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## President's Message

On behalf of the Executive of the Nova Scotia Mathematics Teachers Association, welcome to the NSMTA Conference MMXVIII. We are pleased to offer over 100 sessions facilitated by educators, researchers, specialists, and other professionals. It is wonderful to see many returning workshop presenters and exciting to see a number of first time presenters this year. Welcome to our future leaders in mathematics! The presenters volunteer their time and expertise to bring all attendees a day of authentic professional development and for this we owe them a sincere debt of gratitude. Please take a few moments during the day to acknowledge the contributions of the presenters.

Thank you to the staff and administration of Charles P. Allen High School for once again opening their doors and serving as host school. The school is an exceptional site for a professional conference and all members of the CPA community have been very accommodating in meeting the needs of the MTA. Special thanks to Maureen McInnis, Mathematics Department Head at CPA, who is again serving as on-site chair.

I would like to personally thank all members of the MTA Executive for their tireless efforts in planning and coordinating another premier professional development event. The NSMTA Executive is a dedicated group of educators from across the province who work year round to promote mathematics education. Anne, David, Erick, Jennifer, Kim, Marc, Sonya, Trisha, and Zeno - you are an amazing team!

I wish to recognize the exceptional contributions of execu-

tive member, Sonya O'Sullivan, who has completed her term and will be moving on to other professional pursuits. Sonya has been an invaluable member of the MTA team who goes above and beyond to advance mathematics education in Nova Scotia. She has filled a variety of roles within the MTA including current conference co-chair. Her expertise and insight will be truly missed. Thank you Sonya and all the best in your future endeavours.

One of the goals of the NSMTA is to acknowledge the outstanding work of mathematics teachers across the province. We would be pleased to recognize any special projects, initiatives, or accomplishments by including an article in future editions of our newsletter, Mathematics Matters. Please contact any member of the executive if you have an item that you would like to see included in a future edition.

I would like to thank all educators in the province for the outstanding work that you do for your students every day. I wish you a successful and rewarding 2018-19 school year. Continue to set high standards for all your students and be proud to be a Nova Scotia mathematics teacher!

Enjoy your conference and thank you all for being here.  
Joe

*Joe Mac Donald*

*President*

*Nova Scotia Mathematics Teachers Association*

# Math in the News and Around the Web

## What Does Math Look Like to Mathematicians? An Excerpt from *Math with Bad Drawings* by Ben Orlin

A common question I get from students: “Does it matter whether I multiply by 11 or 13 first?” The answer (“no”) is less interesting than what the question reveals: that in my students’ eyes, multiplication is an action, a thing you do. So one of the hardest lessons I teach them is this: Sometimes, don’t.

You don’t have to read  $7 \times 11 \times 13$  as a command. You can just call it a number and leave it be.

Read the full article at: <https://www.popsci.com/what-does-math-look-like-to-mathematicians>

## UVA Professor Promotes Equity in Mathematics in New Leadership Role

In both his research and his new position as the President of the National Council of Teachers of Mathematics (NCTM), Dr. Robert Q. Berry knows he’s posing complex questions on the topics of access and equity – and he’s careful not to suggest that there are easy answers. But he sees a responsibility for NCTM, as a leader in the field, to ask those questions. These days, he’s concerned that we’re too often divorcing the utility of math from the beauty of it and hopes to help change that.

Read the full article at: <https://at.virginia.edu/2tt2XOe>



Andre Sasser  
@MrsSasser



Two years ago, I was saying “do you have any questions?”. Last year I switched to “what questions do you have?”. It made a difference. Today I tried “ask me two questions”. And they did! And those ?s led to more ?s. It amazes me that the littlest things have such a big impact!

1:42 PM - Aug 27, 2018

338K 63.1K people are talking about this

Instead of asking your students “do you have any questions?” you might try “ask me two questions.” A small change in the wording of this question might have a big impact on the response you get from students. Try it out!

