:45	Invited Address: "Simple Surprises" Aparna Higgins, University of Dayton	Kennedy	9
2:45–3:10	Break	CLC South Lobby	
3:10–3:15	Centennial Minute	Kennedy	
3:15–4:15	Invited Address: "Packing Space with Regular Tetrahedra" Jeffrey Lagarias, University of Michigan	Kennedy	1
4:25–6:20	Contributed Paper Sessions	SMH 249 SMH 250 SMH 251 SMH 252 SMH 346 SMH 347	1
4:25–6:20	Executive Committee Meeting	McDonald 130	
6:30-8:00	Student Pizza Party	Cintas Concourse	
6:30–6:50	Social Time	Schiff Banquet Ctr. (Cintas)	1
6:50-8:00	Banquet	Schiff	
8:15–9:15	After Dinner Event: Calculus: The Musical!	Schiff	
9:15	Business Meeting and Presentation of the Teaching Award	Schiff	

	Saturday, April 14	
8:00–10:00	Registration	CLC South Lobby
8:00–10:20	Vendor and Book Exhibits	CLC 413
8:00-8:50	Coffee and Pastries	CLC South Lobby
8:05–8:40	Liaisons' and Department Chairs' Meeting	CLC 308
8:05–8:40	Committee on Local Arrangements	CLC 309
8:50–9:00	Announcements; Student Competition Results	Kennedy
9:00–10:00	Invited Address: "Submajorization and the Geometry of Unordered Collections, with Applications to Music and Welfare Economics" Rachel Hall, St. Joseph's University	Kennedy
10:00–10:20	Break	CLC South Lobby
10:25–11:40	Contributed Paper Sessions	CLC 405 CLC 406 CLC 419 CLC 308 CLC 309
11:50–12:50	Retiring President's Address: "Using Mathematics to Gain the Upper Hand at Family Game Night" Jon Stadler, Capital University	Kennedy
12:50	Closing Remarks	Kennedy

Event locations are subject to change. Check the official program you receive when you register for the meeting in Conaton Learning Commons. Also, check the Section web page, www.maa.org/Ohio, for program updates, online registration, and contributed paper submissions.

## Aparna Higgins "Simple Surprises"

Once upon a time, in the Ohio Section of the MAA, two students who attended different schools and who did not know each other, presented talks at the Spring Meeting that were variations of the same problem. One spoke of the result of alternately inscribing regular polygons and circles, while the other spoke of the result of



alternately circumscribing regular polygons and circles. Recently, I heard a talk on other variants of this theme, and I found myself still intrigued by the questions. I plan to take you on a meandering walk through some problems that delight me mathematically. The problems are simple to state, yet they have an element of surprise.

Aparna Higgins received a B.Sc. in mathematics from the University of Bombay in 1978 and a Ph.D. in mathematics from the University of Notre Dame in 1983. Her dissertation was in universal algebra, and her current research interests are in graph theory. She has taught at the University of Dayton, Ohio, since 1984. Although Aparna enjoys teaching the usual collection of undergraduate courses, her most fulfilling experiences as a teacher have come from directing undergraduates in mathematical research. She has advised twelve undergraduate Honors theses; she has co-directed an NSF-sponsored Research Experiences for Undergraduates program; and she continues to help students prepare talks for regional and national mathematics meetings. Aparna is an advocate of academic year undergraduate research at one's own institution. She has presented workshops (often with

Joe Gallian) at mathematics meetings on directing undergraduate research. She enjoys giving talks on mathematics to audiences of various levels and backgrounds. Aparna has been the recipient of four teaching awards -- from the College of Arts and Sciences at the University of Dayton, the Alumni Award (a University-wide award) at the University of Dayton,

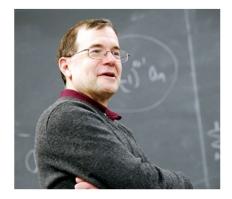
the Ohio Section of the MAA, and in 2005, the Deborah and Tepper Haimo Award for Distinguished College or University Teaching, which is the MAA's most prestigious award for teaching. Aparna has served the MAA in many capacities, including being a founding member of, and then chairing, the Committee on Student Chapters, which helped create and maintain Student Chapters, provided support to Sections for student activities and provided appropriate programming for undergraduates at national meetings. Aparna is Director of Project NExT (New Experiences in Teaching), a professional development program of the MAA for new or recent Ph.D.s in the mathematical sciences. Aparna has served as President of the Ohio Section, and on several committees of the Ohio Section. Aparna Higgins is married to Bill Higgins, a mathematician who teaches at Wittenberg University, in Springfield, Ohio. They like to take year-long sabbaticals and spend part of that time teaching at other institutions. They feel privileged to have taught at the Naval Postgraduate School in Monterey, California, at the United States Military Academy in West Point, New York, and at California State University Channel Islands. Aparna and Bill Higgins have two sons.

