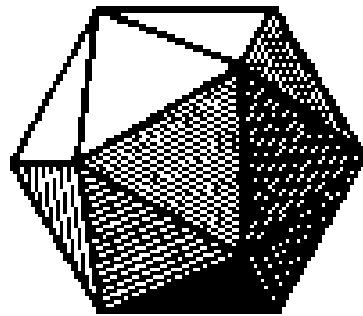


INDIANA SECTION  
OF THE  
MATHEMATICAL ASSOCIATION OF AMERICA



FALL 2003 NEWSLETTER



## Fall 2003 SECTION MEETING

*Goshen College  
Goshen, IN  
October 18, 2003*

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Indiana Section Web Page: <http://www.maa.org/indiana>

## FUTURE MEETINGS

### Section

*Spring 2004:* Indiana State University (Terre Haute, IN), April 2-3.

*Fall 2004:* University of Evansville (Evansville, IN), November 5-6. (*This is a Tri-Section Meeting with Kentucky and Illinois.*)

*Spring 2005:* IPFW, (Fort Wayne, IN), TBA.

### National

*Fall 2003:* AMATYC Meeting, Salt Lake City, UT, November 13-16, 2003

*Winter 2004:* Joint National Meetings, Phoenix, AZ, January 7-10, 2004

*Summer 2004:* Mathfest, Providence, RI, August 12-14, 2004

### Other Meetings

*Miami University 31-st Annual Conference:* "Discrete Mathematics and Its Applications", October 3 - 4, 2003, Miami University, Oxford, OH

*2003 Ohio Fall Section MAA Meeting:* October 17-18, 2003, Ohio Northern University, Ada, OH

### RODNEY HOOD MEMORIAL (by Dan Callon)

Rodney Tabor Hood, a long-time professor of mathematics at Franklin College and active member of the Indiana Section, died on February 10, 2003, after a long bout with Alzheimer's disease.

Rodney was born in rural upstate New York near Buffalo on September 29, 1924. He was a member of Phi Beta Kappa at Oberlin where he earned his bachelor's degree. He received his M.A. and Ph. D. from the University of Wisconsin in Mathematics, then earned a B.D. from Colgate-Rochester Divinity School, and was working toward a Ph.D. in Biblical Studies at the University of Chicago when family demands decreed that full-time employment was necessary.

After short stints in the ministry and teaching at Beloit College and Ohio University, Rodney moved to Franklin College in 1960, where he served as professor of mathematics for 32 years. While at Franklin College, he taught most of the courses in the mathematics curriculum, and also taught courses in religion, Greek, and Latin, as well as winter term and adult education classes in genealogy. He helped develop the Franklin College High School Math Day, which will be observing its 40th anniversary in 2003. He wrote Logic and Mathematics, which was used for several years as a textbook at Franklin College. He taught in the National Science Foundation's summer institutes for twelve years and was well-known as a speaker at local high school math clubs.

Rodney was an inveterate traveler, particularly in Europe, and he presented papers at the International Congress of Mathematicians in 1962, 1966, and 1978, in addition to presentations at a wide variety of professional meetings and conferences. He was consistently active in the Indiana Section, serving as governor,

chair, vice chair, and secretary/treasurer. He was awarded the MAA's Certificate of Meritorious Service in 1989, and there is a room in the MAA national headquarters named in his honor. His major research project, which he was unable to finish, was a compilation of the mathematical works of Leonhard Euler, his ancestor in mathematical genealogy.

Rodney's humor was dry and unexpected to those who did not know him. His bits of verse were highlights of faculty meetings, serving to either open or adjourn those meetings for twenty years. He and his bicycle were familiar sights on the Franklin College campus and in town in all kinds of weather, and have earned their place in Franklin College lore.

Rodney and his wife of 53 years, Carolyn, lived their values to an incredible degree. They were associated for over fifteen years with the Franklin Community CROP walk to raise money for refugees, disaster victims, and the hungry worldwide. They were members of the Baptist Peace Fellowship of North America and the Fellowship of Reconciliation, and attained notoriety for withholding the part of their income taxes that went to produce military weapons. They kept a separate apartment at their home for the use of those in need and for the use of international students. Their frequent use of bicycles for transportation was part of their commitment to preserving the world's natural resources.

Rodney is survived by Carolyn, a daughter Becky, and two sons, Phillip and John, along with six grandchildren.

#### **STATEMENT FROM MICHAEL KARLS (CHAIR OF THE INDIANA SECTION)**

Welcome back to another exciting year of mathematics in Indiana! At our fall meeting at Goshen College we will have a wide variety of talks on topics ranging from good modeling problems to Laplace transform techniques for evaluating infinite series. Our invited speaker is the Mathematics Magazine editor, Frank Farris from Santa Clara University. His talk, which is accessible to undergraduate students, will be about five-fold symmetry in wallpaper. In addition, we are pleased to offer an NSF sponsored MAA workshop titled *Mathematics for Business Decisions*.

This spring, at our Indiana State University meeting, our keynote speaker will be James Serrin, from the University of Minnesota. He will discuss the mathematics of tornados-a topic that is very timely for spring in Indiana. We will also host the Indiana College Mathematics Competition (ICMC) as well as a workshop for students on iterated functions and fractals given by Patricia Oakley of Goshen College. Again this spring, registration for the ICMC will be done on-line through the section's website.

One of the great things about being a part of the Indiana Section is the representation and recognition of our members at the national level in the MAA. I'd like to extend congratulations to Carl C. Cowen of Purdue University, who has been elected the MAA's next President. He will serve as President-Elect in 2004 and begin a two-year term as President in January 2005, when he will succeed Ronald Graham.

This summer David Finn from Rose-Hulman received the George Polya Award at the 2003 Summer MathFest in Boulder, CO, for his paper "Can a Bicycle Create a Unicycle Track?" Congratulations David!