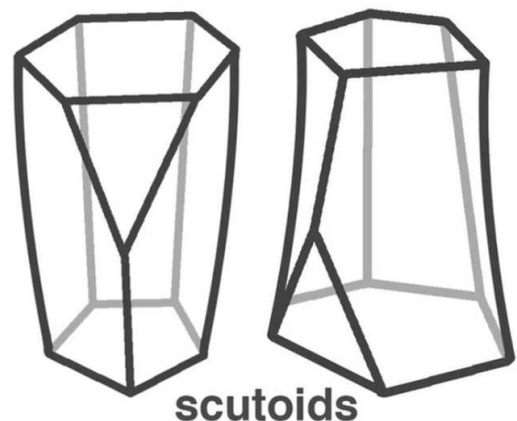
## Geometry Has a New Shape, Meet the Scutoid

Quoted from <https://www.livescience.com/63207-scutoid-new-shape-nature.html>

“Our world is made up of elegant shapes — there’s the square, the rectangle, the sphere, the prism and many more. But sometimes, these shapes don’t quite fit nature’s game board. Sometimes, you also need a “scutoid.”

This shape — new to math, not to nature — is the form that a group of cells in the body takes in order to pack tightly and efficiently into the tricky curves of organs, scientists reported in a new paper, published July 27 in the journal *Nature Communications*.

If you’re interested in learning more about this shape, I recommend you watch this video from Matt Parker as he describes the scutoid and explains its history: [https://youtu.be/2\\_NZ1qI8B8Y](https://youtu.be/2_NZ1qI8B8Y)



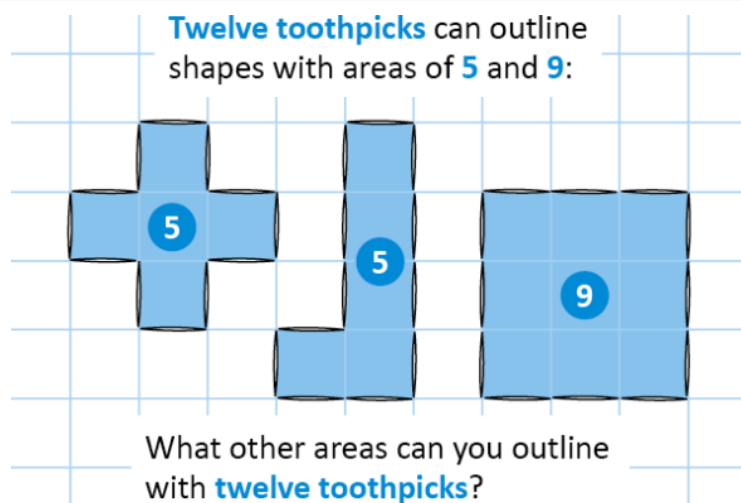
# Math in the News and Around the Web

**CEMC Problem of the Week** - The Problem of the Week is designed to provide students with an ongoing opportunity to solve mathematical problems. Each week, problems from various areas of mathematics will be posted here and e-mailed to teachers for use with their students from grades 3 and up. Problems of the week can be emailed to your inbox in either English or French. Find out more at: <https://www.cemc.uwaterloo.ca/resources/potw.php>

## Wolfram U Introduction to Calculus Course

<https://www.wolfram.com/wolfram-u/introduction-to-calculus/>

A comprehensive introduction to fundamental concepts in calculus, including video lessons and interactive notebooks. Follow along with the examples in the Wolfram Cloud and use the material to prepare for the AP Calculus AB exam. The course starts with functions and limits, followed by differential calculus and its applications, and then moves on to integral calculus and its applications. Problem sessions, exercises, quizzes and a sample exam are provided for self-paced assessment. Earn a certificate by watching all lesson and problem session videos and completing the quizzes with a passing grade.

