Mathesis

President's Message
A Recounting of the Past Year

By Annie Wallace
NHTM President

It seemed as if winter would never end this year, definitely not the mild winter of last year. Last August, which at the moment seems so far away, as we were planning for our Spring Dine and Discuss with Greg Tang, we had to determine a date for the event. Our first choice was March 14th (Pi day), however, due to various things and Greg's schedule, the 16th was determined to be a much better day for our event. Thankfully, we went with the 16th as we were hit with a snowstorm on the 14th, a snow day the following day for most of the state!

Fortunately, March 16th was a beautiful day and in the midst of snow on either side of the day, we were able to host our annual meeting along with our Dine and Discuss at the Holiday Inn in Concord. I would like to thank and give my appreciation to Sharon McCrone, Suzy Gagnon and Rob Lukasiak for all of their

time and efforts in providing us this wonderful opportunity to share time and learning with friends and colleagues. Our featured guest was Greg Tang whose talk was titled *Best Practices and Best Ways to Practice*. Greg reminded us that no matter the knowledge and skills that our students arrive with, it is our responsibility not to blame their past education, but to take them from where they are and move them forward in their understandings and skills. We then participated in various games, puzzles and strategies that Greg highlighted as ways to help build and strengthen our students' understandings, fluency, and flexibility in working with numbers. My students found that they enjoyed doing Greg's Kakooma puzzles as a way to practice and strengthen their work with integers (http://gregtangmath.com/resources -- found about half way down the page.

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There is also an online "game version" http://gregtangmath.com/kakooma)

During the awards ceremony, we recognized two very dedicated teachers for their work in mathematics within their districts, schools and classrooms. The 2017 Richard C. Evans Distinguished Mathematics Educator Award was presented to Jess Jacques, a mathematics specialist for the Merrimack Valley School District. In a letter written by a parent, Ms. Jacques is described as an "inspiring teacher who changed the way my daughters viewed math. She is enthusiastic, knowledgeable, and passionate about her subject matter and challenges the students in a way that inspires them to achieve greatness".
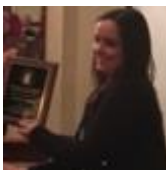
Elisabeth Murphy, a 6th grade teacher at the Henry Moore School in Candia, was the recipient of the 2017 Fernand J. Prevost Mathematics Teaching Award.   A fellow colleague quoted Greg Cantor with the "'essence of mathematics lies in freedom.' Ms. Murphy's leadership and teaching is reflective of such freedoms in her provisions to students on a daily basis. Her enthusiasm for mathematics makes her a teacher who is not only approachable but also makes learning attainable for all students".

We congratulate and thank both of these teachers for all that they bring to their students, colleagues and to math education in NH.

Cecile Carlton, our past-president, then announced our election results for this year. Congratulations and thank you to the following for their willingness to serve/continue to serve us all:

- President-Elect – Rob Lukasiak,
- Treasurer – Jeanine King,
- ATMNE Representative – Joseph Spadano,
- Middle Level Representative --- Katrina Hall, and
- Secondary Representative – Leslie Fallu.

I would also like to thank all of those that ran for one of the above positions and ask that they will consider running again for any one of the positions up for election on the board this coming year (Elementary Representative, NCTM Representative, and Secretary) --- the dedication and willingness to serve from this year's candidates is greatly appreciated. And if you know of anyone that you think would be willing to serve in any of the positions up for election this coming year, please feel free to email me their name and contact information at nhtmpresident@nhmathteachers.org.

As Cecile Carlton's term as president and past-president soon draws to a close, I would like to take the time to thank Cecile for her many years of hard work, dedication, and time in serving us all in her numerous roles and contributions to NHTM and other organizations within NH and New England. Cecile is one of those inconspicuous extraordinary people who do so much behind the scenes --- I know that I have learned much and appreciate Cecile's patience, superb

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organization and kindnesses – especially through this past year. I hope that Cecile will continue to serve and help throughout the coming years, as I know that we all benefit from her talents, strengths and knowledge.

Terri Magnus, our NCTM Representative, and I, along with Judy Curran-Buck, President of ATMNE were able to travel and represent NH in the NCTM Delegate Caucuses and Assembly in San Antonio, TX in early April. (Right after another snowstorm!) Here we were updated on the support and advocacy that NCTM continues to provide for us, as an affiliate, at a National Level, as well as providing support for our work here in NH. Please see Terri's article for more details on our attendance learning and participation.

This past October, Cecile Carlton and Laurie Boswell, Co-Chairs of the 2016 ATMNE Annual Fall conference, *Vote for Math!,* along with many volunteers from around New England, presented us with wonderful professional development opportunities in Manchester. Over the past few years I have come to realize how much work and how many hands are needed in providing us all with these wonderful opportunities to meet, share, and learn from and with others in NH and New England, as well as those traveling from outside of New England. It truly is an enormous amount of planning and time (believe me – it just does not happen overnight!), but the outcome is so worth it to us all.

ATMIM, one of our fellow affiliates in ATMNE, will be hosting the 2017 ATMNE Fall Conference, *Common Sense Mathematics*, on 2-3 November 2017 in Marlboro, MA. Then in 2018, RIMTA will be hosting the Annual Fall ATMNE Conference in Rhode Island. If you would like to help out on any of the program committees for this conference please contact either Cathy or Lynn.

Here in NH we continue to work on strengthening our Regional Structure in providing excellent professional development while sharing with colleagues in relaxed environments closer to home. Some of the happenings that have occurred/are occurring this year are:

- Southwest Region (Donna Furlong) --- providing an online book-study and discussing ways to use Math Running Records to assess basic fact fluency in grades K-5
- North Region (Kim Knighton) --- hosting a North Country meeting
- Southeast Region (Michelle Morton-Curit and Steve Latvis) – hosting a book study on "*Mathematical Mindsets: Unleashing Students' Potential through Creative Math, Inspiring Messages, and Innovating Teaching*" by Jo Boaler

If you have any ideas on some professional development that may be coordinated through our regional structure, please email me at nhtmpresident@nhmathteachers.org .

