

POINTS AND ANGLES

Newsletter of the Metropolitan
Mathematics Club of Chicago



Volume XXXVII

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Adventures in the Chaos Club

Robert Devaney, Boston University

BY SIMONETTE URBAIN

MMC is pleased to have Robert Devaney back with us to open the 2002-03 year. As we all recall, his talk last fall was postponed due to the horrific events of September 11, 2001. These events have changed the way we live our lives each day. Many of life's comforts, which were taken for granted, are now looked upon in a different light. In a sense, the world is in a chaotic state.

The field of mathematics is also going through some changes as it is studied and researched from a fractal and chaotic point of view. Robert L. Devaney, of Boston University, will present "Adventures in the Chaos Club: Online Activities Involving Chaos and Fractals." In his talk, Bob will demonstrate different internet-based tools that can be used to introduce topics from contemporary mathematics in both the middle school and high school curricula.

Anyone who has heard Robert Devaney speak can attest to how exciting and prevalent his presentations are. Bob has given over 1,000 invited lectures worldwide. He has taught at several universities and has held the position of Chairperson of the Mathematics Department at Boston University. Mr. Devaney has authored and edited numerous research papers and books, and has developed software packages designed to teach students of all educational levels. He still finds time to be the director of the National Science Foundation Institutes and Projects. Most importantly, Bob is a believer in stimulating interest and enthusiasm in his students. Bob has found that "Chaos Club" activities allow students to discover mathematical topics. Join us on September 13 and see how a classroom teacher can lead their students on an internet journey into chaos.

REMEMBER!! You can earn CPDU credits for attending dinner meetings!

Date: Friday, September 13, 2002

Time: 5:30 p.m. Doors Open

6:00 p.m. Social Hour

7:00 p.m. Dinner and Talk

Place: Fountain Blue Banquets &

Convention Center

2300 Mannheim Rd.

Des Plaines, IL

(847) 298-3636

Cost: Members \$29

Nonmembers \$35

RESERVATION DEADLINE

Friday, Sept. 6, by noon, please!

TO RESERVE:

Call 847-295-1068 or

email bowlerjp1234@msn.com

(Pat Bowler-Johnson)

Day or night, leave a message on machine.



From South I-294 & East I-290: Exit at I-190 East to O'Hare; Exit onto North Mannheim Rd.; Take Mannheim Rd. North 2.25 miles.

From North I-294: Exit at West Touhy Ave.; Take Touhy Ave. to Mannheim Rd.; Turn right on Mannheim Rd.

Public Transit: Take the CTA Blue Line to the Rosemont Bus Terminal; Take Pace Bus #223; Exit at Touhy Ave. & Lee Rd.

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Future Meetings: October 25,

November 22, December 13, January 17, February 7, March 14 (π day), May 9

Glimpses of Teachers' Mathematics

BY MARY LAPPAN

Last May 10, Zalman Usiskin introduced a very large MMC crowd to his most recent project, a new course for undergraduate mathematics majors and preservice teachers. In his biennial appearance, Zalman worked his usual magic, delighting us all with his enthusiasm, his ideas about mathematics and teaching, and of course, his jokes. Zalman, along with colleagues at Illinois, UC Berkeley, and Cal State Northridge, helped by a grant from Carnation Milk, have been working on a new applied mathematics course built around generalizations, problems, and concepts that are fundamental to teaching and learning. In the course of the evening, Zalman shared with us some wonderful examples from this new project.

Zalman started off with some examples straight from the high school trenches, asking about formulas in geometry. Following the comment that many new high school teachers know no more about geometry than their students, he ran through a series of formulas for the area of a triangle. He started with the basic “one

half base times height” and Hero’s formula that appear in every text. Does every mathematics teacher actually know the proof of Hero’s formula? Zalman thinks that we should, even though it doesn’t always appear in the text due to the usual reliance on trigonometry for the proof. He then asked about some less common formulas, like the ASA formula and the circumradius formula

$$\text{Area} = \frac{1}{2} a^2 \frac{\sin B \sin C}{\sin(B+C)}$$

$$\text{Area} = \frac{abc}{4R}$$

He commented that it is nice to know that there are lots of area formulas.

Then Zalman moved into a series of “unrelated” examples involving equations and inequalities. These

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Mark the Date
Saturday, February 1st
in your assignment notebook!