#### Calculus: The Musical!

*Calculus: The Musical!*, produced by Know Theatre of Cincinnati is a comic "review" of the concepts and history of calculus. Using musical parodies that span genres from light opera to hip hop, it introduces and illuminates such concepts as limits, integration and differentiation. With their unique comic style the actors dramatize some high points of calculus' history. From Archimedes to Riemann, the quest for the instantaneous rate of change and the area under the curve comes to life through song! Musical tributes to The Beatles, Gilbert & Sullivan, Petula Clark and even Eminem are just a few of the artists who have inspired this engaging and educational lesson that is nothing at all like your high school (or college) textbooks. *Calculus: The Musical!* promises to be entertaining to the arithmophobe and the rocket scientist alike. (This description was taken from the show's web site, http://matheatre.com/calculus/.)

#### Jeffrey Lagarias "Packing Space with Regular Tetrahedra"

The problem of determining the densest packing of space by congruent regular tetrahedra has a long history, starting with Aristotle's assertion that regular tetrahedra fill space, and continuing through its appearance in Hilbert's 18th problem. This talk describes its history and many recent results obtained on this problem including contributions by physicists, chemists and materials scientists. The current record for packing density is held by my former student Elizabeth Chen, with Michael Engel and Sharon Glotzer.



Jeffrey Lagarias is a Professor of Mathematics at the University of Michigan. His research interests include number theory, discrete and computational geometry, cryptography, dynamical systems. optimization and more. He was a Putnam exam winner at MIT in 1970, and received his PhD from MIT in 1974 in analytic number theory. He then worked at Bell Laboratories and its descendants on a wide variety of pure and applied mathematical topics. At various times he held visiting positions in mathematics, computer science and physics. In 2004 he moved to the University of Michigan. He has received a Lester R. Ford prize twice, and was the 2005 Raymond Hedrick Lecturer at MathFest. He recently edited a book on the 3x+1 problem ("The Ultimate Challenge") and another on the Hales-Ferguson solution of the Kepler Conjecture on sphere packing.

# Rachel Hall "Submajorization and the Geometry of Unordered Collections, with Applications to Music and Welfare Economics"

If several voices or musical instruments sound a sequence of chords, our ears track the movement in each voice. This association is called voice leading. Although composers are normally instructed to "minimize" the overall amount of vocal movement, there is no principled way of choosing a measure for vocal movement when multiple individuals are involved. A similar problem arises in welfare economics: if we wish to measure income volatility, we must measure multiple income changes simultaneously. Tymoczko (2006) proposed requirements that every method of comparing voice leadings should satisfy. We show that these requirements are equivalent to the submajorization partial ordering, defined by Hardy, Littlewood, and Polya (1934) and developed in the study of welfare economics. We further show how to use submajorization to compare distances in the orbifolds (quotients of  $\mathbb{R}^{n}$ ) representing the geometrical space of "chord types." (This represents joint work with Dmitri Tymoczko, Princeton University.)

#### Rachel Wells Hall is

an associate professor of mathematics at Saint Joseph's University, where she researches and teaches both mathematics and music. She is writing a book entitled The Sound of Numbers: A Tour of Mathematical Music Theory. She has toured the Mid-Atlantic states since 1995 with the folk trio Simple Gifts and recorded three albums.



She plays English concertina, piano, and fiddle. Rachel is originally from Cincinnati, where she attended Walnut Hills High School.

#### **Jonathan Stadler**

#### "Using mathematics to gain the upper hand at family game night"

Games are an excellent way for children to develop reasoning, a sense of likelihood and chance, and mathematical skills such as counting and elementary arithmetic. In the meantime, kids enjoy the prospect of winning, the pleasure of problem solving, and the company of their fellow gamers. Although mathematicians are apt to enjoy games for these reasons as well, we cannot resist using mathematics to analyze these games, sometimes learning better playing



strategies (sharing these strategies with our mini counterparts, of course!). We will discuss mathematics related to Duck Duck Bruce and Left Center Right. In particular, we will study the best card-stealing strategy in Duck Duck Bruce, and the likelihood of winning as a function of whether you go, first, second, or even last in Left Center Right. Probability, discrete mathematics, and linear algebra are some of the familiar undergraduate topics that will be used to investigate these games.