This past year we have been able to participate in opportunities to work with the DoE and

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have supported the Presidential Awards for Excellence in Mathematics and Science Teaching (PAESMT). We were able to provide support to work being done in support of math education in NH at UNH-Durham in two of their national grant applications. While one grant is still going through consideration, the second grant for "NH Early and Elementary Mathematics Collaborative" was awarded. We also provide support for the MathCounts® middle school competition in NH and sponsored the NH HS Math Competition whose annual final competition is held at Plymouth State University. We were also able to provide some support to the ARML team from NH, allowing NH students another opportunity to compete with others nationwide in mathematics.

In May, we will be reviewing applications for our organization's scholarships – one to a high school senior and one to a college student studying mathematics, math education or elementary education. Last year we were able to award these scholarships ($1000 each) to Trevor Labrecque from Berlin and to Hannah Bush, from Richmond and who is studying at the University of NH. Congratulations to both!

May you have a productive end to your school year and have time to relax and be revitalized over the summer as you get ready for the 2017-18 school year.

NHTM Student Achievement Certificates are available to any and all NHTM Members sent directly to you *free of charge.* Unfortunately, four certificates per school is the limit.
Contact Michelle Fox at
mailto:m_fox@sau58.org for more information or to order certificates for your school!

MATH PLUS New England Institute

August 1-2 in Portsmouth

NHTM Executive Board 2017 Election Results

By Cecile Carlton, Past-President

Results of our recent Executive Board elections are finalized. **Congratulations** to:

- Rob Lukasiak who will serve next year as President-Elect, then take the reigns of the Presidency from Annie Wallace in 2018;
- Jeanine King who will serve another two years as our Treasurer;
- Katrina Hall who will continue for the next three years as the Middle School Representative;
- Joseph Spadano who is new to the board and who will serve for three years as the ATMNE representative and;
- Lesley Fallu who will be in the Secondary Representative role for three years.

Thank you to all who voted and placed their confidence in leaders in the mathematics community who will continue to work with teachers throughout the state. We also want to acknowledge Kristi Upschulte, Bernadette Kuhn, and Natalya Vinogradova who were also on the ballot and have dedicated time to working with NHTM throughout the years. It is through the efforts of many who volunteer their time and expertise that allows us to meet the goals of our mission reiterated here: *The mission of the New Hampshire Teachers of Mathematics is to provide vision and leadership in improving the teaching and learning of mathematics so that each student is ensured quality mathematics education and each teacher of mathematics is ensured the opportunity to grow professionally.*

Post Secondary Representative
Rotating Squares: Finding Area through Mathematical Reasoning

By Sharon McCrone

Background
I originally found this problem in a high school geometry textbook and I have developed it to be used with middle school and high school students as well as in many professional development settings with middle school and high school teachers, and student teachers. This is a simple problem to state, and the answer can be found in many different ways. It's the reasoning behind the answer that brings out the mathematics and helps students understand *why* the answer makes sense. This is the value of

mathematical reasoning. I would argue that understanding why the mathematics works helps students develop confidence and mathematical autonomy. High school geometry students should be able to approach this problem and congruent triangles to justify the result. Middle school students may need more guidance and scaffolding to understand the reasoning.

For more details on this problem and for sample classroom discussion and student solutions, see the National Council of Teachers of Mathematics' publication *Focus in High School Mathematics: Reasoning and Sense Making in Geometry* by McCrone, King, Orihuela, & Robinson, 2010.

Post Secondary Representative Rotating Squares: Finding Area through Mathematical Reasoning

(CONTINUED FROM PAGE 5)

The Problem

Two congruent squares 5 inches by 5 inches (alternately: n units by n units) overlap as shown in Figure 1. Vertex C of one square is at the center of the other square. If the square to the right is allowed to rotate about the center, C, of the square to the left, **what is the largest possible value of the area of the overlapping shaded region?**
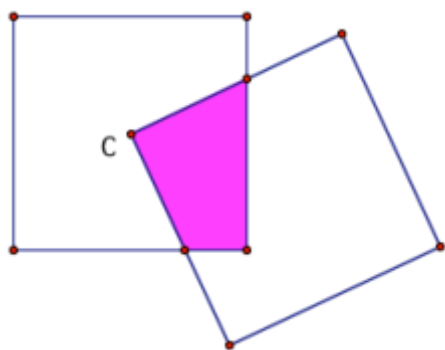

Figure 1. Overlapping Squares of the Rotating Squares Problem.

Whether using a physical model (card stock squares held together with a brad) or a dynamic geometry software program to model the situation, students should be able to investigate various possible shapes. In addition to the general quadrilateral in Figure 1 above, Figure 2 provides two more possible shapes. Students should be able to determine the areas of these figures and notice that they are the same, 6.25 square inches. In fact, the solution is that 6.25 square inches is the measure of the overlapping area no matter how the two squares are placed

(given that vertex C of the first square is located at the center of the second square).
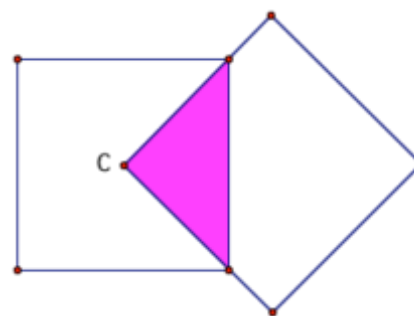

(a)
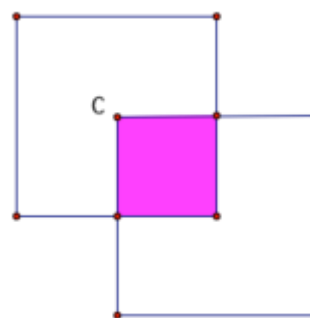
(b)

Figure 2. Figure formed by overlapping squares as (a) triangle and (b) square.

