

# POINTS AND ANGLES

Newsletter of the Metropolitan  
Mathematics Club of Chicago

NCTM  
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Metropolitan  
Mathematics  
Club of  
Chicago



Volume XXXIX

January 2005

No. 5

## Challenging the Mathematically Gifted

The theme for this year's MMC program is equity- a concept often used in designing programs for students who have hurdles to overcome. But we seldom think about the particular needs of our most able students. Who are these gifted kids? They are quirky- deep thinkers who often have a broad range of interests. They may hide their talents under a variety of adolescent smoke screens and often go unnoticed. Susan Brown and Virginia Highstone, January's speakers, have spent the last ten years working with these students and designing activities to pique their curiosity and capture their imagination. The sequence of courses they teach calls on gifted students to push their limits and focus on the deeper meaning of mathematics. Are any of these asynchronous teens lurking in your classroom? How can you engage them, keep them interested in mathematics, and push them to higher thinking levels? And, most importantly, can what we learn in working with them enhance and enrich teaching for all students?

Virginia Highstone has been a mathematics teacher at York High School in Elmhurst for the past fourteen years, where she has developed the gifted curriculum for Geometry and Precalculus. She has a special interest in teaching gifted students and has earned Illinois gifted verification. Virginia has National Board Certification and was a 2002 finalist for Illinois Teacher of the Year. She has spoken at state, regional, and national conferences, often on projects which move students to higher thinking levels and promote connections between mathematics and other topics. Susan Brown is Mathematics Department Chair at York, a position which involves working with school-wide initiatives and the K-12 curriculum. In York's gifted sequence she teaches Advanced Algebra/Trigonometry and is interested in the complexities involved in learning trigonometry. Sue is a past president of MMC and has served on the Editorial Panel of The Mathematics Teacher and the ICTM Board. She gives talks on activities that get students thinking about relationships in algebra, geometry and trigonometry, often through the use of technology. Both Sue and Virginia served on author teams for UCSMP textbooks, Sue on Algebra and Precalculus and Discrete Mathematics, and Virginia for Geometry and Functions, Statistics, and Trigonometry.

If you want absorbed, creative, and thoughtful students – gifted, bright, or average – this talk will give you ideas to bring back to your classroom – and will help you begin the year with a new perspective on teaching mathematics.

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

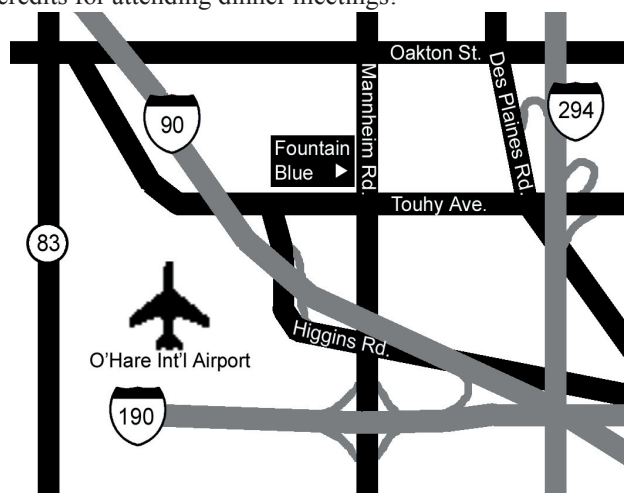
Date: Friday, January 14, 2005  
Time: 5:30 p.m. Doors Open  
6:00 p.m. Social Hour  
7:00 p.m. Dinner and Talk  
Place: Fountain Blue Banquets &  
Convention Center  
2300 Mannheim Rd.  
Des Plaines, IL  
(847) 298-3636  
Cost: Members \$31  
Nonmembers \$37

**RESERVATION DEADLINE**  
Monday, January 10, by noon,  
please!

To RESERVE:

Call Lee Ann Swanson at  
(630) 570-8421 or  
email: [lswanson@hinsdale86.org](mailto: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.

Future Meetings:  
February 11, March 11, May 13

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# Points from the Interior

BY GWEN ZIMMERMANN

Have you made any resolutions for the new year? Or are you like me and don't bother as they are usually quickly broken or forgotten. Regardless of how you feel about new year's resolutions, the time still seems appropriate to reflect on where we are professionally. Remember when the school year began and we set professional goals for ourselves? Maybe we decided we were going to focus on assessment or homework or student engagement or \_\_\_\_\_ (fill in the blank) this year. Have you made progress towards those goals or did the day-to-day inundate you to the point it has become all but impossible to remember what those goals were? As we begin to gear up for second semester, maybe now is a good time to remind ourselves of what called us to teach.