Jon Stadler's first exposure to the Ohio Section was in 1991, when the annual meeting was held at Bowling Green State University. At this conference, he presented on the Cantor Set. After graduating from BGSU in 1992, Jon attended The Ohio State University, earning his PhD in 1997 in algebraic combinatorics. After a year of teaching at Coastal Carolina University, he

returned to Ohio to begin his current position at Capital University. Jon has served in the Ohio Section on CONCUR, as the local arrangements chair for the 2003 summer short course on cryptology, and on the program committee, serving as chair from 2008-2009. His research interests are in recreational mathematics, particularly puzzles, games, and most of all, juggling.

#### **Meeting Registration**

(Continued from page 1)

arrangements and is always appreciated. Registration will be held beginning 12:00 p.m. on Friday in the lobby of the Conaton Learning Center and will continue Saturday morning at 8:00 a.m.

Meeting participants who are unable to register online at www.maa.org/Ohio may register by mail by sending the following information: name, affiliation, address, phone, e-mail address (if any), type of position, and banquet buffet reservation. Send with check, payable to Ohio Section MAA, for applicable fees [registration fee (\$30 ordinary registration, \$15 retired or part-time, no fee for students or first-time attendees), banquet buffet fee (\$30 per person)] to: Ohio Section MAA Spring Meeting, c/o Daniel Otero, Department of Mathematics, Xavier University, 3800 Victory Parkway, Cincinnati, OH, 45207-4441. Phone: (513) 705-2012, FAX: (513) 745-3272. Registration by FAX or e-mail will be pending receipt of registration fees.

#### Banquet

The banquet on Friday, April 13, will be in Schiff Banquet Center (in the Cintas Center), beginning at 6:50 p.m. It will be preceded by a cash bar in the same location, starting at 6:20 p.m. The banquet will be a buffet for a cost of \$30, and the menu includes salads, chicken piccata, portabella mushrooms in Marsala sauce, roasted vegetables, and pasta. You should reserve your banquet tickets when you register for the meeting online at www.maa.org/Ohio, as there will be few, if any, banquet tickets available for on-site registrants.

The banquet will be followed in the same room by the performance of *Calculus: The Musical!*, the Section Business Meeting, and the presentation of the Section Teaching Award. All meeting participants are welcome at these after-dinner events, regardless of whether they attend the banquet.

## **Driving Directions**

These directions take you to the parking lot for the Cintas Center. You do not need a parking permit unless you are parking somewhere else.

#### From the north via Interstate 71

1. From Interstate 71 north, take Exit 5 for Dana Avenue/Montgomery Road. Turn right at end of ramp, following signage to Xavier University.

2. From Dana Avenue, turn right onto Montgomery Road (Rt 22/3).

3. Turn left onto Cleneay Avenue. Entrance to the parking lot is 0.3 mile on the right.

#### From the north via Interstate 75

1. From Interstate 75 south, take Exit 7 for State Route 562 east.

2. Use Exit 2 for U.S. Route 42/Reading Road and turn right at the end of the ramp.

3. Turn left at the third traffic signal for Victory Parkway.

4. Turn left at Ledgewood Dr. and turn left into campus at the traffic circle.

5. Continue up the hill to the Cintas Center parking lot.

For more detailed directions, or for those not driving south on I-75 or I-71, see the Local Arrangements web page at http://www.xavier.edu/ohiomaa/Maps-and-Directions.cfm.

#### Parking

You may park without a permit in lots C2, C3, or C4 at the Cintas Center (see the campus map on page 11). If you plan to park elsewhere, you will need to pick up a visitor's parking permit at the welcome booth at the main entrance to campus (on University Drive, just off Dana).

There is a XU campus map on page 11. For additional information, see the Local Arrangements web page, at **www.xavier.edu/ohiomaa/.** The local contact person at Xavier University is Danny Otero, otero@xavier.edu, 513-745-2012.

#### Where to Stay

All of the hotels below offer special rates for meeting participants. To obtain the rate listed on this page, mention "OHIO MAA Math Conference" when making your reservation. See below for each hotel's individual cut off dates for reservations. **To make reservations online, click the hotel name below, or see the Local Arrangements web page, at www.xavier.edu/ohiomaa/lodging.cfm.** See the local arrangements for lists of amenities at each hotel.

#### Hampton Inn & Suites

3024 Vine Street, Cincinnati, Ohio 45219 513-281-2700 Room Rate: \$109.00 per night Reservations must received by 3/28 Free hot breakfast Self Parking \$9.00 If making online reservations, type in check-in and check-out dates, click "Continue," enter the group code "MAA", and continue.