To fully answer the question stated in the problem, students need to investigate the more general quadrilateral. Although advanced students should be able to approach this on their own or in groups, a possible worksheet for this investigation is provided below.

Rotating Squares – Finding Area

Imagine two congruent squares, 5 inches by 5 inches, overlap. Vertex C of one square is at the center of the other square. If the square to the right is allowed to rotate about the center, C, of the square to the left, **what is the largest possible value of the overlapping shaded area?**

1. If the two squares are rotated so the overlapping area takes the shape of a smaller square, what is the area of the small square? Explain how you arrived at your answer.
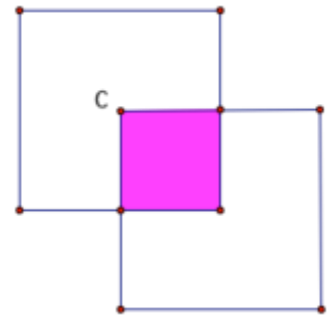
2. If the two squares are rotated so the overlapping area is a triangle, what is the area of the triangle? Explain how you arrived at your answer.
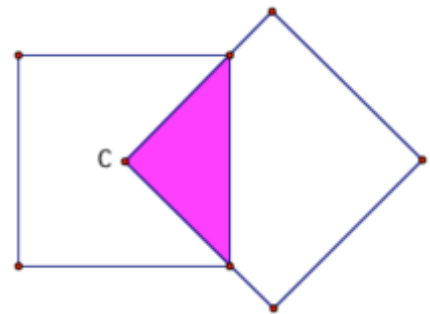
3. If the two squares are situated so the overlapping area is a quadrilateral such as the one in the figure below, how could you find the area? Do not find the area yet, but describe at least two different methods you could use to find the area.
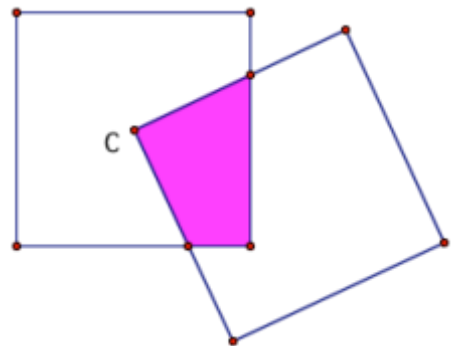
4. Method 1: If the quadrilateral is divided into two triangles, use the figure and the information below to find the area of the quadrilateral. What is the area? Be sure to show your work.

5. Methods 2 and 3: If the quadrilateral is divided into a triangle and a trapezoid, use the left-hand figure to find the area of the quadrilateral. If you "square off" the quadrilateral to make a rectangle, use the right-hand figure to find the area of the rectangle first, then subtract the two triangles (dashed lines) to find the area of the shaped quadrilateral. Did you get the same answers as in #4? Be sure to show your work.

6. Using the figure below, develop a mathematical argument (or proof) to justify that ΔCJK is congruent to ΔCLM.
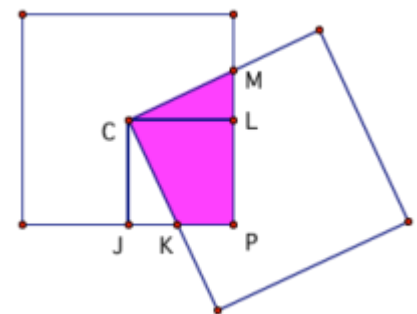
** If you were successful in showing those triangles congruent, then you can see why the area of square CJPL is the same as the area of any quadrilateral such as quadrilateral CKPM. Explain why using your own words.
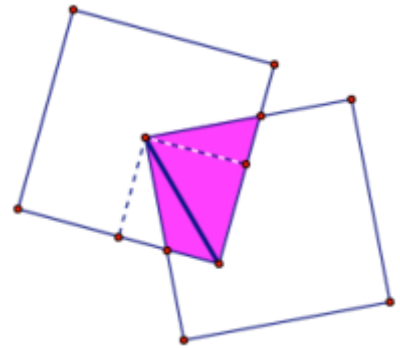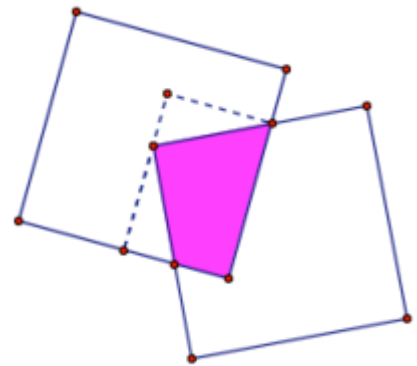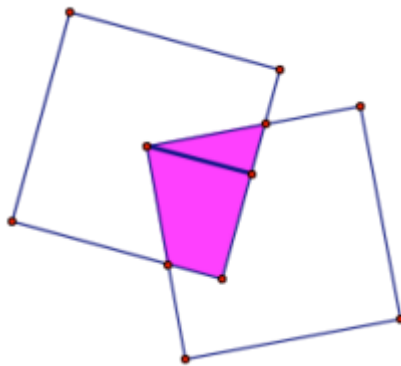
SOLUTIONS

1. If the two squares are rotated so the overlapping area takes the shape of a smaller square, what is the area of the small square? Explain how you arrived at your answer.

    ANSWER: Since the larger squares are 5 in. by 5 in., the length of a side of the smaller square is 2.5 in. To find the area of the shaded region, find 2.5 inches x 2.5 inches to get 6.25 sq. inches.

2. If the two squares are rotated so the overlapping area is a triangle, what is the area of the triangle? Explain how you arrived at your answer.

    ANSWER: This triangle has a base of 5 inches and an altitude of 2.5 inches. The area of the triangle is ½ x 5 x 2.5 or 6.25 sq. inches.