Also, Lowell Beineke of Indiana University-Purdue University Ft. Wayne has succeeded Woody Dudley of DePauw University as the editor of the The College Journal of Mathematics. Michael Kinyon of Indiana University South Bend is responsible for the Classroom Capsules portion of this journal.

Have a great year-I look forward to seeing you at Goshen College this fall!

## FALL MEETING TALKS: TITLES AND ABSTRACTS

Goshen College  
Goshen, Indiana  
Saturday, October 18, 2003

### The Riemann Sphere and its Generalizations

Reza Akbari, Saginaw Valley State University

Referring to the stereographic projection, the Riemann sphere is constructed. Generalization of this construction is discussed. Applications to the complex analysis are described.

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### A Generalization of the Climbing Stairs Problem

Mohammad Azarian, University of Evansville

In this presentation, we first discuss some elementary questions regarding the staircase problem. We use generating functions as a computing tool, and we will see that the staircase problem is a simple application of elementary partition theory. At the conclusion, we present some open questions. This paper will appear in a future issue of the Missouri Journal of Mathematical Sciences.

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### Forbidden Symmetry—Relaxing the Crystallographic Restriction.

Frank Farris (Keynote Speaker), Santa Clara University

If you look at enough swatches of wallpaper, you will see centers of 2-fold, 3-fold, 4-fold, and 6-fold rotation. Why not 5-fold centers? They cannot occur, according to the Crystallographic Restriction, a fundamental result about wallpaper patterns, which are defined to be invariant under two linearly independent translations. Even so, we offer convincing pictures that appear to show wallpapers with 5-fold symmetry. This talk is intended to be accessible to students who know something about level curves in the plane and linear algebra.

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### A Laplace Transform Technique for Evaluating Infinite Series

James Lesko, Grace College

There are various techniques for evaluating infinite series  $\sum_{n=1}^{\infty} u_n$ . One technique is to write the summand  $u_n$  as a Laplace transform integral

$$u_n = \int_0^{\infty} e^{-nx} f(x) dx,$$

so that if we interchange the order of summation and integration (with proper justification of course!) we obtain

$$\sum_{n=1}^{\infty} u_n = \int_0^{\infty} f(x) \sum_{n=1}^{\infty} e^{-nx} dx = \int_0^{\infty} f(x) \left( \frac{e^{-x}}{1 - e^{-x}} \right) dx.$$

If this last integral can be computed, then we have found our sum. In this presentation we demonstrate a generalization of this technique. Some series are of the form  $\sum_{n=1}^{\infty} u_n v_n$  where it is convenient to write only  $v_n$  as a Laplace transform integral. In this case we have

$$\sum_{n=1}^{\infty} u_n v_n = \sum_{n=1}^{\infty} u_n \int_0^{\infty} e^{-nx} f(x) dx.$$

Sometimes we can still swap sums with integrals and obtain a closed form expression for the series. We will illustrate this technique with several examples.

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## Good Modeling Problems, Practices and the MCM

Don Miller, Saint Mary's College

As an MCM judge with eleven years tenure, I have seen several modeling problems of variable quality and many "models" of yet more variable quality. From these experiences, I will discuss criteria for a good modeling problem as well as the components of a quality solution. Good problems beget good models thus facilitating the teaching of good modeling practices. Audience participation will be solicited.

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### Leftist Numbers

Andrew Rich, Manchester College

Leftist numbers are strings of decimal digits with the infinite tails running to the left instead of the right. Addition and multiplication are just as easy as with the more prevalent rightists and the leftists form a ring. All rationals are leftists (although some appear in disguise). Zero divisors crush our hopes for a leftist field, but if we change to a prime base, we have discovered a favorite field of number theorists, namely the p-adic field.

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### Computation and Application of the Cosine of a Matrix

Morteza Seddighin, Indiana University East

We will discuss the computation and application of cosine of a matrix on finite dimensional space. Given a square matrix  $A$ ,  $\cos(A)$  is defined by

$$\cos(A) = \inf_{Tf \neq 0} \frac{\operatorname{Re}(Af; f)}{\|Af\| \|f\|}.$$

Although in recent years we have been able to compute  $\cos(A)$  for special classes of matrices (such as normal matrices), the computation of  $\cos(A)$  for a general matrix remains a challenging optimization problem (even for the case of a two by two matrix!). In this talk we will discuss some methods of approximation of  $\cos(A)$ . We will also discuss the application of  $\cos(A)$  in numerical optimization including the method of steepest descent.

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### Analysis of a Randomized Selection Algorithm

Mark Ward, Purdue University

We consider a randomized selection algorithm in which  $M_n$  of  $n$  participants are selected, where  $1 \leq M_n \ll n$ . The selection algorithm involves a series of elimination steps. In each round, a moderator flips a biased coin; each participant also flips a biased coin and remains for subsequent rounds if and only if the result agrees with the moderator's result. The process continues until no participants remain. We define  $M_n$  to be the number of participants in the final round. We give precise asymptotic characteristics of the  $j$ th factorial moment of  $M_n$  for all  $j \in \mathbb{N}$ , where  $\mathbb{N}$  is the set of natural numbers. Also, we present a detailed asymptotic description of the exponential generating function for  $M_n$ . In particular, we exhibit periodic fluctuation in the distribution of  $M_n$ , and we prove that no limiting distribution exists. The results we develop are proved by probabilistic and analytical techniques of the analysis of algorithms. In particular, we utilize recurrence relations, analytical poissonization and depoissonization, the Mellin transform, and complex analysis.