#### **Spring Hill Suites Cincinnati**

610 Eden Park Drive, Cincinnati, Ohio 45202 513-381-8300 Room Rate: \$129.00 Reservations must be received before 3/22 Buffet Breakfast, coffee in the Lobby \$8.00 Parking fee per room per night

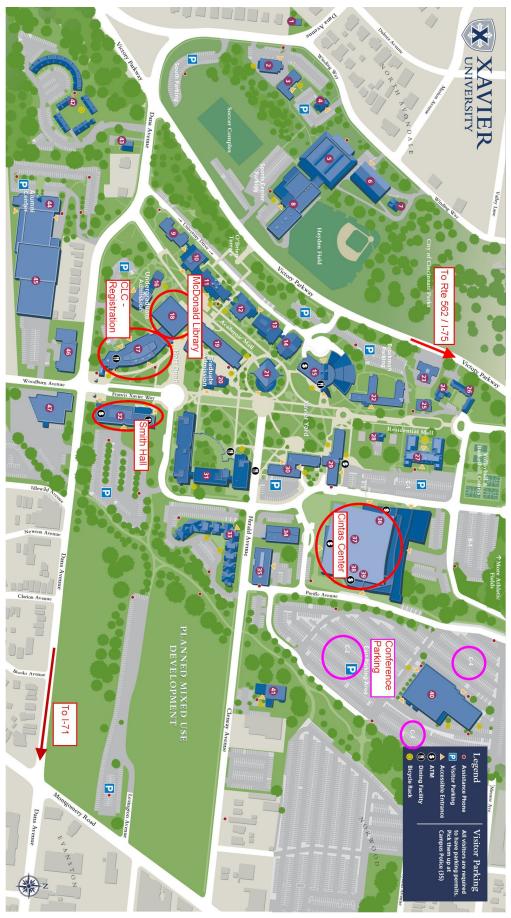
# Kingsgate Marriott Conference Hotel at the University of Cincinnati

151 Goodman Drive, Cincinnati, Ohio 45219 513-487-3800 Room Rate: \$124.00 Reservations must received before 5:00 p.m., 3/23 Parking \$9.00 per day Valet Parking \$15.00 per day

#### Holiday Inn Cincinnati Riverfront

600 W 3rd Street, Covington, Kentucky 41011 859-291-4300 Room Rate: \$99.00 Reservations must be received by 3/29 Free Parking Rate includes continental breakfast for each guest One suite upgrade

Xavier University Campus Map



#### **Report from CONCUR**

CONCUR would like to thank everyone who participated in the Calculus survey this last Fall. We had excellent participation: More than one hundred people participated and a preliminary scan of the data shows some interesting patterns. The full results will be discussed at the Section meeting this coming Fall.

> William Fuller, CONCUR Chair Ohio Northern University

#### In Memoriam: H. David Lipsich

H. David Lipsich, Professor Emeritus at the University of Cincinnati, died January 12, 2012 in Cincinnati at the age of 91. He received his Ph.D. in 1949 under Otto Szasz, a student of L. Fejer. His dissertation was entitled "On Hypergeometric Summability".

He had been on the UC faculty since 1942, except for 1945-46 which he spent at Princeton. He became Department Head



in 1961, and was Dean of the College of Arts and Sciences, 1976-1981. In 1966 he received the prestigious UC Dolly Cohen Award for excellence in teaching.

He was an active member of the Ohio Section, serving as Section Chairman 1966-67, Program Chair 1956-57, and was the first chair of CONCUR. His Retiring Chairman's address was entitled, "Some New Directions for the Ohio Section."

#### Campus News

**Baldwin-Wallace College** has recently started a Math Club (over and above the Kappa Mu Epsilon Chapter they've had for a long time). The department was able to create a Math Lounge in their building, and they recently revised their mathematics curriculum.

**Xavier University** has introduced a new Actuarial Sciences major to complement their long-running major and minor programs in Mathematics and a Statistics minor that has been in place since 2008. In addition, Assoc. Prof. Max Buot (PhD, statistics, University of Virginia) was awarded tenure early in 2012.

# New Liaison Coordinator, Newsletter Editor

Wiebke Diestelkamp (University of Dayton) was the Ohio Section Liaison Coordinator since the spring of 2006. She stepped aside from that role in January 2012, after becoming President-Elect of the Section. Carl Spitznagel, from John Carroll University, is the new Ohio Section MAA Department Liaison Coordinator. You can reach him at spitz@jcu.edu.

Barbara D'Ambrosia (John Carroll University) has been the Section Newsletter Editor since the fall of 2008. As of the end of the 2011-2012 school year, David Stuckey of Defiance College, will be taking over that position. David can be reached at dstuckey@defiance.edu.

The Section thanks Wiebke and Barbara for their many years of service.

#### **Proposed Bylaws Amendment**

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appear as item 12 in Article IV in the bylaws.