3. If the two squares are situated so the overlapping area is a quadrilateral such as the one in the figure below, how could you find the area? Do not find the area yet, but describe at least two different methods you could use to find the area.

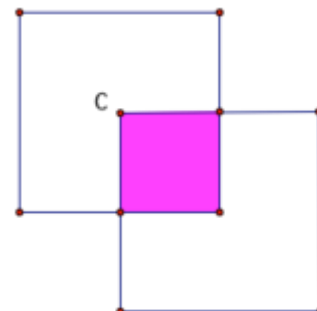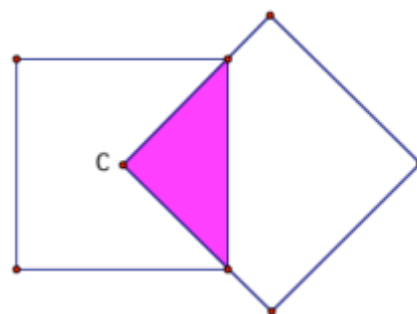   *ANSWER: See ideas presented in Methods 1, 2 & 3 below.*
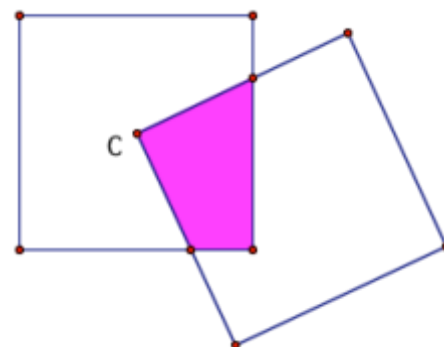
4. Method 1: If the quadrilateral is divided into two triangles, use the figure and the information below to find the area of the quadrilateral. What is the area? Be sure to show your work.

    ANSWER: The two triangles in the diagram both have altitudes of length 2.5 inches (see dashed lines). One can argue that is the length of one base is x, then the other is (5-x). Total area of the shaded region is ½ (2.5x) + ½ (2.5(5-x)) = ½ (2.5)(5) = 6.25.

5. Methods 2 and 3: If the quadrilateral is divided into a triangle and a trapezoid, use the left-hand figure to find the area of the quadrilateral. If you "square off" the quadrilateral to make a rectangle, use the right-hand figure to find the area of the rectangle first, then subtract the two triangles (dashed lines) to find the area of the shaped quadrilateral. Did you get the same answers as in #4? Be sure to show your work.
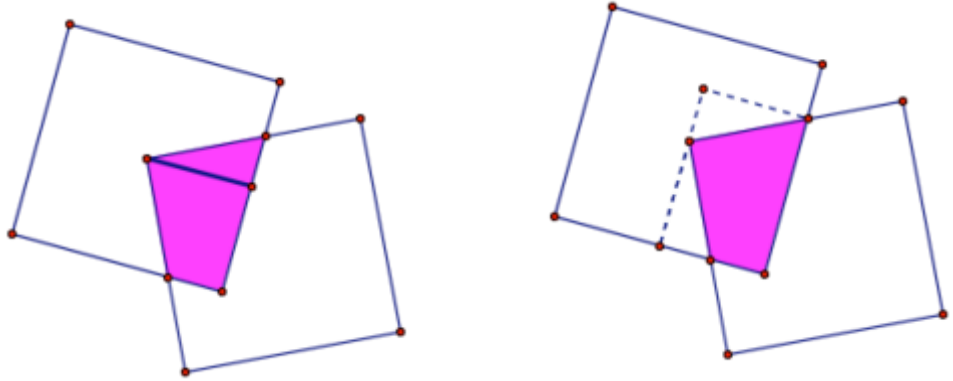
ANSWERS: Method 2 - The longer base of the trapezoid is also the altitude of the triangle. Both are 2.5 inches. If the base of the triangle is x, then the shorter base of the trapezoid is 2.5-x. Notice that the height of the trapezoid is also 2.5 inches. Using the area formulas for a triangle and a trapezoid, we get the result:
½ (2.5x) + ½ (2.5)(2.5+2.5-x)= ½ (2.5)(5) = 6.25
Method 3 – The rectangle's area is (2.5)(2.5+x). Each triangle has area ½ (2.5x). So the area of the shaded quadrilateral is (2.5)(2.5+x)- ½ (2(2.5x)) = 6.25.

6. Using the figure below, develop a mathematical argument (or proof) to justify that ΔCJK is congruent to ΔCLM.

   ANSWER: The goal is to prove congruent triangles by the ASA theorem. Using a rotational argument, one can see that angle JCK is the same measure as angle LCM. Both of these triangles have an altitude of 2.5 inches (segments CJ and CL) because these segments start at center C and extend perpendicular to a side of the larger square. Finally, the angles at J and L are congruent because they are each right angles.
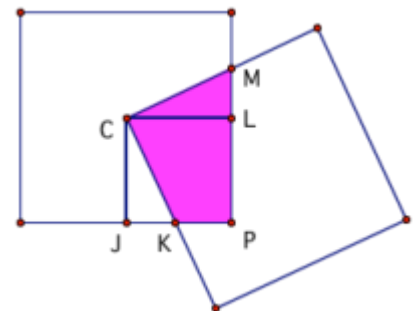
Elementary Representative
Summer Professional Development

By Amy Gregoire

Spring always seems like a crazy time of year. Everyone is scrambling, trying to make sure they cover all of the curriculum. At the same time there are tons of fun field trips, end of year assemblies, and there always seems to be testing galore. By June everyone is tired and ready for summer vacation. Once teachers have had a little rest however, they are ready to reflect upon what went well over the year, what they would like to change for next year, and are ready to be inspired. I always find that attending professional development sessions over the summer is a wonderful way to spark my creativity and to get excited about trying new ideas that I have learned over the summer. I have put together a list of upcoming math professional development opportunities along with the links. Now is a perfect time to approach your administration about allocating some of your school's professional development or course funds to one of these events.