For updates on the fall meeting schedule, see

<http://www.goshen.edu/poakley/MAASection/>

## MAA WORKSHOP ON MATHEMATICS FOR BUSINESS DECISIONS

After five years of development, and testing by thousands of students, the Mathematical Association of America has published the electronic texts *Mathematics for Business Decisions*, Parts 1 and 2. These are distributed as boxed software, with installation CD's and Student Notebooks. Jointly written by a mathematician and a professor of finance, these e-texts feature four interdisciplinary, multimedia projects for lower division students in business and public administration. The two course sequence, including probability, simulation, calculus, and optimization, is designed to replace the traditional combination of finite mathematics and brief calculus. We will demonstrate the new materials, discuss the challenges and rewards of teaching the program, and allow plenty of time for hands-on computer experimentation with the texts.

This  $2\frac{1}{2}$ -hour workshop will occur parallel with the morning talks. There is no charge for the workshop, but registration by October 1, 2003 is required. To register, please contact Doris Yoder at [dorisoy@goshen.edu](mailto:dorisoy@goshen.edu) or 574-535-7305. For further information about the workshop, please contact Patricia Oakley ([poakley@goshen.edu](mailto:poakley@goshen.edu)).

### FALL 2003 MEETING INFORMATION

#### Directions to Goshen College

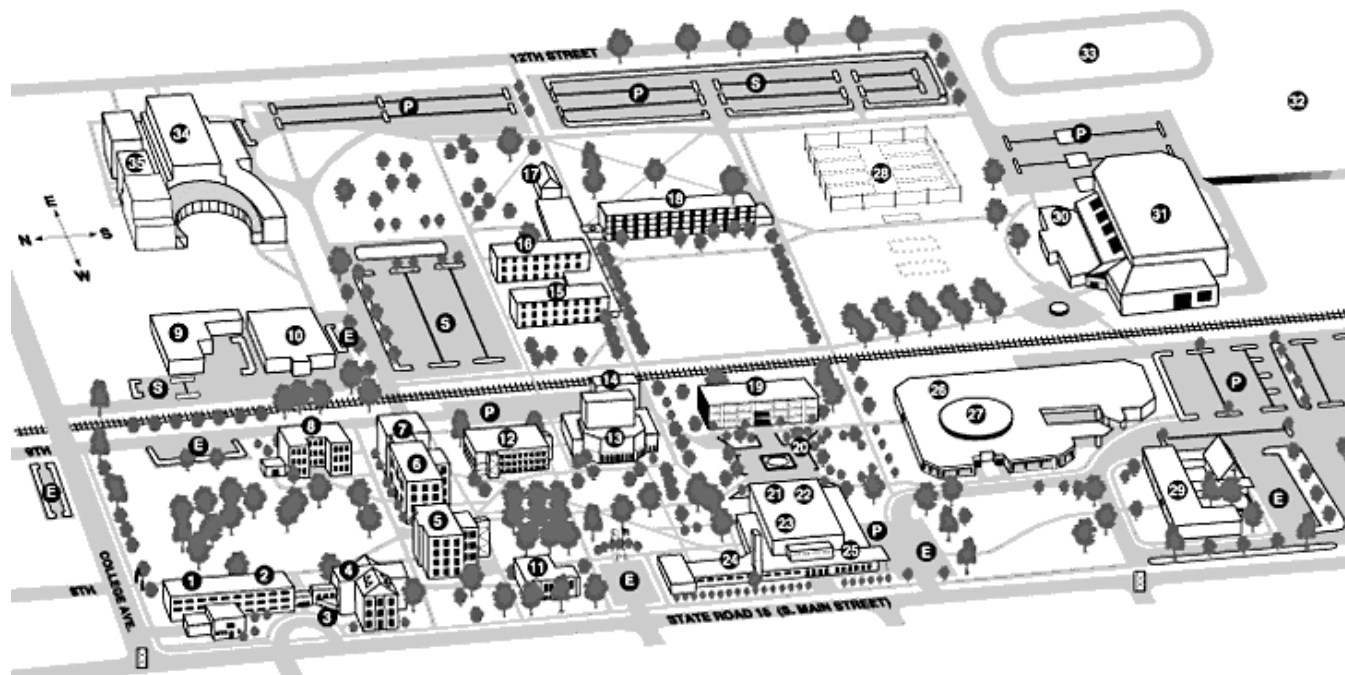
**From the North:** Follow Indiana State Road 15 south through the city center. About 1 mile south of the city center turn left at a traffic light on College Avenue. (This is the north edge of the campus and is marked by a Goshen College sign.) Go two blocks on College Avenue and turn left or right just before the railroad tracks to find parking in designated lots.

**From the South:** Follow Indiana State Road 15 north through Waterford Mills. About 1 mile north of a traffic light at Kercher Road (County Road 38), just after passing the Goshen College Union and Welcome Center, find parking in a small lot on the north side of the Union. Alternatively, continue to a traffic light at College Avenue (marked by another Goshen College sign) and turn right. Go two blocks on College Avenue and turn left or right just before the railroad tracks to find parking in designated lots.

**From the East or the West:** Follow U.S. Route 33 into Goshen until it intersects with Indiana State Road 15. Turn south on Indiana 15, and follow it about 1 mile to a traffic light at College Avenue. (This is the north edge of the campus and is marked by a Goshen College sign.) Turn left and go two blocks on College Avenue; then turn left or right just before the railroad tracks to find parking in designated lots.



## Campus Map



The MAA meeting and registration will be held in the Administration Building (Building 5). Science Hall (Buildings 6-7) house the science departments, including mathematics and computer science. Lunch will be in the Fellowship Hall of the Church-Chapel (Building 27).