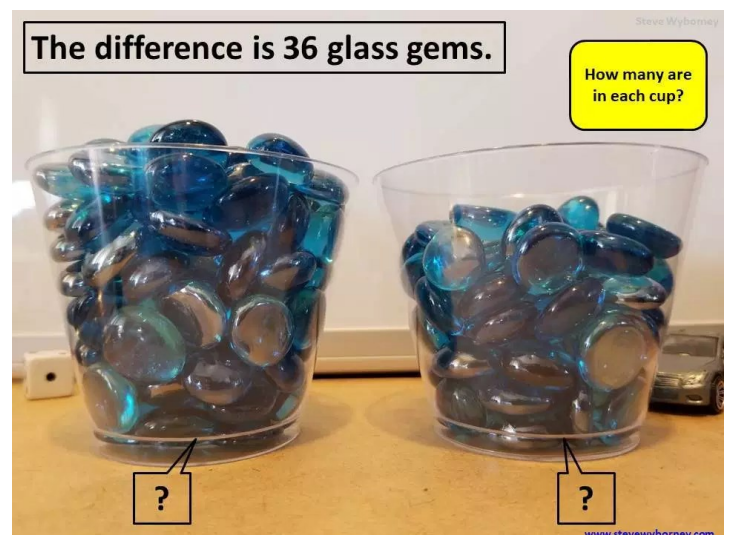


**Play with Your Math** - This website has a nice collection of interesting math problems and challenges. The authors of the site present engaging problems and activities in a way that is easy to understand.

Check them out at:  
<https://playwithyourmath.com/>

**The Estimation Clipboard from Steve Wyborney** - The Estimation Clipboard is a set of 40 lessons that each include 4 highly similar images. Each image provides an invitation to estimate. Then as new images are introduced, the students' context and intrigue will grow – and so will their excitement.

Visit Steve's web page:  
<http://www.stevewyborney.com/?p=1483>



# Familiar

By Heidi Fessenden (@heidifessenden) - Mathematics Coach in Boston, Massachusetts. Reprinted with permission from <https://tooteeter.blogspot.com/2018/05/familiar.html>

In recent months, I have occasionally seen one second grader, Wilfred, engaged in passionate mathematical discovery. At other times, I have seen him head down during math, tears dripping. In fact, he's cried during math a handful of times that I can think of. It rips me up inside each time.

This week, we've been working on two-part problems that involve adding two quantities, then figuring out how much more you need to get to 100. He has been dejected, overwhelmed, and tearful.

Today, though, he worked with his teacher and had more success. I walked in and could hear his teacher saying, "See, Wilfred, you CAN do it! Do you see that you can do it?"

I walked him to the bus this afternoon. "I heard you worked really hard and figured out some hard problems today!" I said as we made our way down the stairs.

"Yeah," he replied with a small smile.

"You know," I said carefully. "That's how math usually is. Usually, you can't just look at a problem and know the answer. You have to think about it and work hard to figure it out, maybe try some different ways, before you know the answer."

"Yeah," he said. Then, after a pause: "But not for all kids. Some kids just know the answer right away."

There it was. The thought I'd been fearing.

"Only if what they're doing is familiar," I said, reaching for a word we've used often this year instead of saying something is "easy" (thanks to Tracy Zager for that suggestion). "If they've practiced that kind of math a bunch before, they might know the answer right away. But only if they've had a lot of practice."

"No," he said dejectedly, refusing to give in to my arguments because of what he had seen with his own eyes. "Some of the kids in our class haven't had practice. But they still know the answer right away."

I stopped, crouched down on the hot blacktop, and looked him right in the face.

"The only reason kids know the answer right away is if they have had a lot of practice," I insisted. "They might not have had practice in school. Some kids have had more practice with math before they got to school, or when they're not at school. But NOBODY knows the answer right away unless it's familiar to them because they've practiced it. NOBODY is born just knowing the answer in math. Do you hear me?"

"Yeah," he answered, half resigned, half hopeful.

This is what some kids think, folks. They see other kids who know the answer right away, and they think: you're supposed to do that. If you can't do that, you can't do math. And now it's the end of May, and school is almost over, and that's what Wilfred thinks. He thinks he isn't good at math because he doesn't know the answer right away.

I go back in my memory to the mental image I have of Wilfred during one of our inclusion math lessons, when he was making arrays of cubes with 4 in each row. He was ecstatic when he told me that 72 was twelve groups of four and six more groups of four, and he was over the moon when I talked him through the multiplication equations that would show his discovery. There was no quick "knowing the answer" -- it was an hour of completely student-led exploration and discovery, driven by his own questions. It was one of the highlights of my year, and, I hope, of his. I'm holding out hope for more of those mathematical moments for Wilfred.



# Sidewalk Math

By Erick Lee (@TheErickLee), Halifax Regional Centre for Education (HRCE) Grades 7-12 Mathematics Consultant.