Events in July:

July 10-12 Bartlett, NH

Diagnosis and Remediation of Learning Problems in Mathematics with Professor Mahesh Sharma
http://events.r20.constantcontact.com/register/event?llr=qupgl7cab&oeidk=a07edtoaroydcea1308

July 10 – 14 Mount Holyoke South Hadley, MA

Building a System of Tens
http://mathleadership.org/about/summer-institutes/schedules-and-costs-2/

July 17 – 21-Mount Holyoke South Hadley, MA

Developing Mathematical Ideas: Making Meaning for Operations

- Professional Development for Mathematics Coaching
- Developing Mathematical Ideas-Facilitation (DMI-F)

http://mathleadership.org/about/summer-institutes/schedules-and-costs-2/

July 17-19 Baltimore, Maryland

Facilitating Mathematical Discourse
http://www.nctm.org/discourse/

July 20 – 22 Baltimore, Maryland

Supporting Students' Productive Struggle
http://www.nctm.org/productivestruggle/

July 25-27 Cambridge, MA

Lesley University Summer Institute - Exploring the Standards for Mathematical Practice http://www.lesley.edu/center-for-math-achievement-summer-institute-2017/?terms=summer%20institute

Elementary Representative
Summer Professional Development

Events in August:

August 1-2 Portsmouth, NH MATH PLUS New England Institute for K-6 teachers
http://gregtangmath.com/newengland

August 2, 3, 4, 7 and 8 Plymouth, NH

Math Games Help Reach CCSS, Graduate course Plymouth State

https://www.plymouth.edu/outreach/impact-center/files/2012/10/Summer-2017-graduate-course-description.pdf

August 7-11 Kennebunkport, Maine

Diagnosis and Remediation of Learning Problems in Mathematics with Professor Mahesh Sharma
http://events.r20.constantcontact.com/register/event?llr=qupgl7cab&oeidk=a07edtoaroydcea1308

Middle Level Representative
Middle School Students Need Change

By Katrina L. Hall

Math anxiety, a low self-concept of ability in mathematics and an overall low mathematical disposition are grade killers for middle school math students. Studies have shown that these three factors along with what many call a math phobia are high contributors to middle school students' low achievement and disinterest in mathematics. The frightening aspect is that much of this negativity is a direct result of adult behaviors and can be changed with minor adaptions.

Students want to be successful. They recognize the value of mathematics in many careers of the future. They react to academic press and clearly recognize the significance of good grades in mathematics. They enter elementary school with a drive and focus to learn mathematics and often find it fun. Then there is a change.

Studies have shown a significant dip in students' math self-concept, disposition and achievement as students enter middle school. Anxiety levels peak and students quickly change their tune when it comes to mathematics. Math turns from a fun, inspiring and well-liked subject to a subject of dread and fear. The interest in mathematics drops, especially in girls, and students veer away from more complex coursework at the high school level.

The inspiring news is a student's self-concept of ability in mathematics is malleable. If we listen to the voices of middle school students, changes can be made at the middle level that can have a positive impact on the disposition of students and change current

Middle Level Representative
Middle School Students Need Change

negative trends. As parent, teachers and leaders there is ample time to make changes that can turn this negative dip to positive growth.

The first and easiest step is to stop sharing personal stories of math phobia and "inability." The intent of sharing is frequently to make a student feel better about a poor math grade or mathematical struggle. However, the fact is that sharing a phobia or the supposed a personal inability to perform mathematics confirms a student's belief in his/her inability, therefore increasing the low self-concept and disposition in mathematics. Individuals should instead share the stories of overcoming challenges, perseverance and stories of success. Change the focus to one, which includes positive feedback and reinforcement focused on goals, accuracy and growth. Make the ability to overcome struggles and an increase in confidence the focus of the shared stories rather than confirmations of negativity.

Students value academic press in the math classroom. When students perceive high-expectations in the math classroom, results show an increase in dispositions towards mathematics. Set high standards in the classroom and let students know they can achieve these standards. Don't let the students expect and instead mark progress towards goal achievement. Provide a no-failure zone for students and be their cheerleader towards positive growth.

Change the learning environment to one that focuses on the social needs of middle school students. Remove yourself from the sage-on-the-stage and let the social interactions grow. Students at this age strive for socialization. Increase teacher-student interaction in the classroom as well as peer-to-peer interaction. Use mixed gender grouping strategies, however, be sure to provide frequent check-ins, hold individual students accountable, and vary the level of work per group. Ability grouping for class tasks can be a successful strategy; allow students to move out of groupings based on their abilities per concept. Reward groups for success in achieving goals. Remember...feedback, feedback, feedback.

This list can go on but consider ways in which the class environment can be changed to best fit the needs of the middle school math student. Students describe a stage-fit classroom environment as one that supports their achievement in mathematics and is directly related to what is relevant to them. Think about what is important to the middle school math student. A mortgage on a house is not pertinent for a 13 year old nor is determining the surface area of a box. Take the time to talk with students and learn about their interests. Provide different learning materials, instruction and learning time for individual students. It will make a difference.

Deep down students care about math and understand its importance to their future. We

Middle Level Representative
Middle School Students Need Change

(CONTINUED FROM PAGE 13)

need to stop the spread of math phobia and share positive math experiences. We need to reinforce growth, support perseverance and develop a stage-fit model to increase students' self-concept in mathematics. Middle school students care about math and as leaders we need to listen to their needs. We still have time to make a difference. What changes will you make?