### Key to Goshen Campus Map:

5 **Administration Building**, 22 Computer Labs, 10 Maintenance Building, 13 Umble Center, 12 Admissions, 17 East Hall, 15 Miller Residence hall, 23 Union Building, 35 Art Gallery, 33 Eigsti Track and Field Complex, 34 Music Center, 11 Visual Arts Building, 32 Athletic Fields, 19 Good Library, 29 Newcomer Center, 25 Welcome Center, 26 Campus Center for Young Children, 30 Wellness and Health Center, 12 Olive G. Wyse Hall, 2 Westlawn Dining Hall, 21 Bookstore, 14 Heating Plant, 31 Roman Gingerich Recreation-Fitness Center, 3 Westlawn Lounge, 9 Chairman Building, 16 Kratz Residence Hall, 7 **Schrock Science Annex**, 1 Westlawn Residence Hall, 27 **Church-Chapel**, 4 Kulp Residence Hall, 20 Schrock Plaza, 18 Yoder Residence Hall, 8 Coffman Residence Hall, 24 Leaf Raker Snack Shop, 6 **Science Hall**, P Visitor Parking, 28 Tennis Courts, S Student Parking, E Faculty/Staff Parking.

### Parking on Campus

On Saturday, October 18, 2003, participants can park in any parking space designated as faculty/staff or visitor parking. On the map above, these lots are designated by E and by P. **Do not park in lots designated as student parking.**

### Meeting Registration

The MAA meeting will be held in the Administrations Building. Registration will be held on the second floor on the south side of the building. Registration will begin at 8 a.m. The regular meeting registration fee is \$10.00. Cash and personal checks made out to "Indiana Section, MAA" will be accepted. There is no registration fee for students or speakers. All participants, including students and speakers, are expected to sign-in at the registration table. Please note that Goshen College is a smoke free environment.

## Meal Reservations

We would appreciate all persons planning to attend the meeting to let us know in advance. Your name tag will be prepared, and you will spend less time in the registration line.

Lunch will be served in the Fellowship Room of the Church-Chapel and will cost \$8.00 per person. The lunch will be a taco bar. Advanced reservation is required and must be made no later than 12:00 noon, Monday, October 13, 2003. Payment should be made at the meeting registration table.

To place your meeting and lunch reservation, send an e-mail message to Doris Yoder at [dorisoy@goshen.edu](mailto:dorisoy@goshen.edu). Please include

- (1) your name as you would like it to appear on your name tag;
- (2) the name of your school or company;
- (3) whether you are a student, faculty, or other;
- (4) whether you are a member of the MAA; and
- (5) whether you will be coming to lunch.

E-mail reservations will be acknowledged by e-mail. If you prefer voice to print, call Doris Yoder at 574-535-7305 or Patricia Oakley at 574-535-7311.

## Accommodations

Room availability is **really tight** for the weekend of the MAA Fall Section Meeting. As of the first week in September, there are only two motels in Goshen that still have rooms available. They are

Super 8 Motel  
 2628 Lincolnway East  
 Goshen, IN 46528  
 574-642-9944  
 Double \$75  
 Suites \$80-\$90  
 (Only 12 rooms left)

Best Western  
 900 Lincolnway East  
 Goshen, IN 47526  
 574-533-0408  
 All rooms \$71 (This is a Goshen College price - you must mention that you are at a Goshen College event.)  
 (Only 10 rooms left)

There are some places farther afield:

Holiday Inn Express  
 3825 Lake City Hwy.  
 WARSAW, IN  
 574-268-1600  
 2 queens \$76.49 (15 rooms available)

1 king \$84.99 (14 rooms available)

Inn at Amish Acres  
 1234 W Market St.  
 NAPPANEE, IN  
 Doubles \$114  
 King \$135  
 (25 rooms available)

Given the lack of room availability, persons needing a hotel room should make their reservations as early as possible.

Additional listing of hotels and B&B's can be found at <http://www.goshen.edu/aboutgc/map.php>.

### Information for Student Presenters

The Indiana Section of the MAA awards free memberships to all students (including graduate students) who present papers at an Indiana Section meeting. The recipients of these memberships are allowed to select any one MAA journal. In case the prize winner is already a member, an MAA-published book can be substituted for the membership.

### Local Organizers

For general information regarding the meeting, please contact Ron Milne ([ronjm@goshen.edu](mailto:ronjm@goshen.edu)) or Patricia Oakley ([poakley@goshen.edu](mailto:poakley@goshen.edu)).

## INDIANA COLLEGE MATHEMATICS COMPETITION (ICMC)

### Preregistration for 2004 ICMC

For the 2004 ICMC at Indiana State University, we strongly recommend that teams pre-register, so that the host institution can reserve enough rooms for the contest. Teams that pre-register will be guaranteed admission to the contest, while those teams that register on-site will be granted admission provided that space is available.

To preregister, please visit the Section website <http://www.maa.org/indiana>.

### Team results for the 2003 ICMC

There were 39 teams participating, representing 19 schools. The top four teams, from first to fourth, were IPFW, IUPUI, Wabash College, and Purdue University. Congratulations to these teams and thanks to all who participated.

### Solutions for the Spring 2003 ICMC

- Let  $S$  be a set with a binary operation  $*$  that has the property

$$(a * b) * (c * d) = a * d$$

for all  $a, b, c, d \in S$ .

- (4 points) If  $a * b = c$ , prove  $c * c = c$ .

Since  $(a * b) * (a * b) = a * b$  by the given property, we have by substitution that  $c * c = c$ .

(b) (6 points) If  $a * b = c$ , prove  $a * y = c * y$  for all  $y \in S$ .

We have  $(a * b) * (c * y) = a * y$  by the given property. Using the hypothesis, we get  $c * (c * y) = a * y$ . From part (a), we can substitute  $c * c$  in for  $c$ , yielding  $(c * c) * (c * y) = a * y$ . Finally, using the given property, we get  $c * y = a * y$ .

2. (10 points) A tennis club invites  $2^k$  ( $k \geq 1$ ) players of equal ability to compete in a single-elimination tournament. If the probability of a competitor winning his or her match is  $\frac{1}{2}$ , and the competitors are paired together in a random order in the first round, show the probability that a particular pair of competitors will face each other during the tournament is  $\frac{1}{2^{k-1}}$ .