My son and I enjoy sidewalk chalk. During the Summer, we like to create sidewalk obstacle courses using chalk on the sidewalk in front of our house (some might call this computerless coding). The obstacle course challenges might ask passers by to twirl, touch your toes, stomp and roar, hop, or follow a line. It is a lot of fun to see neighbors participate and comment as the walk past our house.

Getting outside and using sidewalk chalk with math students can bring out the same energy and enthusiasm in all grade levels. You might ask students to use chalk to solve a few problems by creating a chalk number line or graph. You might ask students to create some mathematical art or geometric figures or constructions. You might also set up math stations or scavenger hunts for students to rotate through. When the weather cooperates, it is a great opportunity to get outside and incorporate movement into a classroom activity. It is also nice to share joyful mathematics with the school community.

If you search for the term “sidewalk math” on Twitter (you don’t need a Twitter account to do this) you’ll find lots of examples of teachers talking their classes outside to work.

If you search the hashtag #sidewalkmath on Twitter you will see additional examples and photos posted. You’ll probably see some photos posted by Brian Palacios (@\_b\_p) showing how he posts mathematical problems for the public around his community to publicly promote joyful mathematics. It can help the general public see mathematics in a new way and focus on fun and creativity. Brian presented a session this summer to a group of math educators about how he has created #sidewalkmath in his community and with his students.

Check out Brian’s blog post:  
<https://lazycho.com/2018/05/19/sidewalk-math/>

Jonathan Claydon (@rawrdimus) is another teacher that uses sidewalk chalk. He has an annual Sidewalk Chalk Day when he takes high school students outside to create math art on the sidewalks around his school. He has been doing this for a number of years.

Check it out here: <http://infinitesums.com/commentary/2018/sidewalk-chalk-seven>



<https://www.facebook.com/novascotiaMTA>



[https://twitter.com/MTA\\_NS](https://twitter.com/MTA_NS)

# The Aftermath: Second Chance Mathematics

By Nat Banting (@NatBanting), Saskatoon Public Schools Classroom Mathematics Teacher. Initial task adapted from “16 Boxes” available at <http://natbanting.com/resources/>

Most of the mathematical opportunities I design for my students are built with the goal of eliciting and defending mathematical choices. A large portion of task design is devoted to anticipating the mathematical choices students might make, and I always try to consolidate classroom activity with a review of student choices and justifications. I do this because I believe it is powerful for students to discuss and defend their actions, but the real payoff comes when they are asked to mobilize that experience by working with another task. It is in these second chances—the aftermath—that I observe their learning.

Typically, aftermath activities are more routine than the opening task. The initial activity unearths a large understanding and the students are expected to apply it during the aftermath. This might take the form of an exercise set. Alternatively, students might be asked to review the same task after conferencing with their classmates. This version of aftermath often results in students applying the method the class (often implicitly) deemed to be the most successful. Recently, I have made it my focus to infuse the aftermath with more student choice. That is, I want to avoid the quick distillation toward exercises or a simple mimicry of some optimum strategy. In other words, my goal is to follow a task with another that introduces novelty but retains familiarity.

This type of sequence often grants students another power or ability. With that power comes a new set of mathematical choices from which I can observe learning. During one such progression of tasks aimed at order of operations, students are presented with the following:

$$\boxed{\phantom{00}} \cdot \boxed{\phantom{00}} - \boxed{\phantom{00}} \div \boxed{\phantom{00}} + \boxed{\phantom{00}}$$

*I will roll a 10-sided die five times. After each roll, you must immediately place the result in a box (no changes; no substitutions). Your goal is to get the largest possible answer.*

The mystery of the die adds validation to multiple lines of reasoning, and it is entirely possible (probable, actually) that students will come up with valid mathematical justifications for different placements of numbers. It is my job to elicit those justifications. While writing this piece, I generated five random numbers between one and ten. The results (in order) were: 10, 1, 4, 5, 6. Two possible arrangements are shown below.

$$\begin{array}{ccccccccc} \boxed{10} & \cdot & \boxed{5} & - & \boxed{6} & \div & \boxed{1} & + & \boxed{4} \\ \boxed{6} & \cdot & \boxed{10} & - & \boxed{4} & \div & \boxed{1} & + & \boxed{5} \end{array}$$

After a class discussion about strategy, I might provide students with a set of ten order of operations exercises or ask them to verify the largest result possible from these rolls. Both of these are completely valid aftermath moves. However, in the interest of promoting extra mathematical choice, I attempt to introduce novelty by granting them a new

## The Aftermath: Second Chance Mathematics

*Continued from page 6...*

power or ability, yet retain familiarity by preserving task structure.

