A message from the Executive Director, Tom Young

Four meets down, one to go! And then the State Tournament! Meet Four turned out to be a mixed bag: tough for some, easier for others. Wayzata posted one of the top 5 scores ever with a 128/136. A quick but not exhaustive search found Wayzata had a score of 130 in Meet One of November 2013. But as far as we researched, the best Meet ever was by Edina in Meet 2 of 2014 – 2015 with a score of 131! Amazing!

Division coordinators, we'd like to hear feedback from you regarding the contest and the problems. Use the Meet Op> Meet Feedback and help us improve!

Meet Five is right around the corner, February 8th. Sign up for time slots will start February 1st. I encourage teams to stay in their slot. We've got a good thing going that we don't want to mess up. Meet 5 will decide close section races in 6AAA, 8AA, 7AA, 6AA, 5AA, 4AA, and 3AA. It's down to the wire!

Note the information concerning the State Tournament. *It will be online this year!* Plans are being made to hold the State Tournament via Zoom or like product. To help practice the uncharted waters of holding an online state tournament, **we are holding the Invitational Event a week before the tournament on Monday, March 8th, from 4:00 to 5:30.** The Invitational Event includes the top 50 students in the state, individual division winners, and other top state students. Students and their coaches will be notified if they qualify. *Students and coaches that think they will qualify should reserve that time now*. More details will follow after Meet Five.

The State Tournament itself will be held in the morning on **Monday, March 15th**. Exact times and details will be sent out after Meet Five. **We do plan to hold the Math Bowl online on Monday, March 15th.**

We have at least 3 t-shirt design submissions. And don't forget to enter the video contest for cash prizes!

Check out the third entry of our continuing series highlighting previous Math Leaguers. **If you know of a former student that would like to share their experiences, pass their name along.**

And don't forget to tell your students about the opportunity to participate in the ZIML Online Competition for free for the rest of the school year!

Go Math Team!   *P.S. Look for hints to Meet 5 later in the newsletter!*
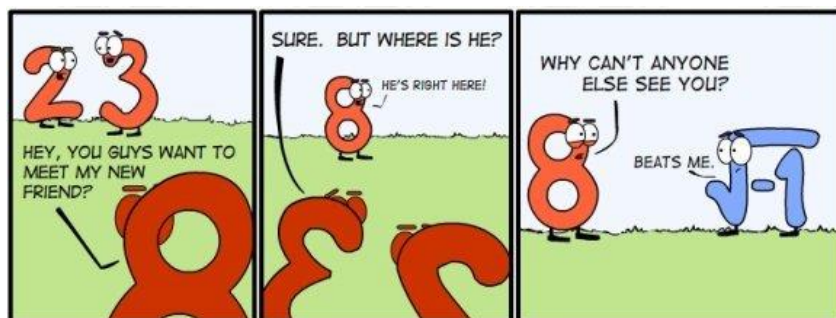
Meet Four was another success! Most students wrote integer answers for their solutions. Students should note that they ***do not have to include units*** in their answers. All they have to do is ***enter the integer in the text box.***

As a reminder, here are the conventions we are using this year:

Two expressions have been used extensively throughout this years' problem sets.

> ***"… can be written as $a\sqrt{b}$ where b is square-free. Determine the value of a + b"***
>
> *For b to be "square-free", it cannot have factors which are square numbers (other than 1). For example, as in the past, an answer of $\sqrt{12}$ would be unacceptable and students would have had to convert it to $2\sqrt{3}$ to receive credit. This year the student must still convert but the student must submit the answer 5 to receive credit. (N.B. If $\sqrt{b}$ cannot be simplified, the problem would state "… can be written as $\sqrt{b}$, where b is square-free." And the answer to submit would be b)*

"… can be written as $\frac{p}{q}$, where p and q are relatively prime integers. Determine the value of p + q."