Let  $p_k$  represent the probability a particular pair of competitors will face each other in a tournament involving  $2^k$  competitors. By induction on  $k$ :

For  $k = 1$ : There are only  $2^1$  competitors, so  $p_k = 1 = \frac{1}{2^{1-1}}$ .

Now, assume  $p_k = \frac{1}{2^{k-1}}$  for  $k \leq n$ . For  $k = n + 1$ , The probability a competitor meets any other competitor in the first round is  $\frac{1}{2^{n+1}-1}$ . The probability they meet in later rounds is the probability they do not meet in round one, they both win in round 1, and they meet in subsequent rounds. This is given by  $\left(1 - \frac{1}{2^{n+1}-1}\right) \left(\frac{1}{2}\right) \left(\frac{1}{2}\right) p_n$ . So,

$$\begin{aligned} p_{n+1} &= \frac{1}{2^{n+1}-1} + \left(1 - \frac{1}{2^{n+1}-1}\right) \left(\frac{1}{2}\right) \left(\frac{1}{2}\right) p_n \\ &= \frac{1}{2^{n+1}-1} + \frac{2^{n+1}-2}{2^{n+1}-1} \cdot \frac{1}{4} \cdot \frac{1}{2^{n-1}} \quad \text{by ind. hyp.} \\ &= \frac{1}{2^{n+1}-1} + \frac{2^n-1}{2^n(2^{n+1}-1)} \\ &= \frac{2^n+2^n-1}{2^n(2^{n+1}-1)} \\ &= \frac{1}{2^n} \end{aligned}$$

So, by induction,  $p_k = \frac{1}{2^{k-1}}$  for all  $k \geq 1$ .

3. If 5 points divide the unit circle into 5 equal arcs, express  $ab$  in terms of  $\sin 18^\circ$ , where  $a$  and  $b$  are the lengths of the chords indicated in Figure 1.

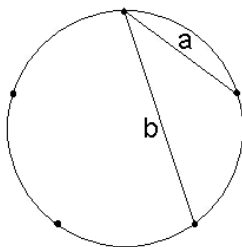


Figure 1: Chords

If we connect the 5 points on the unit circle, we get a regular pentagon. Hence, the length  $a$  is the same as the one shown in Figure 2:

From the law of cosines,  $a = \sqrt{2 - 2 \cos 72^\circ}$ . Going back to the given chords, we obtain the picture shown in Figure 3.

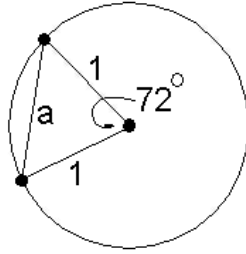


Figure 2: Side of a regular pentagon

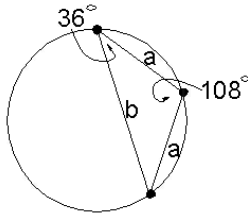


Figure 3: An isosceles triangle

Again using the law of cosines, we get

$$\begin{aligned}
 b^2 &= 2a^2 - 2a^2 \cos 108^\circ \\
 &= 4 - 4 \cos 72^\circ - (4 - 4 \cos 72^\circ) \cos 108^\circ \\
 &= 4 - 4 \cos 72^\circ + (4 - 4 \cos 72^\circ) \cos 72^\circ \\
 &= 4 - 4 \cos^2 72^\circ = 4 \sin^2 72^\circ \\
 b &= 2 \sin 72^\circ
 \end{aligned}$$

Using the law of sines, we get:

$$\begin{aligned}
 \frac{\sin 108^\circ}{b} &= \frac{\sin 36^\circ}{a} \\
 \frac{\sin 72^\circ}{2 \sin 72^\circ} &= \frac{\sin 36^\circ}{a} \\
 a &= 2 \sin 36^\circ
 \end{aligned}$$

So,

$$\begin{aligned}
 ab &= (2 \sin 36^\circ) (2 \sin 72^\circ) \\
 &= 4 (2 \sin 18^\circ \cos 18^\circ) (\cos 18^\circ) \\
 &= 8 \sin 18^\circ \cos^2 18^\circ \\
 &= 8 \sin 18^\circ (1 - \sin^2 18^\circ)
 \end{aligned}$$

4. A  $3 \times 3$  array of integers has the property that the products of the elements in each of the 3 rows, in each of the 3 columns, and in each of the 2 diagonals are all the same; call this product  $k$ . (We call such an array a multiplicative magic square.) Prove that  $k$  is a perfect cube, and determine the element in the array that  $k$  is the cube of.

Write the square as an array:  $\begin{matrix} a & b & c \\ d & e & f \\ g & h & i \end{matrix}$ . Then,  $k = aei = beh = ceg$ . So,  $a = \frac{k}{ei}$ ,  $b = \frac{k}{eh}$ ,  $c = \frac{k}{eg}$ . Now,  
 $k = abc = \frac{k}{ei} \cdot \frac{k}{eh} \cdot \frac{k}{eg} = \frac{k^3}{e^3ghi} = \frac{k^2}{e^3}$ . So,  $k = e^3$ .

5. Does the series

$$1 + \frac{1}{2} - \frac{1}{3} + \frac{1}{4} + \frac{1}{5} - \frac{1}{6} + \frac{1}{7} + \frac{1}{8} - \frac{1}{9} \cdots$$

converge or diverge? Justify.

$$\begin{aligned} S_3 &= 1 + \left(\frac{1}{2} - \frac{1}{3}\right) \\ &\geq 1 \\ S_6 &= 1 + \left(\frac{1}{2} - \frac{1}{3}\right) + \frac{1}{4} + \left(\frac{1}{5} - \frac{1}{6}\right) \\ &\geq 1 + \frac{1}{4} \\ S_9 &= 1 + \left(\frac{1}{2} - \frac{1}{3}\right) + \frac{1}{4} + \left(\frac{1}{5} - \frac{1}{6}\right) + \frac{1}{7} + \left(\frac{1}{8} - \frac{1}{9}\right) \\ &\geq 1 + \frac{1}{4} + \frac{1}{7} \\ &\vdots \\ S_{3n} &\geq 1 + \frac{1}{4} + \frac{1}{7} + \cdots + \frac{1}{3n-2} \end{aligned}$$

A limit comparison with  $\sum \frac{1}{n}$  shows  $\sum \frac{1}{3n-2}$  diverges. Hence, a direct comparison shows the given series diverges.