Goal setting is ongoing and very personal. We continuously set goals for ourselves so we can become better educators constantly striving to improve what we do to help our students learn. However, are there not some core beliefs that all mathematics teachers hold? Although not always recognized as such, we are professionals. Like doctors, lawyers, and engineers, we hold college

degrees (many of us have advanced degrees), we meet professionally, and we seek out opportunities for continued professional growth. We are dedicated to what we do – teach students mathematics! Other professions, in particular doctors, have a common oath – a common set of guiding principles and values. In his President's Message in the NCTM News Bulletin (April, 2004), Johnny Lott suggested that we consider an "Oath for Mathematics Teachers." This oath recognizes the complexity, dedication, and responsibilities that come with being a mathematics teacher. It acknowledges that students come first, and as teachers we are there to offer support and respect to our students. Furthermore, the "special value of mathematics" is recognized yet at the same time, we appreciate that teaching mathematics is the means, not necessarily the end by which to help our students learn and grow. Mathematics teachers who accept this oath agree to engage and encourage all students regardless of social class or differing abilities. Lastly, the oath professes that we are committed to professional growth. That is, we "recognize the limits of [our] knowledge of mathematics and seek advice from colleagues." We promise to stay informed of current research and best practices, and we will share this knowledge with others.

As members of this organization, we have demonstrated our commitment to our students, our commitment to growth, and our commitment to sharing what we have learned with others. We see this happen once a month (a Friday night no less!) throughout the school year. So maybe we don't need an "Oath for Mathematics Teachers." But then again, maybe an oath can act as a reminder of our responsibilities and passions when we begin to question our purpose in the classroom and as we look toward the remainder of the year.

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The official club website: <http://www.mmcchicago.org/>

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## Mathemusic: An Analytical Approach to Musical Composition

Natalie Jakucyn and Marty Sirvatka, with members of the Glenbrook Orchestra,

MMC Speakers on Friday, December 10, 2004

BY CAROL NENNE

In her introduction, Sandy Dawson promised that tonight we would find “the mathematics in music and the music in mathematics.” That was certainly the case, as Natalie Jakucyn and Marty Sirvatka (even without his voice) and four students from the Glenbrook Orchestra gave us a “mathemusal” tour of some of those connections between mathematics and music. Even the introductions were “mathemusal,” as the students were introduced not only by their musical background, but also by the mathematics they were studying. (two in Pre-Calculus, two in Calculus)

It was soon shown that the audience represented a similar connection – when asked how many consider themselves musically inclined in some way (instrumental, vocal, or dance), almost everyone raised their hand. In addition, approximately  $2/3$  of the audience was able to read music.

Natalie gave us the background on her interest in “mathemusic” – she was looking for an application to teach transformations of functions and trying to make math accessible to more than the typical math-science oriented students. In creating this unit, she joined her two favorite things – math and music – and the result “tickled her soul.”

What the presentation was NOT:

- the typical physics or acoustics of sound
- the probability dice game of Mozart (chance music)
- the “Mozart Effect,” the theory that listening to certain pieces makes children more spatially inclined and numerically aware
- the rationale behind the 12-tone scale
- the assignment of notes to each digit in the value of pi (but if you’re interested in this, it is on the pi website!)

What the presentation WAS:

- a more quantitative approach to analyzing musical composition
- a connection to mathematical transformations (translation, reflection, scale change, and rotation)

Natalie mentioned that transformations and symmetry are often considered a predominant aspect of musical composition. The questions then become: Is the composer aware of the transformations and symmetry? Are creative and analytical processes separate? While some composers may just FEEL it, many also CALCULATE it, which was demonstrated many times during the presentation, with some examples of what master composers have done in creating their works. Natalie has come to believe that that there is probably a mixture of both creative and analytical processes in composing. (As she said, the idea that they are completely separate is BUNK!)