> *For example, as in the past, an answer of $\frac{6}{8}$ would be unacceptable and students would need to simplify it to $\frac{3}{4}$ to receive credit. This year the student must submit the answer 7 to receive credit.*

There is an area of caution with this type of fraction formatting of which all students should be made fully aware:

<u>***Negative Rational Answers***</u>

> *Although we all know that $-\frac{p}{q} = \frac{-p}{q} = \frac{p}{-q}$ in order to create a unique answer, all students should be made aware that for this competition, the negative sign MUST be assigned to the numerator and NOT to the denominator.*
>
> *So if the answer is $-\frac{3}{5}$ the student must submit the answer 2 to receive credit and if the answer is $-\frac{5}{3}$, the student must submit the answer – 2 to receive credit.*

We finally come to the last meet of the season. It is usually the toughest meet of the season, so I thought I would offer few hints:

Event A are puzzle problems, often with a variety of ways of solving them. One problem is a base arithmetic problem. Usually, bases are positive integers greater than 1. But what happens if the base is a negative integer?

In Event B, three of the problems deal with the ratio of the areas of two triangles … so brush up on your triangle area formulas.

in Event C, two of the problems deal with selections or combinations while the other two require a unique way of counting.

I would often tell my students, tongue in cheek, that Event D is the easiest event of the year because you know all the problems and how to solve them! All you need to do is study the problems **and** solutions from last year's AMC 12A and 12B. You should be able to find them on **The Art of Problem Solving** web site. Problem 1 is usually taken from problems 1 through 5; Problems 2 and 3 are usually adaptions of problems 6 through 10; and Problem 4 is a variation of a problem numbered 11 through 15. The Team Event contains a problem from 16 through 21. Sometimes it is very easy to pick out which problems could have easy variations (like changing a number) … focus on them!

Finally, the Team Event has at least one problem that could have been included in each of the Individual Events. Three problems come from Event B.

Good luck to all!

Minnesota Math League students can participate in the ZIML Competitions for free for the rest of the school year!! Here are the instructions:

To enroll in the contests, students will need to create a free account on the site zim.areteem.org, if they don't have one already. Once they are logged in, they can go to the "Monthly Contests" page (https://ziml.areteem.org/ziml/monthlycontests.php) and choose which division they want to register for.

Once in the division page they will be asked for a payment method OR an enrollment key; they can use enrollment code MNMLSp2021 in the box below that says "Enroll using an enrollment key", so no payment information is necessary. If a student wishes to participate in more than one division, they need to repeat these steps for each division.

Then, on the weekend of the contest, they need to go back to the contest page and the contest quiz will be available. Students can participate any time during the weekend (Friday at 00:01 to Sunday 23:59), but once they start the quiz the timer will give them one hour to finish.

The code we provided you is valid for all remaining monthly competitions for the current school year. They will need to follow the above steps each time to register.

In addition to the monthly competitions, students can find daily problems of various levels (the Daily Magic Spells), as well as all past AMC 8, 10, 12, and AIME tests for practice.

Zoom International
Math League

ZIML

The Impact of Math Team

The call went out last summer to Math League alumni to Share Your Story. Here is one alumnus who shared:

Winston Fu

1984 Graduate of Highland Park HS

Undergraduate Degree: BS in physics at MIT
Graduate Degree: PhD in physics at Stanford

Currently works as : Venture Capitalist (LDV Partners)
Was Entrepreneur and co-founder of Vixel Corp

The impact of Math Team on my life and learning:

When I was growing up, my parents held education in high esteem. It was our way out of our modest socio-economic class. Math and science were held in the highest esteem, so I sought as many opportunities related to math as I could. I loved math partly because I was pretty good at it and partly because English was my second language and math was a universal language. There were few opportunities back in the 1980s for advanced math coursework in high school. I couldn't believe it when one of my math teachers said my high school, Highland Park in St. Paul, was going to participate in the MN Math League for the first time. It felt pioneering despite the jokes from my friends who were too cool to be on the math team.

I was in high school during the early 1980s: well before it was cool to be nerdy, before the Internet, well before Big Data, and Artificial Intelligence was essentially science fiction.