#### **Proposed Amendment**

The Teaching Award Committee shall consist of the Past President of The Section, the Secretary of The Section, and the two most recent teaching award recipients who are members of The Section, but not the current teaching award recipient. The President may appoint committee members should any committee member not be available to serve. The Past President shall be the Chair of the Teaching Award Committee. The Teaching Award Committee shall be responsible for soliciting and receiving nominations for the Section Teaching award. Deadlines for nominations shall be set to allow sufficient time to select the winner and forward the name to the national office to be nominated for the Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching of Mathematics. Nominees for the section award must meet the eligibility requirements for the Haimo Award. Award winners shall be announced at the Annual Meeting and will be invited to speak at the fall meeting of the following calendar year.

Editor's Note: The Teaching Award Committee is not currently mentioned in the Ohio Section Bylaws.

#### **Nominations for Section Officers**

The election of officers will take place at the Business Meeting, Friday evening, April 13, after the banquet at Xavier University in Cincinnati, Ohio. At that time, nominations for other candidates may also be made from the floor. The President-Elect serves for one year and then becomes President for one year. The senior person on the Program Committee serves as the chair of that committee. The Treasurer-Elect and Secretary-Elect serve in those positions for one year, and then become Treasurer and Secretary, respectively, for a three-year term.

The Nominating Committee is pleased to present Phil Blau (Shawnee State University) as the nominee for President-Elect. Phil received his Mathematics Ph.D. from the University of Massachusetts in the area of ring theory. Phil spent four years teaching at Boston University's College of General Studies, before moving to Portsmouth, Ohio. He is currently in his 12<sup>th</sup> year at Shawnee State University, where he is a Professor of Mathematical Sciences and the Director of the General Education Program. His service to the Ohio Section includes membership on the Program Committee, CONTEAL, and CONSACT (including one year as chair). Phil also served as the local arrangements chair for the Spring 2007 Meeting. Prior to his involvement with the Ohio Section, he co-chaired the program committee for a meeting of the Northeastern Section. He participates in a semi-annual reading group that discusses original source material in mathematics.

The Committee also presents **David Meel** as the nominee for a three-year term on the **Program Committee**. David earned his Ed.D. from the University of Pittsburgh and has been at Bowling Green State University since the fall of 1996. He is a national Project NExT Fellow and served over the years as Secretary/Treasurer, Secretary and most recently Program Chair for the Special Interest Group of the MAA on Research in Undergraduate Mathematics Education (SIGMAA on RUME). Locally, he served as BGSU's assistant for local arrangements in 1998 and local arrangements coordinator in 2008. David is very active in research with multiple publications involving both undergraduate and graduate students. For the past three years he has directed research groups composed of freshman to investigate mathematically rich topics.

**Brian Shelburne** (Wittenberg University) is the nominee for **Treasurer-Elect**. Brian is Associate Professor of Mathematics and Computer Science and Chair of the Department of Mathematics and Computer Science at Wittenberg University. He earned a B.S. from Davidson College, an M.A. and Ph.D. in Mathematics from Duke University, and an M.S. in Computer Science from UNC Chapel Hill. Thus he considers himself a "double threat" in both mathematics and computer science. He has been active in the Ohio Section since arriving at Wittenberg in 1987. He has been a member of CONSTUM, served with Bill Higgins as co-editor of Ohio Focus, the section

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Phil Blau, nominee for President-Elect



David Meel, nominee for the Program Committee



Brian Shelburne nominee for Treasurer-Elect

#### Nominations

(Continued from page 13)

newsletter, served as local arrangements liaison for the Fall section meetings in 2000 and 2007 (and will serve as local arrangements liaison for Fall 2014), was a member of the Program committee serving as chair in 2009-2010, is chair of the Ad-Hoc Committee on Local Arrangements, and is currently serving as section Treasurer. He would like to continue on as Treasurer for another term.

Pamela Warton (The University of Findlay) is the nominee for Secretary-Elect. Pam earned her Ph.D. in 1997 in infinite ordered groups at BGSU working with Dr. Stephen McCleary. She spent 5 years teaching at BGSU, and then 4 years at Siena Heights University in Michigan where she was introduced to the undergraduate research experience. She came to the University of Findlay in 2006 and has taught just about every undergraduate mathematics course. While her training is in theoretical mathematics, she has become fascinated with applied mathematics, and has done research with undergraduate students in everything from kaleidoscopes and knot theory to managing perishable goods inventories at a restaurant. Pam is the faculty advisor of the University Euler Math Club, and has won several teaching awards, an advisor of the year award, and was nominated by students for Who's Who of America's Teachers four separate years. Pam is the current Ohio Section Secretary, and we are pleased that she is willing to serve for another term.