Secondary Representative
Farewell to All

By Michelle Fox

It has been my pleasure to serve as the NHTM Secondary Representative to the Executive Board. I am proud to have served on the board for such a long time. During my time on the board, I had the pleasure of attending many different conferences and workshops all over New England and beyond. First, I traveled to Washington DC with Greg Superchi to attend the annual NCTM conference. Then in 2015, I attended the NCTM conference in Boston with my Groveton High School colleague and friend Lisa Guay. Both of these conferences allowed me to network with nationally renowned textbook authors, past NCTM and NHTM presidents, and meet all kinds of talented, hardworking, and passionate teachers from all over the country who love their jobs as much as I do! I even won a TI-84 Plus color graphing calculator at the Boston conference! Icing on the proverbial cake!!

Attending, co-chairing for, and presenting at our local NHTM institutes, Dine and Discuss nights, and so on were also highlights of my years on the Executive Board. I look forward to reading future Mathesis articles from Board Members, new and old, and attending workshops, institutes, book reads, and the like in the future with each and every one of the talented, hardworking, and respected members of NHTM throughout the state. Thank you to each and every one of you who inspired me, worked beside me, taught me, or otherwise crossed my path during my time on the board.

This time of year, the minds of our students begin to wander and thoughts of summer vacation are taking over! Keep up the great work inspiring and educating the youth in the great state of New Hampshire!

NCTM Representative
Access, Equity, Empowerment, and Action

By Terri Magnus

These four goals were mentioned frequently at the NCTM Annual Conference last month in San Antonio. In the 2014 NCTM publication, *Principles to Action*, it was asserted that, "an excellent mathematics program requires that all students have access to high-quality mathematics curriculum, effective teaching and learning, high expectations, and the support and resources needed to maximize their learning potential." Clearly the terms equity and access suggest that all students should have access to a full mathematics curriculum regardless of their ethnic, cultural, or socioeconomic background, but NCTM President Matt Larson suggests that we need to be mindful of how we teach the mathematics as well. In his President's Address, *Empowerment WITH Access and Equity*, which can be viewed online at http://www.nctm.org/2017sanantonio/, he talks about how students receive different experiences in mathematics education based on the tracks they have been placed into, sometimes very early in their education. Students in the lower tracks see examples of mathematics being applied but are often shown how to apply the mathematics while students in the upper tracks are challenged with genuine problem-solving. Thus the students in the lower tracks have fewer opportunities to develop a positive identity with mathematics—they do not develop the growth mindset needed to pursue higher mathematics and be successful. English language learners, minorities, students from homes unable to give students a head start are disproportionately placed in the lower track before they have an opportunity to develop their mathematics identity. Thus, we should think about empowering our students through meaningful discourse and productive struggle, to call on all students (not just the ones we know can answer), and send positive messages to all students about their mathematical growth and potential.

Terri Magnus, Judy Curren Buck, and Karen Graham await the start of ShadowCon 2017 at NCTM San

A new pair of NCTM books, *Taking Action: Implementing Effective Mathematics Teaching*, written for the 9-12 and 6-8 grade bands, respectively, was so popular that it sold out in the first day of the conference. These books are designed "to foster teachers' understanding of the effective mathematics teaching practices and their ability to apply those practices in their own classrooms" and include narrative cases, classroom videos, real student work, reflective experiences for teachers, and concrete suggestions for implementation. The books can be purchased separately from the NCTM bookstore http://www.nctm.org/Publications/Books/.

NCTM has also created a task force, led by UNH professor Karen Graham, to develop a

NCTM Representative
Access, Equity, Empowerment, and Action

publication *Pathways through High School Mathematics: Building Focus and Coherence*, which will address the purpose of high school mathematics, define curricular pathways leading to college, career, and civic readiness, and provide descriptions of course exemplars that could make up the pathways. The task force will address the purpose of high school mathematics, consider the possibility of moving away from the narrow focus on symbolic manipulation and calculus preparation, and look at opening up places for topics from discrete mathematics, technology, and coding. NCTM plans to make the document available for public comment in the fall and to release the final publication at the 2018 Annual Conference. More information can be found at http://www.nctm.org/News-and-Calendar/Messages-from-the-President/Archive/Matt-Larson/Bringing-Needed-Coherence-and-Focus-to-High-School-Mathematics/.

I enjoyed a wide variety of talks at the conference including one by Tony DeRose of Pixar Animation Studios introducing "Pixar in a Box". You undoubtedly have students who love Pixar so I encourage you to check out the website www.pixarinabox.org. Activities are designed for a wide range of grade levels. In his presentation, "Looking Forward: What'll be Possible in Math Ed in a Decade," Eli Luberoff of Desmos, Inc. discussed how technology was evolving and would assist in differentiated learning and making mathematical learning assessable to the sight-impaired. We saw how a Marbleslides activity was taken to a new level by a student looking for a challenge and we listened to the shape of the sine wave and other functions. In another talk, William McCallum discussed the progression of geometry in the common core from middle school to high school and talked about how Illustrative Mathematics was completing the middle school curriculum https://www.illustrativemathematics.org/curriculum for the Common Core State Standards and how high school geometry teachers could build on their students' familiarity with geometrical transformations while still developing rigor and proof. The mathematics consultant for the movie *Hidden Figures* and Baltimore Ravens

The San Antonio River Walk

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football player (and MIT mathematics doctoral student) John Urschel each gave popular presentations. In my opinion, the most dynamic and moving presentation was Dan Meyer's *Math is Power Not Punishment* where he engaged the audience in a number of activities that motivate the learning of mathematics. His message was that students will learn mathematics better if we develop a need and desire to know BEFORE presenting them the mathematical tools and shortcuts to solve the problem.

