POINTS AND ANGLES

Newsletter of the Metropolitan Mathematics Club of Chicago

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Unfolding the Mathematical Mysteries Within a Sheet of Paper

Professor Edward B. Burger

BY JOHN DIEHL

Please join us for our May meeting on May 13th. Our speaker will be Professor Edward B. Burger from Williams College. Well known for his recent book, The Heart of Mathematics: An Invitation to Effective Thinking (a winner of a 2001 Robert W. Hamilton Book Award), Professor Burger will share his ideas on "Unfolding the Mathematical Mysteries Within a Sheet of Paper". He plans to take us on a journey to discover how beautiful and intricate structure arises from very simple processes. More importantly, our journey will be a metaphor for the far-reaching power of having our students uncover mathematics for themselves.

Edward Burger is Chair and Professor of Mathematics at Williams College. His research interests are in number theory and he is the author of over 30 research articles and three books. The other two books are Exploring the Number Jungle: A Journey into Diophantine Analysis, and Making Transcendence Transparent: An Intuitive Approach to Classical Transcendental Number Theory. Burger was awarded the 2000 Northeastern Section of the MAA Award for Distinguished Teaching and 2001 MAA Deborah and Franklin Tepper Haimo National Award for Distinguished College or University Teaching of Mathematics. In 2002-2003 he was the Ulam Visiting Professor at the University of Colorado at Boulder, where he was awarded the 2003 Residence Life Teaching Award. Burger is an associate editor of the American Mathematical Monthly. The MAA named him the 2001-2003 Polya Lecturer. In 2004 he was awarded Mathematical Association of America's Chauvenet Prize.

It is sure to be an excellent finale for this year's fine program. Hope to see all of you there.

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

Date: Friday, May 13, 2005
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 $31
Nonmembers $37

RESERVATION DEADLINE
Monday, May 9th, by noon, please!
TO RESERVE:
Call Lee Ann Swanson at
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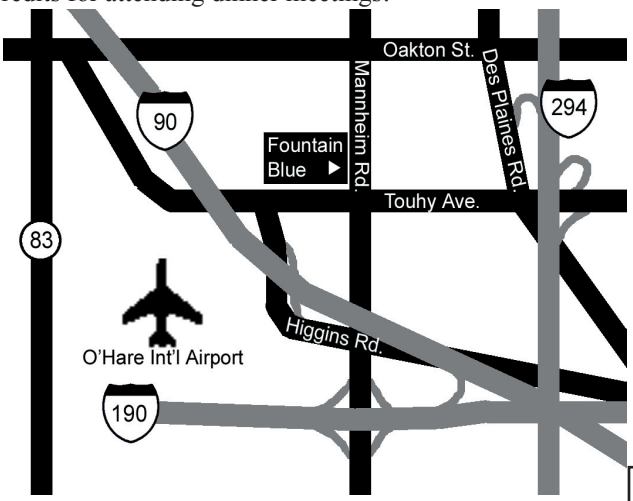
email: lswanson@hinsdale86.org
Requests for special meals must be made in advance.



From Southbound I-294 & Eastbound I-290:
Exit at I-190 West to O'Hare; Exit onto North Mannheim Rd.; Take Mannheim Rd. North 2.25 miles.
From Northbound 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.; Walk East on Touhy to Mannheim Rd.

INSIDE...

Points from the Interior

Helping Students Become Better Students

BY GWEN ZIMMERMANN

Given the permeation of NCLB in all our lives, I was thinking of writing on that topic. But, frankly, the topic wears me out. Instead I found an article I had saved from Educational Researcher dated November 2003 on "What Is an 'Expert Student?'" (see below for citation) and found more enthusiasm for this topic.

The author, Robert J. Sternberg, suggests that teaching, as most people know it, does little to help students develop the expertise required to become effective life-long learners. Sternberg further argues we must go beyond helping students to think "well" rather we should help students think "wisely." We know from personal experience that not all learners are the same, and by using a one-size-fits-all approach to teaching, we are doing a disservice to many of our students.

There is a body of mathematical knowledge we want our students learn (although what this "body of mathematical knowledge" is varies from teacher to teacher, from school to school). However, Sternberg points out that this knowledge is meaningless if students are not able to use it to solve real life problems. If we want our students to apply this knowledge, they must be given opportunities to do so. This translates into providing tasks, problems, or simulations that requires students to define problems and then use the mathematics to solve the problems.