MMC Conference of Workshops
at Argo Community High School

*in Summit just 2 miles from Midway
**No substitute needed

POINTS AND ANGLES

Volume XXXVII, Number 1, September 2002

Points and Angles is the official publication of the Metropolitan Mathematics Club of Chicago. Founded in 1913, the Metropolitan Mathematics Club is the National Council of Teachers of Mathematics' first affiliate.

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Zalman Usiskin, University of Chicago

included the six statements listed below. He asked us to consider when the following are true:

$$a = b \Leftrightarrow a + c = b + c$$

$$a = b \Leftrightarrow ac = bc, c \neq 0$$

$$a^2 = b^2 \Leftrightarrow a = b \text{ and } \sqrt{a} = \sqrt{b} \Leftrightarrow a = b$$

$$a = b \Leftrightarrow a^3 = b^3$$

$$c^a = c^b \Leftrightarrow a = b$$

$$\sin a = \sin b \Leftrightarrow a = b, 0^\circ \leq a \leq 90^\circ, 0^\circ \leq b \leq 90^\circ$$

The high school teacher and student of advanced mathematics, he notes, should see all six of these properties as related to the following general properties of functions:

$$f(x) = g(x) \Leftrightarrow h(f(x)) = h(g(x))$$

iff h is one-to-one on the range of f and g

$$f(x) < g(x) \Leftrightarrow h(f(x)) < h(g(x))$$

iff h is strictly increasing

$$f(x) < g(x) \Leftrightarrow h(f(x)) > h(g(x))$$

iff h is strictly decreasing

Zalman then showed three types of definitions and looked at examples of each. The first category was equivalent definitions, such as those given by many textbooks for a rectangle. Is a rectangle a parallelogram with four right angles? A quadrilateral with four right angles? A parallelogram with one right

Mathematics teachers should “look at the landscape from above, instead of from underneath.”

angle? A parallelogram with two perpendicular sides? Why do we choose one definition over another when all are equivalent? The second category was of definitions that are not equivalent. Different sources give conflicting definitions of natural number, trapezoid, isosceles trapezoid, parallel lines, and many more. The last category was of definitions that change over time, as the student develops. This includes such examples as trig functions, congruence, similarity, exponents, angle, and much more.

Looking more closely at the concept of parallel, Zalman explored with the audience three common definitions. First came the standard “do not intersect” referring to lines in the plane. Commenting that kids

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Joyce Pulphus Wins 2002 MMC Scholarship

BY CONRAD WAYNE AND ISAAC GREENSPAN

Joyce Pulphus, now a graduate of Illinois Math and Science Academy, was named the winner of the \$1000 MMC Scholarship for 2002. She attended the May, 2002 meeting with her parents and teacher Sue Eddins.

Pulphus volunteered extensively while in high school, including as a tutor at IMSA and in Chicago. During her sophomore year, Pulphus developed content units for an IMSA summer program for younger students. She participated in

a mentoring program for grades K-8 at Cabrini Green and was one of the head teachers for the program during her senior year.

She was also a representative of the student body at IMSA’s annual budget meeting with the Illinois State Board of Education and spoke about leadership activities at IMSA. She will be attending the University of Pennsylvania this fall to prepare to be a mathematics teacher.



Prof. Zalman Usiskin (left), Mr. Pulphus, Joyce Pulphus, and Sue Eddins at the May, 2002 dinner meeting.

PHOTO BY PAT BOWLER-JOHNSON

Glimpses of Teachers' Mathematics

CONTINUED FROM PAGE 3

often come up with “railroad tracks” as an example, he answered the question “what would Euclid have used?” with the obvious “Chariot Tracks!” Second was the “equidistant apart” version, and third was “go in same direction.” Based on the definition chosen, proofs and related topics become easier or harder. The “go in same direction” concept leads to corresponding angles, where the “equidistant apart” and railroad track ideas lead to some interesting ideas of parallel function graphs. Consider the graphs of

$$y = x^2 \text{ and } y = x^2 + 1.$$

Are these parallel? What about

$$y = x^2 \text{ and } y = (x-1)^2$$

In all of these analyses, Zalman is interested in looking at mathematics from an advanced perspective. He wants teachers to “look at the landscape from above, instead of from underneath.” While a focus on proof and rigor is important, connections and multiple perspectives are also critical. Many of the concepts and problems in the new course come from questions that are asked in class. He added the common example of $0.9999\dots = ?$ Zalman gave five different explanations, from

$$\frac{1}{3} = 0.333\dots$$

and multiply by 3 to looking at $0.9999\dots$ as an infinite geometric series. Along the way is the trichotomy

question (is $0.9999\dots$ less than, equal to, or greater than 1?), the algebra solution (if $x = 0.9999\dots$ then $10x = 9.9999\dots$, subtract to get your answer), and the idea of a limit.