6. The Fibonacci sequence  $f_1, f_2, f_3, \dots$  is defined by  $f_1 = f_2 = 1$ ,  $f_n = f_{n-1} + f_{n-2}$  for  $n = 3, 4, 5, \dots$ . Thus, the sequence begins 1, 1, 2, 3, 5, 8, 13, 21, 34, ...

Let

$$Q = \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$$

- (a) (4 points) Prove

$$Q^n = \begin{bmatrix} f_{n+1} & f_n \\ f_n & f_{n-1} \end{bmatrix}$$

for  $n = 2, 3, 4, \dots$

By induction on  $n$ :

$$\text{For } n = 2: Q^2 = \begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} f_3 & f_2 \\ f_2 & f_1 \end{bmatrix}$$

$$\text{Assume } Q^n = \begin{bmatrix} f_{n+1} & f_n \\ f_n & f_{n-1} \end{bmatrix}. \text{ For } n + 1:$$

$$Q^{n+1} = Q^n Q$$

$$\begin{aligned}
&= \begin{bmatrix} f_{n+1} & f_n \\ f_n & f_{n-1} \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix} \\
&= \begin{bmatrix} f_{n+2} & f_{n+1} \\ f_{n+1} & f_n \end{bmatrix}
\end{aligned}$$

So, the result holds.

(b) (6 points) Establish the identity:

$$f_{3n} = f_{n+1}^3 + f_n^3 - f_{n-1}^3$$

for  $n = 2, 3, 4, \dots$

From part (a),  $Q^{3n} = \begin{bmatrix} f_{3n+1} & f_{3n} \\ f_{3n} & f_{3n-1} \end{bmatrix}$ . Also,  $Q^{3n} = Q^n Q^n Q^n = \begin{bmatrix} f_{n+1} & f_n \\ f_n & f_{n-1} \end{bmatrix}^3$ . Direct computation shows that the upper right entry when cubing this matrix is  $(f_{n+1}^2 + f_n^2) f_n + f_{n+1} f_n f_{n-1} + f_n f_{n-1}^2$ . Equating this with the upper right entry of the first matrix, we get:

$$\begin{aligned}
f_{3n} &= (f_{n+1}^2 + f_n^2) f_n + f_{n+1} f_n f_{n-1} + f_n f_{n-1}^2 \\
&= f_{n+1}^2 f_n + f_n^3 + f_{n+1} f_n f_{n-1} + f_n f_{n-1}^2 \\
&= f_{n+1}^2 (f_{n+1} - f_{n-1}) + f_n^3 + f_{n+1} (f_{n+1} - f_{n-1}) f_{n-1} + (f_{n+1} - f_{n-1}) f_{n-1}^2 \\
&= f_{n+1}^3 - f_{n+1}^2 f_{n-1} + f_n^3 + f_{n+1}^2 f_{n-1} - f_{n+1} f_{n-1}^2 + f_{n+1} f_{n-1}^2 - f_{n-1}^3 \\
&= f_{n+1}^3 + f_n^3 - f_{n-1}^3
\end{aligned}$$

## INFORMATION FOR GRADUATE STUDENTS

### Graduate Student Workshop

The bi-annual Section Workshop for Graduate Students, which ordinarily runs during the Fall Section Meeting, has been **postponed** until the Spring 2004 Section Meeting due to a delay in the selection of organizers for the workshop. Details will be forthcoming in the Spring Newsletter. Questions and/or suggestions pertaining to the workshop should be addressed to the organizers: Josh Holden (Joshua.Holden@rose-hulman.edu) and Wesley Calvert (wcalvert@nd.edu).

### Free MAA memberships

MAA Section meetings provide a wonderful opportunity for graduate students to gain experience in giving professional presentations. To help graduate students avail themselves of this opportunity, the Indiana Section will now provide free MAA memberships to graduate students who make a presentation at an Indiana Section meeting.

### Graduate students sought to grade ICMC papers

Graduate students who are interested in our yearly mathematics competition for undergraduates (ICMC) are welcome to help grade ICMC papers should they be interested in doing so. Graduate students who are interesting in grading ICMC papers should contact Mohammad Azarian (ma3@evansville.edu).

## NOTES FROM AROUND THE MAA

### Update Your Listing

If your information at the Combined Membership List (CML) or with the MAA is out of date, please take a few moments to update your information. Your CML listing can be changed online at <https://www.ams.org/cml-update>. To update your MAA listing, either send email to [maaservice@pmds.com](mailto:maaservice@pmds.com) or call 1-800-331-1622. Please be aware that changing your CML listing will not automatically change your MAA listing.

## SECTION NEWS

### Ball State University

The Mathematical Sciences Department welcomes Dr. Beverly Hartter from Illinois State University. Dr. Hartter has accepted a tenure-track position in mathematics education.

We are also happy to announce three promotions in our department. Ralph Bremigan and Kerry Jones were promoted to professor, while Elizabeth Bremigan was promoted to associate professor.

### Earlham College

Mic Jackson led a May term environmental course to Menorca (a Mediterranean island off the coast of Spain) which is an international biosphere under UNEP (United Nations Environmental Program). I'm still Director of Environmental Programs and teach a course titled "Analysis of Environmental Problems", using Mathematical Modeling in the Environment by Charles Hadlock.

Jennifer Ziebarth continued work on finding more effective ways to teach Elementary Statistics.