*You are now allowed to place one pair of parentheses in your arrangement. Where do you place them in order to make your result as large as possible?*

The students are granted a new power, and with it a new host of mathematical choices need to be made. However, the key idea of order of operations should continue to play a central role in their deliberations. The aftermath now contains a balance of novelty and familiarity and provides a new host of possible actions for the teacher to observe. Three possible parentheses placements for the first arrangement are shown below. Interestingly enough, one solution gets larger, one gets smaller, and one remains the same.

$$\begin{array}{c} \boxed{10} \cdot \boxed{5} - \boxed{6} \div (\boxed{1} + \boxed{4}) \\ \boxed{10} \cdot (\boxed{5} - \boxed{6} \div \boxed{1} + \boxed{4}) \\ (\boxed{10} \cdot \boxed{5} - \boxed{6}) \div \boxed{1} + \boxed{4} \end{array}$$

Both of these tasks can be easily adapted by providing new arrangements of boxes, re-rolling the die, or offering two pairs of parentheses to the student. I often shift tasks in the midst of classroom action, and these shifts are always prompted by a perceived opportunity to trigger further student choice. What we do in the aftermath of student activity is crucial because it provides occasions for students to mobilize new understandings and for teachers to observe their learning. A touch of novelty infuses the aftermath with further impetus to make and defend mathematical decisions.

In this spirit, I leave the following two tasks as the aftermath of this article:

*If you had the power to re-roll one result, which one would it be and why?*

*If the goal was to create the smallest possible result, how might you place the five rolls? Justify your answer*

### OAME Annual Conference 2019—May 16-18th in Ottawa, ON

The annual conference for the **Ontario Association for Mathematics Education** (OAME) is being held in Ottawa this May. Featured speakers include Nat Banting (author of the article presented above), Marian Small, Tracy Zager and Lisa Lunney Borden. The OAME is seeking both English and French proposals for submissions for OAME2019. Submissions will be accepted until November 15th so please consider sharing your expertise. For more information about the conference, visit the website at <https://oame2019.ca>. To submit a proposal for OAME2019, visit <http://oame.on.ca/MCIS/>.

# Adventures in Logic and Reasoning

## Suguru Puzzles

These puzzles look similar to Sudoku but the rules are quite different. The grid is subdivided into containers or cages, each of which is 1 to 5 cells in size. You need to fill each container with unique digits, counting up from 1. So for example a 2-square container contains the numbers 1 and 2. A 5-square container contains the numbers from 1 to 5. Adjacent (touching) cells may never contain the same number, and this includes diagonally adjacent cells.

Try the two Suguru puzzles below from the Krazydad.com website (<https://krazydad.com/suguru/>)

**Suguru #1**

4				5	
		4			
			2	3	
				5	
		1			

© 2015 KrazyDad.com

**Suguru #2**

2							
			3		5	4	
			5				
					5	3	
	5			4			
						2	
	1				3	5	

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*Suguru Puzzles reprinted with permission from Jim Bumgardner.*

## The Digital Century

*The question below comes from Amusements in Mathematics, by Henry Ernest Dudeney. One of two Dudeney books available for free at Project Gutenberg's repository of public domain e-books (<https://www.gutenberg.org/>)*

$$1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9 = 100$$

It is required to place arithmetical signs between the nine figures so that they shall equal 100. Of course, you must not alter the present numerical arrangement of the figures. Can you give a correct solution that employs (1) the fewest possible signs, and (2) the fewest possible separate strokes or dots of the pen? That is, it is necessary to use as few signs as possible, and those signs should be of the simplest form. The signs of addition and multiplication (+ and ×) will thus count as two strokes, the sign of subtraction (−) as one stroke, the sign of division (÷) as three, and so on.

Find Dudeney's solutions at: <https://bit.ly/2CzNIQf>



# Mathematics Contests and Competitions

## The Centre for Education in Mathematics and Computing (CEMC) Contests

(<http://cemc.uwaterloo.ca/contests/contests.html>) - The CEMC develops and administers many internationally recognized contests to help to inspire the next generation of students to develop an interest in and love for mathematics and computer science. The Pascal (Gr. 9), Cayley (Gr. 10), and Fermat (Gr. 11) are popular multiple choice contests that take place in February while the Gauss (Gr. 7/8) takes place in May.