There are many students who are "content experts." Given problems out of context or with few parameters, they can go through the steps and come up with a solution. At the same time, these students are often unprepared to apply this content knowledge to an unstructured and open-ended problem as may be encountered outside of school. To successfully solve these types of open-ended problems, the learner must be able to think in different ways. Sternberg recognizes the need for memorization, but beyond that, he suggests that we must also help students to think "analytically, creatively, and practically." Generally, teachers of mathematics do pretty well helping students think analytically. We frequently ask students to compare and contrast, evaluate, and assess. We can, however, encourage our students to think creatively by having them create, ask "what if," and make their own discoveries. It is the practical thinking that is often pushed aside for the sake of "getting through the curriculum." If we are to help students develop practical thinking, we need to provide students with opportunities to apply the mathematics we teach to problems that they might encounter in their life at some point.

In his article, Sternberg discusses how focusing on the development of one type of thinking shortchanges our students. First, students have their own learning preference styles. If we only focus on one type of thinking, such as analytical thinking, students who are stronger creative thinkers are at a disadvantage. They do not have the opportunity to learn the material as well as their peers who already think analytically, and furthermore, they are unable to demonstrate what they do know if they are constrained to demonstrating their knowledge through an "analytical" lens. Secondly, we are not helping students to develop all types of thinking. If we helped students to develop all three types of thinking, it would enable students to utilize their strengths and at the same time "compensate for their weaknesses."

We chose to teach mathematics because we are passionate about the content and believe in its importance in the world. However, to help our students think "wisely," we need to provide opportunities for them to develop all types of thinking, not just the analytical. If we can help our students to view mathematics through an analytical, creative, and practical lens, not only will our students be able to learn the mathematics and apply it outside the classroom, but they are likely to gain an appreciation for the beauty and relevance of a subject we as teachers care so deeply about.

Continued from Page 2 . . .

Allow me to take a moment to acknowledge the hard work of so many friends and colleagues who have made this an amazing year for me as President of such a respected organization. There are few places where one can go and be surrounded by so much passion for teaching a subject of which many seem fearful. The members make MMC a unique and enriching organization. Thank you also to the elected and appointed Board members who work together to make things run so smoothly and ensure the work gets done. A special thanks to Sam and John for all their support and work to make me look good. Thank you MMC for the opportunity to serve as President this past year.

(Sternberg, R.J. (2003). What is an "Expert Student?." Educational Researcher, 32(8), 5-9.)

Yes, Virginia, There ARE Women Mathematicians

Dr. Herb Kasube, 11 March 2005

BY JENNY WEXLER

MMC member Michelle Kolet introduced Dr. Kasube, a professor at Bradley University in Peoria. She told us of his encouragement of his students and his enthusiasm for mathematics and the history of mathematics from the perspective of a former student. Dr. Kasube's interest in the role of women in mathematics was perhaps triggered by his daughter's interest in math as a junior high student and her role as the first girl on her school's math team. Women have faced obstacles in pursuing the study of mathematics, from the Renaissance, when men were concerned that the study of math and science would take too much blood to the brain, draining it away from reproductive organs, to the present, when attitudes like those of Harvard president Lawrence Summers are not uncommon. But as Carolyn Summers, a math professor at Dartmouth and president of the Association for Women in Mathematics, points out, "About a third of all United States citizens who have received Ph.D.'s in mathematics recently are women. About half of all undergraduate mathematics degrees in the United States go to women." In general, we all know the names of influential people in art, entertainment, athletics, etcetera, both male and female, but we don't know the names of mathematicians. Dr. Kasube presented brief biographies of seven great female mathematicians to help us begin to see the involvement of women in mathematics, from Hypatia (who lived in the late 4th century) to Julia Robinson (1919-1985).

The story of Hypatia is a powerful illustration of the difficulties women in mathematics faced. Among other endeavors, she worked on a version of Euclid's elements. Her scholarship and depth of mathematical knowledge, however, was viewed as a threat to Christianity, and she was therefore labeled a Pagan and held up as an example to the public of the evils of learning for women. In the end, the story goes, Hypatia was stoned to death by an angry mob.

Dr. Kasube fast-forwarded several centuries and next talked about the French mathematician Sophie Germain (1776-1831). Concerned that as a woman she would not be allowed to learn mathematics, she studied in secret and corresponded with Gauss using a male pseudonym (Antoine LeBlanc). Her work on Fermat's Last Theorem contributed heavily to one of the strongest results prior to Andrew Wiles findings in the early 1990's.