Tim McLarnan has been focusing on updating our Advanced Geometry course to make use of Java-based tools.

We have all been working on development of mathematics courses which will fit the College's new "Earlham Seminar" courses for entering first year students. We're fiddling with topics like the history of mathematics, non-Euclidean geometry, how to lie with statistics, environmental mathematics, etc.

Finally, students have gotten quite excited about our yearly participation the the annual Mathematical Contest in Modeling, sponsored by COMAP each February. Last year, we had five teams of three, all got in good submissions, and had a good time. Three received ratings above "thanks for participating". They are eager to do better this coming February.

### Goshen College

David Housman was promoted to full professor. Patricia Oakley was promoted to full professor and received tenure. One of our students, Matt Rissler, placed in the 89th percentile on the Putnam exam. Three students did mathematical research in our "Maple Scholars Program" during the summer, 2003. Funding was received for one of these students from the MAA's Strengthening Underrepresented Minority Mathematics Achievement Program.

### Hanover College

Ralph Seifert has retired after 33 years in the Mathematics Department, most of them as department head. Dr. Barbara Wahl has succeeded Ralph as Chair.

### IPFW

We welcome the following new faculty members: Jason Parcon, Assistant Professor (Ph.D., Western Michigan University), and 2003 Robert Trammel, Visiting Instructor.

Adam Coffman, Dan Coroian, Peter Dragnev were promoted to associate professor.

Peter Hamburger and Peter Dragnev are on sabbatical leave. Peter Hamburger is visiting the University of Illinois, while Peter Dragnev is on leave for Fall 2003 only.

Finally, we have established an Indiana Zeta Chapter of Pi Mu Epsilon, which was installed on May 11, 2003.

## **IUPUI**

Two awards were made at the I.U. Founder's Day program:

- Alexander R. Its, professor of mathematical sciences at IUPUI was elevated to the rank of Indiana University Distinguished Professor. Its' work is on integrable systems, which lie at the interface of mathematics and physics. Among other things, he and Matveev, using the tools of algebraic geometry, derived an elegant formula to describe certain periodic solutions to the Korteweg de Vries equations of non-linear water waves.
- Jeffrey X. Watt, associate professor of mathematical sciences at IUPUI, won Indiana University's Herman Frederic Lieber Memorial Award, which recognizes outstanding teaching. This award was established in 1954 by Katie D. Bachman in honor of her grandson.

Also, Michal Misiurewicz was invited by the Polish Mathematical Society and Warsaw University to deliver the 2003 Sierpinski Lecture and to be the recipient of the prestigious Sierpinski Medal. Named after the great Polish mathematician, Waclaw Sierpinski (1882-1962), this medal is the highest honor the Polish mathematical community awards mathematicians worldwide for their accomplishments in the field.

## **Indiana University Northwest**

The Department of Mathematics and Actuarial Science is pleased to report that Dr. Iztok Hozo has been promoted to a Full Professor and Dr. Vesna Kilibarda has been promoted to an Associate Professor with tenure.

The department thanks Ms. Candy Myers for 10 years of service as a departmental secretary and is happy to welcome Ms. Kathleen Erwin as our new secretary.

## **Indiana University at South Bend**

Effective July 1, 2003, Dr. Yu Song is the chairperson for the Department of Mathematics. Dr. Dean Alvis is now the associate chairperson.

## **Purdue University North Central**

The Purdue University North Central Mathematics, Statistics and Physics Department is pleased and proud to announce that Dr. Alain Togbe joined our faculty on June 30, 2003. Dr. Togbe received his M.A. degree in 1994 and his Ph.D. in 1997, both in Algebraic Number Theory, from Laval University in Quebec. He completed a DEA in Differential Geometry from the University of Abidjan in 1988, and a Teaching Certificate and B.S. in Mathematics from the National University of Benin, in 1985. His research interest is in Algebraic Number Theory in which he specializes in solving Thue Equations. Although Dr. Togbe's research focuses mainly on solving families of Thue equations using Baker's method, he works on solving other Diophantine equations such as equations in relative fields, norm forms in two dominating variables, index form equations, Thue-Mahler equations, elliptic equations, and hyperelliptic equations. In addition to a number of papers in his field that he has authored or co-authored, Dr. Togbe has recently submitted for publication the papers: A Parametric Family of Cubic Thue Equations, (with C. Heuberger) Complete Solutions to Certain Families of Cubic Thue Equations, (with E. Goins) On Pythagorean Quadruplets. He is currently preparing for publication the paper A Parametric Family of Sextic Thue Equations. You may contact Dr. Togbe at atogbe@pnc.edu.

## **Rose Hulman**

During the 2003 Mathfest, David Finn won a Polya Award for his article "Can a bicycle create a unicycle track?"

Rose-Hulman welcomes two new faculty members, Mark Inlow and Christopher Leisner:

- Mark Inlow joins the Rose-Hulman Mathematics Department after two years at the University of Arizona as a VIGRE fellow. Prior to that, he studied Statistics at Texas A& M University, receiving his Ph.D. in 2001 under the direction of Emanuel Parzen. Before and during his doctoral work, he did statistical consulting for DuPont, SAIC, Stata, and several DOD laboratories. He is glad to be back in Indiana, his home state, and working down the road from his Alma Mater, DePauw University. His main research interests are statistical modeling methods, in particular, methods for assessing model adequacy.
- Christopher Leisner received his B.S. in Mathematics with a minor in Computer Science from the State University of New York College at Brockport in May 1991. He received his M.S. in Electrical Engineering in December 1999 and his Ph.D. in Applied Mathematics in May 2000, both from Purdue University. His Ph.D. advisor was Bradley Lucier. From September 2000 to August 2002 he worked for the Dartmouth College Mathematics Department and the Dartmouth Brain Imaging Center. From August 2002 to May 2003 he worked for the Harriet L. Wilkes Honors College of Florida Atlantic University.