> The Nominating Committee: Mark Miller (Marietta College), Chair Vicki Van Dresar (Ashland University) Bill Higgins (Wittenberg University)

#### **Election for Section Governor**

Every three years, the Ohio Section must elect a Governor to serve on the MAA's Board of Governors. In February, you should have received an e-mail message or a letter with information about voting in the election for Section Governor. The Ohio Section candidates are Dick Little from Baldwin-Wallace College and Barbara D'Ambrosia from John Carroll University.

#### Fall Workshop, 2012

The Ohio Section workshop following the Fall 2012 Section meeting will be presented by Barbara Margolius and Felipe Martins of Cleveland State University.

The workshop, "Setting up a WeBWork Course on Your Campus," is an introduction to the setup and use of WeBWorK, the MAA/NSF supported online homework system for mathematics. Participants will learn how to setup their own WeBWorK courses. The presenters will give an overview of WeBWorK resources including: the National Problem Library, the MAA wiki, model courses and instructor tools. Participants will learn how to write basic WeBWorK problems.



Pamela Warton, nominee for Secretary-Elect

#### **Coming Up in Ohio**

The Midwest GeoGebra Conference will be held at Miami University on June 11-12, 2012. This free conference is appropriate for both teachers and students. More information is at www.ggbmidwest.com/conference.

Pending support, the Second Undergraduate Knot Theory Conference will be held at Denison University on July 15-18, 2012. Contact Lew Ludwig (ludwigl@denison.edu) at Denison University or Colin Adams (colin.c.adams@williams.edu) at Williams College for more information.

**Thank You** to the many people who have answered my calls for information over the past four years. It has been a pleasure to be the editor of this newsletter.

Barbara D'Ambrosia, Editor

#### The Ohio Section Newsletter Centennial Note #5



The cover of the first Ohio Section Newsletter.

For more than fifty years after the birth of the Ohio Section the primary means of communication with the general membership was through brief notices from the Secretary. Each year there was a preliminary announcement of the annual meeting, including a call for papers. As the meeting date approached, the Secretary sent a second announcement, consisting essentially of the detailed final program. This pattern appears to have been typical of what went on in other MAA sections.

As early as 1926, the Louisiana-Mississippi Section published a newsletter that would eventually morph into the *Mathematics Magazine*, and in 1960 the Southern California Section issued a newsletter consisting of a single mimeographed sheet. In 1972 the Ohio Section Chairman, Will Hahn, attended the annual meeting of section officers at Dartmouth College. At that meeting a representative from the Texas Section enthusiastically described how useful his section's newsletter had been in stimulating interest in the MAA and in the Section's activities. He also distributed sample copies of the Texas newsletter.

The more Hahn thought about the Texas experience the more he thought it might be worth a try in Ohio. Initially there was concern about financing, but preliminary discussions with the manager of the Wittenberg University Print Shop, together with the discovery that the institution's bulk mailing permit could be used, indicated that the cost of producing and mailing a newsletter should not be prohibitive. Armed with this information and the Texas sample, Hahn proposed to the Executive Committee at its November 1972 meeting the publication of an experimental edition of an *Ohio Section Newsletter* and volunteered to produce it. Subsequently the first issue appeared in January 1973, followed by a second issue in April. The format was a 5.5 x 8.5-inch booklet.

For the next sixteen years the pattern of three issues per academic year (fall, winter, spring) was followed. In 1989, however, the Executive Committee decided to publish only two issues per year, corresponding to the spring and fall Section meetings. Any initial qualms about funding soon disappeared, as the total cost of a 16-page newsletter at \$50 per issue was less than the first class postage for mailing the previous one - or two-page meeting announcements.

As the years passed, inflation took its toll as bulk mail rates and costs of paper and printing increased Ohio Section membership also inexponentially. creased from 750 to approximately 1100. By 1990 the cost of publishing a single issue of the newsletter had risen to over \$400, and a decade later it was \$600. This was one reason for the decision to cut back publication to two issues per year. Another cost cutting measure, instituted by Thomas Hern, involved shipping bundles of newsletters to mathematics departments via Priority Mail rather than to individual members. This not only saved money, but it also cut down on delivery time. Eventually the advantages of on-line publication led to bypassing the USPS altogether. The last professionally printed newsletter was the Spring 2007 issue, edited by Carl Spitznagel.

Technological advances in word processing, offset printing, and electronic publishing have greatly changed the appearance of the Ohio Section Newsletter. David Kullman introduced the Ohio Section logo in 1982. A decade later Dwight Olson changed the name to Ohio Focus and enlarged the page format to 8.5 x 11 inches. Today's digital photography and on-line publication make it possible to include color photos of section activities. Nevertheless, the content of Ohio Focus in 2012 is similar in many ways to that of 1973. A typical issue includes columns by the Section President and Governor, reports from one or more standing committees, program and registration information for the forthcoming Section meeting, a calendar of upcoming events, and campus news.