Sofia Kovalevskaya (1850-1891) also had to find a way to circumvent the prevailing attitudes about women in mathematics. In her home country of Russia, a woman could not study mathematics, so she married a German man so she could move with him to Germany, where she would be allowed to study openly. Emmy Noether (1882-1935) received special permission to study mathematics at Erlangen, and after receiving her doctorate was unable to get a university position because of her gender. With the support of Hilbert, she found work at Göttingen. As it became increasingly difficult to be a German Jew, Noether came to the U.S. and taught at Bryn Mawr for the last two years of her life.

In addition to these four women, Dr. Kasube shared stories about Florence Nightingale (1820-1910), Grace Hopper (1906-1992), and Julia Robinson (1919-1985). Each woman had an important place in the history of mathematics. In several cases, Dr. Kasube shared interesting quotes with us. Everyone in the audience was amused by the quote about Florence Nightingale, best known for her role in the field of nursing, but an accomplished statistician as well: *"Florence Nightingale believed -- and in all the actions of her life acted upon that belief -- that the administrator could only be successful if he were guided by statistical knowledge. The legislator -- to say nothing of the politician -- too often failed for want of this knowledge" (Karl Pearson).* After detailing the many "firsts" of Julia Robinson, i.e., first woman to be elected to the National Academy of Sciences, first woman officer of the American Mathematical Society (AMS), and first woman president of the AMS, Dr. Kasube shared this quote: *"What I really am is a mathematician. Rather than being remembered as the first woman this or that, I would prefer to be remembered, as a mathematician should, simply for the theorems I have proved and the problems I have solved" (Julia Robinson).*

Though each of the mathematicians he discussed had her own individual strengths and quirks, Dr. Kasube reminded us of the common thread: each one had someone in her life who encouraged and supported her. He pushed us to be conscious of the importance of this role as a part of what we do as educators. (There are a number of good resources available on the history of mathematics and women in mathematics. Dr. Kasube shared his reference list with us, which included the internet resource http://www-groups.dcs.st-and.ac.uk/~history/Indexes/Women.html There is a wealth of free information out there, as well as books and CD's available from the MAA and other publishers.)

How Multiple Exciting Technologies have Impacted Student Learning

Tom Reardon, 11 February 2005

BY RAY KLEIN

On the evening of Friday, February 11, the MMC was entertained by Tom Reardon, a mathematics teacher at Fitch High School in Austintown, Ohio. In his talk, "Technologies That Make My Classroom More Interesting", Tom demonstrated many of the technologies that he uses in his high school classes as well as at Youngstown State University, where he is an adjunct professor. The variety of tools that he uses and his knowledge of appropriate ways to use this technology in the teaching of mathematics was an inspiration to all.

The first technology that was featured, and the one on which the most time was spent, was The Smart Board. This piece of technology is a virtual chalkboard and computer all rolled into one piece of equipment. Tom showed how he effectively uses color in his board work, how he brings in accurate coordinate grids on which to graph, and how he can import accurate geometric shapes for his demonstrations. To his apparent surprise, the feature that most captivated the audience was the ability of the user to manipulate these figures: dilating them, translating them, and yes, even rotating them. The latter demonstration brought the first of the audience "OOOHS" of the evening. Tom then demonstrated how he saves the daily class notes from the Smart Board and posts these notes on his web page. He downloaded examples of notes from his Calculus, Pre-Calculus, and Algebra classes showing his use of emphasizing colors, screen shots of calculator results, and the ability to edit these notes and save these editions. He related an anecdote about a student who had been absent from his class, but was able to go to his web site, find the notes, work through them, and "catch up" on the material in spite of missing his class. The thought of that feature alone had many of the audience drooling in anticipation of getting one of these Smart Boards for their own classroom.

The next idea to be explored was the use of the Smart Board in conjunction with Power Point and Cabri Geometry II Plus. Tom suggested that Smart Videos could be written in which certain mathematical procedures were demonstrated via a Power Point presentation, saved, and then played back whenever a tutorial on that subject was needed. As an attention grabber, this is a very effective method of review. Next, a digital picture was downloaded from the web onto the Smart Board. Geometric points were positioned on a portion of this picture using Cabri. The coordinates of the points were found, and then a calculator was used to find a regression equation that approximated the curve on the picture. This was an impressive display of multiple technologies used in the solution of a single problem.