Finally, Zalman gave an example of a problem analysis coming from the very simple and common phrase “Jane has an average of 87 on the first four tests.” He stopped there and let the audience fill in the question “what does she need on the 5th test to have an average of 90?” Thinking about a solution, most teachers use arithmetic, not algebra. For this question, is algebra really useful? But Zalman didn’t let us stop there. What about the linear function that comes from the algebraic solution? If

$$\text{Avg} = \frac{(87)(4) + x}{5} = \frac{1}{5}x + \frac{87 \cdot 4}{5},$$

what does the slope mean? This gives another perspective on the average, that it goes up one-fifth of a point for each point on the last test. Can Jane get the 102 she needs on that last test? Will her teacher round up? These are questions for the ages.

But Zalman wanted more. “If I’ve told you n times, I’ve told you $n + 1$ times...” Shaq has 1666 points after 59 games, and Michael has 2313 points after 81 games. (Michael has the higher average, about 28.56 to Shaq’s 28.24.) Both have one game left to play. Since Michael’s game is in Chicago, and Shaq’s is in Los Angeles, Shaq will know Michael’s total before the game in Los Angeles is over. The burning question is “how many points does Shaq need in that last game to

SEE GLIMPSES OF TEACHERS’ MATHEMATICS, PAGE 7

THE 2003 CHICAGO AREA ALL-STAR MATH TEAM TRYOUTS

Thursday, February 27, 2003, 4:00–10:00 pm
(with a break for dinner) at Evanston Township High School

Tryouts are open to all interested high school students from the Chicago metropolitan area. The Chicago Area All-Star Math Teams compete in the ARML contest at the Iowa City site. For more information, contact Coach Isaac Greenspan via email: greenspani@eths.k12.il.us

Announcing the Return of the MMC Conference of Workshops ... and Speakers Wanted!

Chance that you have one good activity a year: 1 out of 180

Chance that fellow math teachers would love to hear about it: 100%

**Play the odds and speak at the MMC Conference of Workshops this year
at Argo Community High School on Saturday, February 1st**
(You won't even need a sub!)

- Workshop Format: 75-minute session where participants are actively involved
- Looking for speakers from all grades K – 16
- New speakers welcome
- Co-presentations encouraged
- Have questions? Contact Virginia at vhighstone@elmhurst205.org or Mary at wiltjerm@eths.k12.il.us
- Fill out the speaker form on the back of this page and return by September 20th

Do you use e-mail?

Would you like an e-mail reminder about each MMC meeting, as well as other MMC events?

If so, send an email to wiltjerm@eths.k12.il.us and ask to be added to *the list*.

Web Site!

Have you visited the MMC web-site lately?

If so, you probably have noticed that it has not been updated since earlier this year. Within the next few weeks, however, the MMC web-site will take on a new look.

Keep visiting [HTTP://WWW.MMCCHICAGO.ORG/](http://www.mmcchicago.org/) and watch for new features, including Points and Angles available online in Adobe[®] Acrobat[®] format.

2003-2004 Program

At the August 2002 MMC Board meeting the establishment of a Program Committee was presented and approved. The task of the committee is to develop the next years MMC Program of speakers. After the development of the program, the committee members will play an integral part of the MMC Program that they have developed. This committee will be comprised of both board and non-board members of MMC. If you have any program suggestions or would like to serve on this committee, please contact Sam Urbain at SAMU303@aol.com.

Comments? Suggestions? Articles? Letters?

E-mail your ideas to Points and Angles editor Isaac Greenspan at greenspani@eths.k12.il.us!

Speaker's Information Form for the MMC Conference of Workshops 2003

Implementing the Principles & Standards for School Mathematics
February 1, 2003 at Argo Community High School

Name _____ School _____
 Address _____

 Phone _____
 e-mail _____

Preferred address: Home School

WORKSHOP INFORMATION

Title: _____

Brief description for program book (25 word maximum): _____

Approximate Grade Band(s): (Please check all appropriate levels.)