At the NCTM Annual Conference, participants not only learn about best practices in teaching mathematics, but also have the opportunity to hear from and talk to the NCTM leadership about current concerns and initiatives in mathematics education. Annie Wallace, NHTM President, and I represented NHTM at the Eastern Regional Caucus and the Delegate Assembly on April 6. We were asked to focus on the question: How are you addressing equity, access, and empowerment in your region and how could NCTM support you in addressing these issues? In the Eastern Regional Caucus, we agreed upon two suggestions to present to the Delegate Assembly: 1. That NCTM needs to provide guidance on accelerating students through the grades. 2. That NCTM develop a more affordable membership option and a more affordable way for members to attend the annual conference. We were concerned about the detrimental effect of the "rush to calculus" and the fact that many teachers (and hence students) are unable to benefit from NCTM's resources due to finances and school limitations. The suggestions from all of the regions were shared at the Delegate Assembly and will be considered by NCTM leadership.

What are your concerns regarding Access, Equity, Empowerment, and Action and how can both NCTM and NHTM address your needs? Rob Lukasiak, NHTM President-Elect, and I will be attending the NCTM Affiliate Leadership Conference "Intent to Impact: Addressing Access, Equity, and Advocacy in Your Affiliate" in Baltimore in late July. Hopefully, we will be able to implement in New Hampshire some of what we learn at this conference. Hearing your ideas and needs in advance is helpful.

NCTM continues to sponsor summer interactive institutes. The July 17-19 Institute is entitled "Facilitating Meaningful Mathematical Discourse" and from July 20-22 "Supporting Students' Productive Struggle." Both are advertised for all grade bands (pre-K through grade 12) and taking place in Baltimore MD. This fall's Innov8 Conference, "Breaking Barriers: Actionable

INNOV8 CONFERENCE

November 15–17
Las Vegas

Breaking Barriers:
Actionable approaches to reach each and every learner in mathematics

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Approaches to Reach Each and Every Learner in Mathematics," will take place November 15-17. There are also two Regional NCTM Conferences this fall: Orlando (October 18-20) and Chicago (November 29-December 1). Next year's Annual Conference will take place April 25-28, 2018 in Washington DC. More information on all of these professional development opportunities is available on the NCTM website http://www.nctm.org/Conferences-and-Professional-Development/Regional-Conferences-and-Expositions/.

Art's Attic
The Booles

By Art Johnson

There is only one husband and wife team in mathematics George and Mary Everest Boole. They did not start out that way and therein lies the story.

George Boole (1814-1864) was a self-made man, born to a poor shoemaker. He attended the national Primary School but received little in the way of formal education after graduation. He was essentially self-taught, with some informal tutoring by various educated men in his county of Lincolnshire. Boole set up and ran a number of schools where he was a teacher and administrator. Meanwhile he began to delve into the mathematics of the day.

He was eventually appointed as a first professor of mathematics at Queen's College in Cork, Ireland. From that time on he published a number of mathematical papers and books. His masterpiece was *An Investigation in the Laws of Thought on Which Are Founded Mathematical Theories of Logic and Probability*, published in 1854. (That has to be one of the longest titles of any major mathematics book). In *Laws of Thought* Boole presented his ideas for symbolic algebra, the algebra represented by A B (set A union set B) and A B, (set A intersection set B). He was ahead his time. His symbolic algebra had no applications in his day, but with the advent of the digital age, Boole's algebra has become an essential part of all electronic circuitry and computer programming logic. Although Boole did not receive the universal acclaim he sought he was still regarded as a first rank mathematician.

Art's Attic
The Booles

An early death would rob him of future accomplishments.
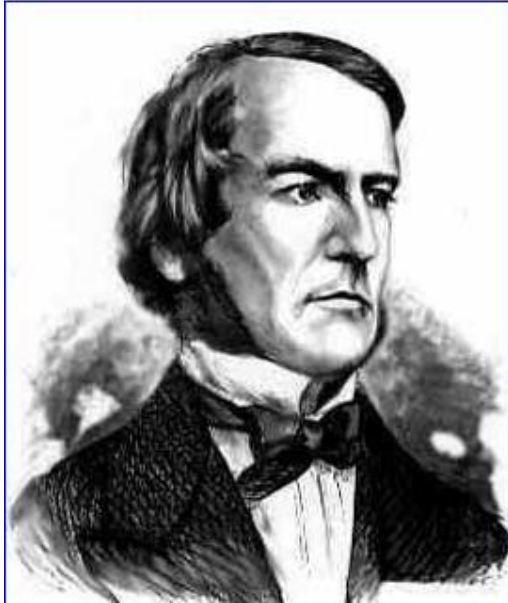
George Boole

Mary Boole

In 1864 Boole took a long walk before a scheduled lecture at the university. He was caught in a downpour and rather than return home to a change of clothing, he delivered his lecture soaking wet. The chill became a fever, and the fever became pneumonia. His death was hastened by his wife Mary's belief that she must fight fire with fire and so the cure should resemble the cause. She kept him in a bed of wet sheets to cure him. It didn't work. He died of pneumonia a week after taking to bed.

Boole left his wife Mary (1832-1916) with five young children. She returned to her family home in England. Mary Everest Boole was the daughter of a Reverend and her uncle was George Everest (yes, *that* Everest). She received tutoring in mathematics from a young age, including from her future husband. Although not the caliber of mathematician as her husband, she edited his publications, including *Laws of Thought.*

Mary was still a young woman, but the prospects of remarrying in England were bleak, as was her ability to find employment. Women did not work out of the home in those days. She did obtain a position in the library of Queens College in London, and eventually started her own school for primary students.

Once Mary founded her schools and could support herself and her family she began to write about social ideas. In *Philosophy and Fun in Algebra* she included what she called Boole Cards. She designed the cards as a means for women to develop their knowledge and talents at home 'without agitation or pubic discussion or…acts of parliament". In short, women could advance their personal knowledge of mathematics without leaving their homes

Art's Attic
The Booles

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or neglecting their families. They might also use the artwork they produced to design home goods that they could sell.

Below is an example of the string art that Mary invented and popularized. See http://www.guidepatterns.com/35-string-art-patterns.php for string art patterns you might use with your students.