## The Ohio Section Newsletter

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In the early 1970's the MAA Executive Director, A. B. Wilcox, shared excerpts from the first *Ohio Section Newsletter* with other MAA sections. This publicity, combined with encouragement from the MAA Committee on Sections, led to a steady increase in the number of sections publishing their own newsletters. The MAA established its own newsletter, *MAA FOCUS*, in 1981, and that has become a full-fledged magazine. Although Ohio cannot claim absolute priority in this area, the *Ohio Section Newsletter* has had a positive influence on the evolution of newsletters throughout the MAA.

Since the first issue in 1973 the Ohio Section Newsletter/Ohio Focus has had ten editors:

Will Hahn (Wittenberg University), 1973 – 1977
Richard Little (Baldwin-Wallace College), 1977 – 1982
David Kullman (Miami University), 1982 – 1987
Carol O'Dell (Ohio Northern University), 1987 – 1992
Dwight Olson (John Carroll University), 1992 – 1997
Thomas Hern (Bowling Green State University), 1997 – 2002
William Higgins and Brian Shelburne (Wittenberg University), 2002 – 2005
Carl Spitznagel (John Carroll University) 2005 – 2008
Barbara D'Ambrosia (John Carroll University), 2008 – 2012

David Kullman Miami University Centennial Committee



**Just for Fun:** John Carroll University students Brian Harrison, Alyssa Harford, and Robert Short put a new spin on the traditional three monkeys "see no evil, speak no evil, hear no evil" pose.

#### 2011-2012 Ohio Section Officers and Committees

#### **ELECTED OFFICERS**

#### President

Jon Stadler, Capital University 614-236-6905; jstadler@capital.edu

Past-President #1 Don Hunt, Ohio Northern University 419-772-2351; d-hunt@onu.edu

#### Past President #2

Mark Miller, Marietta College 740-376-4811; millerr@marietta.edu

President-Elect

Wiebke Diestelkamp, University of Dayton 937-299-2013 wiebke@udayton.edu

**Section Governor** 

Al Stickney, Wittenberg University 937-327-7856; astickney@wittenberg.edu

Secretary

Pamela Warton, University of Findlay 419-434-4147; warton@findlay.edu

#### Treasurer

Brian Shelburne, Wittenberg University 937-327-7862; bshelburne@wittenberg.edu

#### **OTHER OFFICERS**

#### **Department Liaisons Coordinator**

Carl Spitznagel, John Carroll University 216-397-4682; spitz@jcu.edu

#### Webmaster

Darren Wick, Ashland University 419-289-5795; dwick@ashland.edu

#### **On-line Registration**

G. Jay Kerns, Youngstown State University 330-941-3310; gkerns@ysu.edu

**Newsletter Editor** 

Barbara D'Ambrosia, John Carroll Univ. 216-397-4682; bdambrosia@jcu.edu

#### **Ohio Project NExT Co-Coordinators**

Katie Cerrone Arnold, University of Akron 330-972-8809; kc24@uakron.edu Chris Swanson, Ashland University 419-289-5264; cswanson@ashland.edu John Prather, Ohio University Eastern 740-699-2498; prather@ohio.edu

OhioMATYC Liaison to OhioMAA Jim Anderson, University of Toledo

#### OhioMAA Liaison to OhioMATYC Robert Hovis, Ohio Northern University

OMSC Liaison Katie Cerrone Arnold, University of Akron

#### OCTM Liaison

Sandy Schroeder, Ohio Northern University

Archivist

Daniel Otero, Xavier University 513-745-2012; otero@xavier.edu

#### COMMITTEES

\* Denotes committee chair. Elected Officers and Committee Chairs are voting members of the Executive Committee. Terms expire at the end of the Spring meetings of the year listed. See the Bylaws.

#### **Program Committee**

\*David Singer, Case Western Reserve U. (2012) Adam Parker, Wittenberg University (2013)

Lew Ludwig, Denison University (2014)

#### CONTEAL

\*John Prather, Ohio U. Eastern (2014) Pam Warton, University of Findlay (2012) Shelly McGee, University of Findlay (2012) Katie Cerrone Arnold, U. of Akron (2012) Richard Little, Baldwin-Wallace Coll. (2013) Drew Pasteur, College of Wooster (2013) Sandy Schroeder, Ohio Northern U. (2013) Laurie Dunlap, University of Akron (2014) Susan Thompson, Otterbein College (2014)

#### CONSTUM

\*Thomas Wakefield, Youngstown St. U. (2012)