PreK – 2nd 3rd – 5th 6th – 8th 9th – 12th Jr.Col.

Number of participants: optimal _____ maximum _____

(Rooms will hold 28 comfortably, but we can accommodate the number you wish.)

EQUIPMENT NEEDS: Every room will have one overhead projector, screen, and chalkboard. Indicate any additional needs. Please be specific, especially regarding technology and computer hardware and software needs.

Technology level of participants (check one or both):

Experienced Inexperienced

For what type of technology?

Would you be willing to repeat your session?

Yes No

Do you plan to stay for lunch (on MMC of course)?

Yes No

Please return to : MMC
 801 Elmwood Avenue, #2
 Evanston, IL 60202

mmc-chicago@worldnet.att.net

RETURN BY SEPTEMBER 20!!

Please feel free to duplicate & pass on to potential speakers!

Glimpses of Teachers' Mathematics

CONTINUED FROM PAGE 4

have the higher average?" We can look at the situation by comparing the two functions that give the averages,

$$f(j) = \frac{2313 + j}{82}$$

for Michael and

$$g(s) = \frac{1666 + s}{60}$$

for Shaq. Setting these functions equal and solving for s gives the boundary function

$$s = \frac{30j + 1084}{41}$$

which gives Shaq's required points to tie Michael's average. Graph this boundary function (with a slope

less than 1) against the line $s = j$. Look to the right of the intersection point and you find an area where Shaq actually can score less points in the last game but still have the higher average. So Michael leads going into the last game, scores more points in the last game, but still loses? You bet. This example of Simpson's paradox (both parts favor one but the whole favors the other) amazed everyone.

In conclusion, Zalman reminded us that "mathematicians don't appreciate how much mathematics high school teachers know." He and his colleagues are trying to push the college mathematics community to think more broadly about teaching and connections, while offering a rigorous mathematics course for students and teachers. Thank you, Zalman, for giving us a glimpse of some exciting mathematics and some great teaching stories.

For those of you who missed Zalman's talk this time, tune in again in May, 2004 for the next installment.

MMC Membership and Change of Address Form

Mail to: MMC
801 Elmwood Ave. #2
Evanston, IL 60202

Make check payable to MMC.

Please use a different form for each person.

Name _____

Address _____

Phone _____

School _____

Address _____

Phone _____

E-Mail _____

Membership: New Renewal

Choose one:

1 year (\$20) _____

2 year (\$35) _____

3 year (\$50) _____

1st year teacher } (\$10) _____

retired } _____

student } _____

Donations:

Scholarship Fund _____

Speaker Fund _____

Total amount of check: _____

Check preferred mailing address above.

Change of Address

If you have any questions, e-mail
wiltjerm@eths.k12.il.us

Points from the Interior

BY PAT BOWLER-JOHNSON

As we approach the one year anniversary of the day that changed our lives in America, we reflect upon the images that so many of us still hold, question possible reasons why the events of the day occurred, and ponder the impact that the actions of the day and the days that followed September 11 will always have upon our lives as Americans.

Last year was also one that saw many changes for MMC: new locations, the onset of e-mail messages, and the first time since its beginning that an MMC meeting was cancelled. Yet the events of the year only seem to have brought each of us closer by sharing a common bond—an interest in mathematics education. We were also saddened by the deaths of several MMC members. Yet MMC continues to build bonds. As we say thanks to Leona Mirza and Ron Vavrinek for their countless hours of service to the MMC board, we welcome newly elected board members Jennifer

Jayson, Bill Roloff, and President-Elect Sam Urbain. Isaac Greenspan will also join the board, working with Steve Tribbey as co-editors of the MMC newsletter Points and Angles.

Already you can see some of the changes that MMC has taken on, including a new layout for Points and Angles, soon to be followed by a more comprehensive and updated website. On February 1, 2003, Argo High School will be the site of the MMC Conference of Workshops—Virginia Highstone and Mary Wiltjer, along with the assistance of Jennifer Jayson, are working to build a diverse conference where educators from all levels from elementary to college will find sessions to enhance their professional development. I look forward to this year's program that Sam has developed: monthly meetings composed of a balance of technology, art, humor, and, of course, mathematics!

METROPOLITAN MATHEMATICS CLUB OF CHICAGO
c/o MMC
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MAILING LABEL

Your membership renewal date appears in the upper right corner of the label.