We then began to see and hear some of the transformations behind musical composition. Marty began by writing a series of seven notes. Each of these was then assigned a numeric value, based on the scale from the key of C, with middle C being assigned the number 1. He then played this short tune for us. The notes were then raised, as the numeric value of each note was increased by two. As Marty then played the new version, Natalie transposed the music for us, showing the connection of transposition to the mathematical idea of translation of functions, here  $f'(x) = f(x) + 2$ .

Natalie and Marty then moved on to the musical concept of

augmentation, mathematically represented by  $f'(x) = 2f(x)$  and inversion, a mathematical reflection of  $f'(x) = -f(x)$ . These three ideas were then combined with the original music as the parent function. As Marty played the short piece with all three transformations together, the audience could hear the different transformations which blended to make a both mathematically and musically pleasing composition.

Despite overhead projector problems (how many math teachers does it take to change a lightbulb?!), the concepts of the different types of musical transformations and their mathematical counterparts became clear. The audience was even able to prove their proficiency with a short quiz, recognizing the types of transformations by listening to an original piece (the parent function) and then a transformation of that piece. In keeping with the musical theme, tables with 100% proficiency received a recorder and the music to “Row, Row, Row Your Boat,” as well as information about pitch and sequence transformations in the song. (As a bonus, once the recorders were distributed we had a first-hand lesson in mathemusal “chaos theory!”)

The focus then turned to looking at the works of some of the masters and how the use of transformations is so prevalent in many of their compositions. Natalie presented several reasons why this may have occurred. Many were prolific composers and found that transformations were inherent to musical structure. Others, such as Mozart, had a love of mathematics. For others there was a connection to numerology and religious influences. And still for others, it may have been the novelty of musical notation, which was so new that they just played with it. Natalie informed us of the history of musical notation, which for 2200 years had been based on fractions as developed by Pythagoras. In 500 BC, Boethius assigned letters to the musical notes, and it was not until the 9th century that music in Europe was first written down. The first notation was used for Gregorian chants, and the current notation was finalized in the 18th century.

We then looked at and heard several works and the transformations included in them. In Bach’s “The Art of the Fugue Contrapuntus #7), the original motif was pointed out. It was then shown how those notes were used as an inversion, and then also slowed down as an inversion with interval augmentation. In Bach’s “Trias Harmonica” only 8 notes were written. Transformations were then used to generate an eight-part canon for two choirs, using translations (both transposing notes down two steps and five beats later), inversions, and retrograde (a vertical reflection).

In Haydn’s “Sonata No. 4” for violin and piano, there is a symmetry line half-way through the piece. This allows it to be played either forward or backward with equal results. Mozart’s “Duet for Violins” represents rotational symmetry, as demonstrated by two violinists from the Glenbrook Orchestra, who played from the same piece of music while facing opposite directions. The result was a beautifully integrated piece of music. (Natalie thanked Paul Christmas for bringing this particular piece of music to her attention.)

Beethoven was also represented, as his piece “Piano Sonata Op. 90” was analyzed. This showed temporal augmentation, where

Continued from page 3...

a five note measure in sixteenth notes is expanded to eighth notes, then to quarter notes, and finally to half notes, where the five notes are reduced to three, before returning to eighth notes. At the same time, a translation of one octave occurs. The fractal representation of self-similar binary structures in his composition "Eccossaisen" was also pointed out. Finally, the matrix used by von Webern in "First Cantata, Opus 29" was shown, allowing the audience to see the symmetry present in this composition, based on 12 original notes.

To conclude a wonderful evening, the Glenbrook Orchestra performed an original piece, composed by Glenbrook students for MMC, entitled "Transformation." Thank you to Natalie Jakucyn and Marty Sirvatka, and Sophia, Katie, Gerry and Elliott from the Glenbrook Orchestra for this extremely enjoyable and interesting "mathemusical" presentation.

References:

*Functional Melodies: Finding Mathematical Relationships in Music* by Scott Beall, Key Curriculum Press

*Symmetry as a Compositional Determinant in Music* by Larry J. Solomon (<http://wc.pima.edu>)

*Some Numerological Features of Beethoven's Output* by Ivor Grattan-Guinness, *Annals of Science*, Mar. 94

### MMC Problems for January from Michael Keyton

This month's problems are typical of real world problems. There does not seem to be enough information, and the solver must make several assumptions.