Matthew Menzel, Marietta College, (2012) Ryan Rahrig, Ohio Northern University (2013) Mohammad Zaki, Ohio Northern U. (2013) Matt McMullen, Otterbein U. (2014) Elizabeth Wilmer, Oberlin College (2014)

#### CONSACT

\*Karl Hess, Sinclair CC (2013) Glen Lobo, Sinclair CC (2013) Justin Young, Ashland, University (2014)

#### CONCUR

\*William Fuller, Ohio Northern U. (2014) Chandra Dinavahi, U. of Findlay (2013) David Stuckey, Defiance College (2013) Anne Albert, U. of Findlay (2014)

#### **OTHER COMMITTEES**

#### **Nominating Committee**

\*Mark Miller, Marietta College (2014) Vickie Van Dresar, Ashland U. (2013) Bill Higgins, Wittenberg U. (2012)

#### **Committee on Contests**

David Stenson, John Carroll U., AMC12

#### **Teaching Award Committee**

\* Don Hunt, Ohio Northern U. (Past President) Pamela Warton, U. of Findlay (Secretary), Judy Holdener, Kenyon College (Past recipient 2008) Richard Little, Baldwin-Wallace College (Past recipient 2010)

#### **Centennial Committee**

\*David Kullman, Miami University Tom Hern, Bowling Green State University Danny Otero, Xavier University John Zimmerman, Washington and Jefferson College Tom Dence, Ashland University Jon Dunlap, Bowling Green State University

# LOCAL ARRANGEMENTS FOR MEETINGS

Spring 2012: Xavier University Daniel Otero, otero@xavier.edu

Fall 2012: Baldwin-Wallace College David Calvis, DCalvis@bw.edu

Spring 2013: Denison University Lew Ludwig, ludwigl@denison.edu

Fall 2013: Cleveland State University Barbara Margolius, b.margolius@csuohio.edu

If you are interested in serving on one of the Ohio Section committees, please contact the Ohio Section President, Jon Stadler, or the President-Elect Wiebke Diestelkamp.

# Calendar

#### **Ohio Section**

Spring 2012 Section Meeting, April 13-14, Xavier University, Cincinnati, OH

Fall 2012 Section Meeting, October 19-20, 2012, Baldwin-Wallace College, Cleveland, OH; followed by the Fall Workshop

Spring 2013 Section Meeting, April 5-6, 2013, Denison University, Granville, OH

Fall 2013 Section Meeting, Dates TBA, Cleveland State University, Cleveland, OH; followed by the Fall Workshop

Spring 2014 Section Meeting, TBA

Fall 2014 Section Meeting, Dates TBA, Wittenberg University, Springfield, OH; followed by the Fall Workshop

#### National MAA-AMS

MathFest, August 2-4, 2012, Madison, WI

Annual Joint Meetings, January 9-12, 2013, San Diego, CA

MathFest, August 1-3, 2013, Hartford, CT

Annual Joint Meetings, January 15-18, 2014, Baltimore, MD

MathFest, August 7-9, 2014, Portland, OR

Annual Joint Meetings, January 10-13, 2015, San Antonio, TX

MathFest, August 5-8, 2015, Washington, D.C.

#### Other

International Conference on Technology in Collegiate Mathematics (ICTCM), Mar 22-25, 2012, Orlando, FL

Indiana Section MAA Meeting, Mar 23-24, 2012, Ball State University, Muncie, IN

Kentucky Section MAA Meeting, Mar 30-31, 2012, Bellarmine University, Louisville, KY

Illinois Section MAA Meeting, Mar 30-31, 2012, Illinois State University, Normal, IL

Alleghany Mountain Section MAA Meeting, Apr 13-14, 2012, West Virginia University, Morgantown, WV

Great Lakes Section SIAM meeting, Apr 21, 2012, Wayne State University, Detroit, MI

NCTM National Meeting, Apr 25-28, 2012, Philadelphia, PA

Michigan Section MAA Meeting, May 4-5, 2012, Saginaw Valley State University, University Center, MI

SIAM Annual Meeting, Jul 9-13, 2012, Minneapolis, MN

Joint Statistical Meetings, Jul 28 - Aug 2, 2012, San Diego, CA

Indiana Section MAA Meeting, Oct 20, 2012, Butler University, Indianapolis, IN

Central Section AMS Meeting, Oct 21-22, 2012, University of Akron, Akron, OH

OCTM Annual Meeting, Oct 18-19, 2012, Columbus, OH

Would your institution like to host an Ohio Section MAA meeting? Contact the Ohio Section President, Jon Stadler, or the President-Elect Wiebke Diestelkamp for more information.