Next up was a short demonstration of how Tom uses CAS calculators to teach. In particular, he showed the SMG (Symbolic Math Guide) application in use. This was followed by a demonstration of how he uses spreadsheets to create individual problems as alternative assessments. Using a favorite problem dubbed "The Great Applied Problem", Tom showed screen shots of spreadsheets that had solutions of this multi-step problem for various parameters. Tom was able to give each student a different customized problem as an assignment and not have to worry about solving each individual problem when grading these. Other examples that used this technique were given.

The next item explored was the new TI-Emulator for the TI 84+ calculator. Although this product has been officially announced, it is not yet available for purchase. Tom showed how this new technology can be effectively wed with the Smart Board. Among the most interesting features was the ability to simultaneously view the equation editor, the table, and the graph of the equation, thus showing on one screen an analytic, a numeric, and a graphical representation of the problem. He showed how a script could be written and saved that shows students the exact keystrokes on the calculator that accomplish the final result. He also showed how electronic study cards could be created.

The final piece of technology that Tom mentioned was the TI-Navigator. This technology facilitates the quick dissemination of files to a classroom of calculators, allows the teacher to do screen captures of the students' calculators, and conduct quick polling of the students anonymously. Item analysis of test results and a real-time activity center were also features that were discussed.

With the viewing of all this technology, many in the audience left with their heads spinning. We were very fortunate to have a speaker who combined an obvious expertise in the use of this technology with a practical plan on how to use this technology to better teach students mathematics. The enthusiasm that Tom Reardon exhibited, his sense of humor, and his easy rapport with the audience made his presentation a most memorable one. It made us all realize how lucky the students at Fitch High School are to have him as a teacher and how lucky we of the MMC were to be treated to a most delightful evening of technology and mathematics.

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MMC Problems for May 2005

from Michael Keyton

Some of my favorite theorems in geometry are Steiner's Power of a Point Theorems. For any line though a point not on a given circle, the product of the lengths of the two segments from the point to the circle is a constant. (In the event the line is a tangent to the circle then the two intersection points are the same.) These theorems occur in Euclid, but Steiner developed an entire branch of mathematics based upon them. Most textbooks present these theorems incorrectly in my opinion. They tend to state that the product of the two segments of one line is equal to the product of another line. This is the method to prove the theorem. However, this is the way that the theorems are given in Euclid, so why complain? Here are four consequences of the theorems, the first two were obtained from a superb source of problems in geometry (F. G.-M., Exercices de Géométrie 6th ed., 1920.); the other two are generalizations I have not seen anywhere. The problem is also to find the constant, explain it in terms of the geometry.

(1) Given points A and B on a diameter PQ of circle O, symmetric with the O, then for any two points C and D on the same semi-circle of PQ so that AC and BD are parallel, then AC•BD is a constant.

(2) Given a chord BC in circle O and diameter XY perpendicular to BC, For every point M on BC chord XZ containing M, then XM•XZ is a constant.

(3) Given a circle O and a tangent T. If X in on the line OT then for any line through X intersecting the circle at points A and B, construct tangents at A and B intersecting the tangent through T at C and D respectively, then AC•BD is a constant.

(4) Given a circle O and a tangent T. If X in on the line OT then for any line through X intersecting the circle at points A and B, construct perpendiculars to AB at A and B intersecting the tangent through T at C and D respectively, then AC•BD is a constant.

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☐ 1st year teacher ☐
☐ retired ☐ ($10) _____
☐ student ☐

Donations:

Scholarship Fund _____

Speaker Fund _____

Total amount of check: _____

NOTICES & REMINDERS

3rd Annual USACAS Conference
at
The Westminster Schools
Atlanta, GA
June 25 and 26, 2005

For more information contact:
http://www.westminster.net/USACAS
or Natalie Jakucyn at njakucyn@glenbrook.k12.il.us

HTTP://WWW.MMCCHICAGO.ORG/

Old issues of POINTS AND ANGLES, summaries of talks given at MMC meetings, the MMC Scholarship application, job openings and people looking for jobs, and more!

CONGRATULATIONS!

To Our Newly Elected Members of the Board of Directors

President-Elect: Rich Rukin

Board Members: Ilene Hamilton, Steve Viktora and Phil Gartner

Don't Miss The Last Meeing of the School Year!

May 13th

Professor Edward B. Burger

Unfolding the Mathematical Mysteries Within a Sheet of Paper

If you would like a notice or reminder to appear in POINTS AND ANGLES, please email the text you would like to appear to kristenclegg@comcast.net no later than the date of the MMC meeting preceding the issue in which you would like it to appear. All notices are subject to editing.

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

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