(A) For a cylindrical can filled with a liquid, the center of mass is at the center of the can. As the can is emptied, the center of mass changes. But when the can is completely emptied, the center of mass is back at the center. When (interpreted however you wish) is the center of mass at its lowest point?

(B) Sometime during the morning it began to snow. A snowplow went out and was able to plow two miles from noon until 1 pm, but was only able to plow one mile during the next hour. When did it start snowing?

### Board Report

Meeting of 16 November 2004

The Board of Directors held its second meeting of the 2004-2005 academic year on 16 November 2004. The following are highlights of that meeting.

- Board members would like to encourage students to attend the May meeting. We have done this in the past and have found it to be a nice way to introduce potential future teachers to a professional organization that has been valuable for all of us.
- The May meeting will also provide an opportunity to recognize members for their years of membership in the organization.
- Mary Wiltjer reported a club membership of 516, of whom 13 are first year members, 48 are retired members, 54 are student members, and 2 are life members.
- Ron Vavrinek reported that the club is in good financial shape and that the recent price increase was right on target.

The next meeting of the Board is scheduled for 2 February 2005 at Cucina Biagio (7309/7319 W. Lawrence Ave., Harwood Heights) at 6:00 PM. Members of the club are welcome to attend any Board meeting, but please contact Gwen Zimmermann at [gzimmer@hinsdale86.org](mailto:gzimmer@hinsdale86.org) before 26 January if you plan to attend this meeting. Because this is a dinner meeting, you would be expected to pay for your meal.

MMC Dinner Coupon

**\$5 off a dinner for New Attendees**

— or —

**\$7 off a dinner for New Attendees**

**who join MMC**

name \_\_\_\_\_ date used \_\_\_\_\_

Valid only at the MMC Meeting on January 14, 2005.  
Limit one (1) coupon per person.

Once again, MMC is sponsoring a \$1000 scholarship to a graduating high school senior who intends to become a mathematics teacher. Students must be sponsored by a current member of MMC. The application should be sent along with an official school transcript, a letter of recommendation from the sponsoring teacher, and an essay explaining why he or she wants to become a mathematics teacher. The application and guidelines are posted on the web site at [www.mmchicago.org](http://www.mmchicago.org). The winning student and his or her parents will be invited to the May 2005 dinner meeting to receive the award.

All materials are due by March 18, 2005 and should be sent to:

Bill Roloff  
Lake Park High School  
500 W. Bryn Mawr  
Roselle, IL 60172

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**MMC Membership and Change of Address Form**

Mail to: MMC 415 S. Ridgeland Ave. #2 Oak Park, IL 60302
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Make check payable to MMC.

Please use a different form for each person.

Name \_\_\_\_\_

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School \_\_\_\_\_

Address  \_\_\_\_\_

\_\_\_\_\_

Phone \_\_\_\_\_

E-Mail \_\_\_\_\_

Membership:     New  Renewal

Choose one:

1 year                      (\$20)                      \_\_\_\_\_

2 year                         (\$35)                      \_\_\_\_\_

3 year                         (\$50)                      \_\_\_\_\_

1<sup>st</sup> year teacher   

retired                          (\$10)                      \_\_\_\_\_

student                       

Donations:

Scholarship Fund \_\_\_\_\_

Speaker Fund \_\_\_\_\_

Total amount of check: \_\_\_\_\_

Check preferred mailing address above.

Change of Address

# NOTICES & REMINDERS

## THE 2004 CHICAGO AREA ALL-STAR MATH TEAM TRYOUTS

Thursday, March 3, 2004

4 – 10 pm (with a break for dinner)

at Evanston Township High School

All interested high school students welcome.

The teams compete in the national ARML contest  
at the Iowa City site on June 5.

For more information about the tryouts, the  
team, or coaching opportunities, visit the

Chicago ARML web site at [HTTP://WWW.CHICAGOARML.ORG/](http://www.chicagoarmml.org/)  
or email Coach Isaac Greenspan at [ilg@chicagoarmml.org](mailto:ilg@chicagoarmml.org)

Mark the Date  
Saturday, January 29<sup>th</sup>  
in your assignment notebook!

MMC Conference  
of Workshops  
at Francis W. Parker School in Chicago  
(in the Lincoln Park neighborhood)

NCTM Annual Conference  
Anaheim, CA  
April 6-9, 2005

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](mailto: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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