## The Sun Life Financial Canadian Open Mathematics Challenge (COMC)

(<https://cms.math.ca/Competitions/COMC/2018/>) - The COMC is Canada's premier national mathematics competition that is open to any student with an interest in mathematics and a grasp of high school mathematics. Top performing students get invited to participate in the Repêchage or the Canadian Mathematical Olympiad (CMO).

**Purple Comet Math Meet** (<http://purplecomet.org/>) - A free, online competition for teams of 1-6 students. The contest, for junior high (20 questions in 60 minutes) or senior high (30 questions in 90 minutes) teams, can be written at any time within a one week window from April 2-11th, 2019.

**Caribou Mathematics Competition** (<https://www.cariboutests.com/>) – This is a world-wide online contest that is held six times throughout the school year. Contests can be started between 7:30AM and 3:30PM. Students are given 60 minutes to complete the contest.

## Nova Scotia Math Circles

Nova Scotia Math Circles is an elementary, junior and senior high school mathematics outreach program that is based out of Dalhousie University and currently receiving funding from Eastlink. The program is dedicated to enriching the experiences of Nova Scotia students in all areas of mathematics. Our vision is to foster

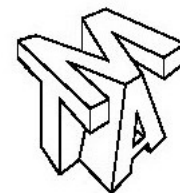
enthusiasm for mathematics through interactive, creative and meaningful presentations. Some of our presentations are related to curriculum outcomes and some that go beyond to introduce new areas of mathematics. Last year, we gave 285 talks to students from 50 schools in seven schools boards in Nova Scotia. Some of these schools were visited on several occasions or even had parallel sessions. The total number of students reached was 7429 students province wide!

Math Circles uses interactive activities to either introduce new topics or reinvigorate old ones. Some of the activities are hands-on and incorporate physical activity while others are focused on thinking problems and classroom discussions. The program website ([www.nsmathcircles.com](http://www.nsmathcircles.com)) contains detailed descriptions of our prepared presentations along with corresponding mathematics outcomes. Math circles staff can also create new presentations on request for specific topics or areas that you feel might interest your students.

Join in the fun today and contact us for ideas on how we can best serve your needs. We would love to coordinate with you and give a presentation to your school for FREE! Email our team at ([mathcircles@dal.ca](mailto:mathcircles@dal.ca)). For more information, check out our website ([www.nsmathcircles.com](http://www.nsmathcircles.com)) or contact the program director, Dr. Mayada Shahada via the email address ([Mayada.Shahada@dal.ca](mailto:Mayada.Shahada@dal.ca)).



# Nova Scotia Math Teachers Association Executive



Below are the current members of the NS MTA Executive. The membership and the positions of the executive may change at the Annual General Meeting held on Oct. 26th, 2018 at the MTA Provincial Conference.

Name	Position	Contact
Joe MacDonald	President	jamacdonald@nstu.ca
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## Special Projects

The MTA strives to give back to its membership by making funding available for special projects developed by classroom teachers. If you have an innovative math education project taking place in your classroom(s), MTA may be able to offer some financial assistance to help develop the project. Information on funding can be obtained by contacting any member of the Executive.

## Call for Contributions

**We are better together.** Mathematics Matters, the MTA newsletter, is looking for a variety of contributions from elementary and secondary teachers, math mentors and coaches, math support teachers and others who are interested in the teaching and learning of mathematics. Please consider sharing a favorite lesson or activity, a reflection or blog post, a book or technology review, or another work of interest to mathematics teachers in Nova Scotia and beyond. Sharing your ideas and reflections with other teachers is a great way to contribute to a vibrant and dynamic community of mathematics educators in our province.

*If you are interested in contributing, please contact me at [eplee@nstu.ca](mailto:eplee@nstu.ca). We look forward to hearing from you!*

The MTA Newsletter is published by the NSTU for the Mathematics Teachers Association, Erick Lee, Editor.  
The opinions expressed are not necessarily those of the Editor, the NSTU, or the MTA.