**String Art
Obtuse Angle**
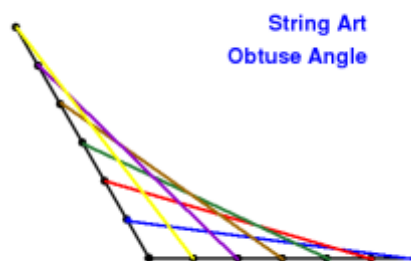
Results of the 45th annual NHTM - PSU Contest
By Stephen Latvis

Our 45th annual State Mathematics Contest has come and gone. Thankfully the weather was perfect (one week after having a major storm) and the trip to Plymouth was smooth sailing for most teams. Thanks to NHTM for their continued support of the event as well as to Plymouth State University for being such gracious hosts once again. 53 schools registered with 51 teams competing – this was an awesome turnout once again and we want to thank everyone for participating.

We extend our congratulations to our outstanding performers, to our winning teams and advisors in each division. High praise goes to Kellie Gabriel and her Nashua High School South team (from the Large school division) for their performance in achieving a score of 244 points out of a possible 432 points. Rounding out the first place schools by division: Hanover High School in the Intermediate school division earned a score of 240 points, Plymouth High School in the Medium school division earned a score of 197, and Bishop Brady in the Small school division earned a score of 193. Bravo!

As for individual top performances, one student achieved a perfect score of 36 – Rubin Zou (from Nashua SOUTH); one student achieved a near perfect score of 32 – Penny Bryant (from Oyster River); and six students achieved scores of 28 – Calvin Ang (from Bedford), Grace Shaw (from Belmont), Oscar Ingelfinger (from Oyster River), Anna Gadecki (from Trinity), Morgan McGinnis (from Windham), and Risit Datta (from Nashua NORTH).

Our sincere thanks for the contributions all of you made to the contest by performing your duties so well. Many of you did other tasks before, during, and after the contest

Results of the 45th annual NHTM - PSU Contest

that assisted in getting the details accomplished. Our special thanks to those who were able to accommodate our needs at the site – Professor Shawn Hackshaw of the PSU Math Department and Karen Weldon, Coordinator of Activities at the Hartman Union Building; to Donna Kelley and her team of question writers; to Jeanine King for heading up registration; to the chairpersons of all the various duties on contest day – Jim Brizard, Ellen Berchtold, Greg Morris, Lorainne Mascioli, Sue Capano and Michelle Morton-Curit; to "team refreshments" for helping me with the food for the coaches; and to any others I may have missed who assisted myself and others attending to the small details on the day itself.

The final stats are still available online at **http://tinyurl.com/45statecontest**; a separate analysis like has been done in the past will be sent at a later date and will be sent out prior to Memorial Day. When you do receive my e-mail with the list of names for perfect scores by category, please respond promptly and verify the spellings of your students' names. I will then work with a colleague to have the certificates printed. Again, our sincere congratulations and thanks to all of you. We hope you are now planning to be present for our 46th contest next spring.

2017 Final Results

SMALL			MEDIUM		
Bishop Brady	193	**1**	Belmont	139	5
Gorham MHS	119	tie - 6	Bow	150	**3**
GBeCS	67	12	Campbell	121	6
Hillsboro-Deering	98	10	Fall Mountain	68	11
Hopkinton	119	tie - 6	Gilford	146	4
Inter-Lakes	126	4	John Stark Regional	81	10
Lisbon	107	8	Laconia	116	7
Moultonborough	93	11	Lebanon	160	**2**
Newfound Regional	121	5	Plymouth	197	**1**
Newmarket	101	9	Raymond	99	8
Portsmouth Christian	145	**3**	Sanborn Regional	83	9
Trinity	158	**2**	Winnisquam Regional	65	12
Wilton-Lyndeborough	51	13			

Results of the 45th annual NHTM - PSU Contest

INTERMEDIATE			LARGE		
Bishop Guertin	188	5	Bedford	152	10
Coe Brown Northwood	164	6	Dover	158	9
ConVal	144	10	Exeter	162	7
Hanover	240	**1**	Keene	82	14
Hollis Brookline	212	**3**	Londonderry	171	tie - 4
Kingswood	120	11	Manchester Central	121	12
Merrimack Valley	101	12	Merrimack	108	13
Milford	192	4	Nashua NORTH	208	**2**
Oyster River	155	9	Nashua SOUTH	244	**1**
Pembroke	159	8	Pinkerton	164	6
Souhegan	169	7	Portsmouth	171	tie - 4
Windham	229	**2**	Salem	146	11
			Timberlane	161	8
			Winnacunnet	199	**3**

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Join us for

ATMNE 2017

Marlborough, MA - November 2-3

**Keynote Addresses by
Steve Leinwand and Tracy Zager**

Come learn with us on the theme of
Common Sense Mathematics. Explore
thoughts and ideas related to curriculum
and instruction in your classroom.

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Professional Development & Conferences

* National *

NCTM Regional Conferences	Orlando, FL	October 18-20, 2017
	Chicago, IL	November 29- December 1, 2017
NCTM Innov8 Conference	Las Vegas, NV	November 15-17, 2017
NCTM Annual Meeting	Washington, DC	April 25-28, 2018

* Regional *

New³ 2017 Summer Conference	Loudonville, NY	July 2-12, 2017
Lesley Summer Mathematics Institute	Cambridge, MA	July 25-17, 2017
ATMNE 2017	Marlboro, MA	November 2-3, 2017

* State *

Math PLUS New England Institute	Portsmouth, NH	August 1-2, 2017

Mathesis is the newsletter of the New Hampshire Teachers of Mathematics. It is published four times a year: August, November, February, and May. The mission of the New Hampshire Teachers of Mathematics shall be to provide vision and leadership in improving the teaching and learning of mathematics so that each student is ensured quality mathematics education and each teacher of mathematics is ensured the opportunity to grow professionally.

Upcoming Deadlines

- Information for August Mathesis- August 1st