### **Saint Mary's College**

The department welcomes Ewa Misiolek to a full time, tenure track position. She has taught part time for us starting in 1994. She holds an MA in Mathematics from SUNY at Stony Brook, and is completing graduate work at Notre Dame in computer science. We look to her to help guide our computer science program.

We also welcome back Prof. Mary Porter from a full year sabbatical. Indiana MAA folks will note that she did not take a sabbatical from MAA work last year!

### **Taylor University**

The Taylor University Mathematics Department welcomes Dr. Ken Constantine as its newest faculty member. Dr. Constantine received his Ph.D. in Statistics from Purdue University. Previously, he had been teaching at Easter Nazarene College in Massachusetts.

### **University of Evansville**

The University of Evansville mathematics department welcomes new member Joanne Redden, who has just completed her Ph.D. at Saint Louis University. Joanne has taught at Illinois College in Jacksonville, Illinois. She enjoys both teaching and research. Her area of specialization is group theory.

### **Valparaiso University**

Rick Gillman is the new chair of the Department of Mathematics and Computer Science at Valparaiso University. Pat Sullivan is stepping down from this position. Ken Luther is assuming the chairmanship of the Environmental Science program committee. Jerry Wagenblast is returning from a two year term as Director of VU's study center in Cambridge, England. His replacement is Greg Hume, also of the Department. Stefan Brandle, of Taylor University, will be a visiting professor in the Department this year. Mary Treanor will be on sabbatical for the year.

## **SECTION AWARDS**

### **2003 Awards**

The 2003 Distinguished Service Award was received by Carl Cowen (Purdue University), and the 2003 Award for Distinguished College or University Teaching of Mathematics went to Johnny E. Brown (Purdue University). Full text of Brown's citation may be found at

<http://www.rose-hulman.edu/rader/INMAA/awards/teaching/Brown.html>

## Call for Nominations for the Indiana Section Award for Distinguished College or University Teaching of Mathematics

Nominations for the thirteenth annual Indiana Section Award for Distinguished College or University Teaching of Mathematics are now being welcomed. The Indiana Section Selection Committee will choose one of the nominees for the Section Award. The awardee will be honored at the 2004 Spring Section meeting and will be widely recognized and acknowledged within the Section. The awardee will also be the official Section candidate for the pool of Section awardees from which the national recipients of the Deborah and Franklin Tepper Haimo Awards will be selected (except that one of the national winners may be selected from another source). There will be at most three national awardees, each of whom will be honored at the national MAA meeting in January 2005 and receive a \$1000 check and a certificate.

Anyone is entitled to make a nomination, but nominations from mathematics department chairs are especially solicited. Although it is not mandatory, involvement of a nominee in preparing the nomination packet is permitted and encouraged. However, self-nomination is not permitted. A previous nominee for this award who did not become a Section awardee can be nominated again. Indeed, the Section has instructed the selection committee that “meritorious nominations for the Distinguished Teaching Award which do not result in an award will be continued as active nominations for next year’s Distinguished Teaching Award and, if again not successful, will be continued for a third year as well.”

### Eligibility

- College or university teachers assigned at least half-time during the academic year to teaching of a mathematical science in a public or private college or university (from two-year college teaching through teaching at the Ph.D. level) in the United States or Canada. Those on approved leave (sabbatical or other) during the academic year in which they are nominated qualify if they fulfilled the requirements in the previous year.
- At least five years teaching experience in a mathematical science.
- Membership in the Mathematical Association of America.

### Guidelines for Nomination

Nominees should

- be widely recognized as extraordinarily successful in their teaching<sup>1</sup>
- have teaching effectiveness that can be documented
- have had influence in their teaching beyond their own institution<sup>2</sup>
- foster curiosity and generate excitement about mathematics in their students

Nominations must be submitted on the official “Nomination Form,” a copy of which may be obtained from David Housman by using the address listed below or by e-mail [dhousman@goshen.edu](mailto:dhousman@goshen.edu). Please follow the instructions on the form precisely to assure uniformity in the selection process both at the Section and National

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<sup>1</sup>“teaching” should be interpreted in its broadest sense, not necessarily limited to classroom teaching (it may include activities such as preparing students for mathematical competitions at the college level, or attracting students to become majors in a mathematical science).

<sup>2</sup>“influence beyond their own institution” can take many forms, including demonstrated lasting impact on alumni, influence on the profession through curricular revisions in college mathematics teaching with national impact, influential innovative books on the teaching of college mathematics, etc.

levels. If a file on a Section awardee significantly exceeds the prescribed limits (as stated on page two of the Nomination Form), it will not be considered for a national award and will be returned to the Section.

Please send six copies of each nomination packet to :

David Housman, Department of Mathematics  
Goshen College, Goshen, IN 46526

so as to be received no later than January 15, 2004.

The Section Selection Committee will select the Section awardee prior to February 15, 2004, at which time it will communicate its selection to the national selection committee so that the national committee can then make its selections. We look forward to your participation in this exciting MAA venture of taking substantive action to honor extraordinarily successful teaching. We want to see such teaching recognized at all post-secondary schools. We depend on you to help us identify those who merit such recognition.

### **Call for Nominations for the Indiana Section Distinguished Service Award**

The Indiana Section Distinguished Service Award was established in 1992 to annually honor a member of the Section for his or her extraordinary contributions to the Section and outstanding efforts consistent with the stated purposes of the MAA and the Section, namely, assisting in promoting the interests of, and improving education in, the mathematical sciences in America, especially at the collegiate level.

The Service Award Committee is soliciting nominations for the 2004 award, which will be presented at the Section's Spring 2004 Meeting. If you wish to nominate an individual, please send a letter of nomination and support to

David Housman, Department of Mathematics  
Goshen College, Goshen, IN 46526

so as to be received no later than January 15, 2004.