It was interesting to see who showed up for the Math Team because it was not cool, but it was cool to see a strong showing from the senior class when I was a sophomore for the inaugural Math Team at Highland Park. It was nice to have team members who valued and loved math. I wish I would have appreciated the comradery within my team and also tried to get to know the participants from other schools during the journey.

Math Team taught me how to be a better competitor and how to handle pressure. I remember doing well as a sophomore because there was no pressure on me as an underclassman. I put so much pressure on myself as a junior that I "choked" during the competitions. Well, I learned to handle the pressure better my senior year, which helped to build my confidence for other situations later in life. It wasn't until years later that I learned while playing and coaching volleyball that "choking" is part of the process of learning to handle pressure. Our society focuses on the negative and dramatic part of "choking" in competitions, but if you are teaching someone how to perform under pressure, it is helpful to view it from a positive perspective. In order to have an opportunity to "choke", one needs to actually have enough skill to come close to achieving one's goal(s). Therefore, the work that needs to be done is about handling the pressure, and it's not about building more fundamental skills.

As much as I loved math, my father wanted me to become an engineer. My first engineering class at Harvey Mudd was a disaster. The instructor did not believe in partial credit and was not really into teaching. Thus, I compromised with physics. I was good at physics in large part because I was good at math. The mathematical representation of a physical principle was as illuminating to me as the verbal explanation of the principle. I went on complete my undergraduate degree in physics from MIT and a PhD in physics from Stanford University. My math skills were useful also in business school at the Kellogg School of Management at Northwestern University. As I was finishing my dissertation at Stanford, I became a co-founder of a company called Vixel Corporation, which went public in 1999. I became a venture capital investor subsequent to being an entrepreneur. My firm backs many entrepreneurs who are mathematicians, engineers, scientists, machine learning programmers – essentially people who are great at math.

I hope the fact that there are lots of job openings for data scientists, machine learning experts and software engineers makes recruiting for Math Team easier today. I hope my story helps to motivate students. Even today, I see social biases of expectations for math proficiencies based on gender and an overall underappreciation of math in the US.

A big thanks to all the teachers who have dedicated their extra time to helping kids love math.

Future Alumni Stories

Evan Erickson, a homeschooled junior, competed with a team from Canada/USA Math Camp in three of the US Math Competition Association affiliates this season. They scored 7th at MMaths, 6th at the Duke Math Meet, and 10th at the Caltech Harvey Mudd Math Competition. Each win qualified them for the National Championship in May.
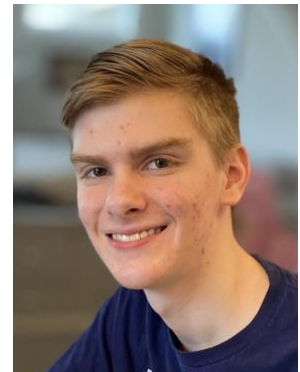
Evan Erickson

Evan's in his second year as assistant coach to Tom Sebo of the Stillwater Middle School Math Team. The team qualified to MathCounts State last year.

Evan and Minkai Li (junior, Woodbury) organized a free online middle school math camp last summer for 90 registered and an average of 60 daily students. They plan to hold it again this summer. They recruited other all-state team members to help as teaching assistants, including Michelle Cao, Kenneth Chen, Matthew Chen, Linden Li, Aurora Wang, Leo Witzke, Kevin Yang, and Emma Zheng.

Minkai Li

The camp's website is: https://minkaili64.wixsite.com/mnmoc.

Summer Coaches Conference 2021
Date: TBD

Last summer, we had to postpone our 40-year celebration due to the pandemic. Hopefully we will be able to hold a celebration this August honoring our new Hall of Famers and toasting to another 40 years!

2021 Summer Math Institute
Dates TBD at Augsburg University

The League hopes to offer two one-week programs of the Summer Mathematics Institute in 2021.   The pandemic will shape our decision; we think we can offer the program, but perhaps not a residential one.

One would be for students entering grades 7-9 in fall of 2021. **The topic would be Knots! and taught by Annie Perkins.**
The other would be for students entering grades 10-12 in fall of 2021.   **The topic would be Probability Theory in Math League and the AMC and taught by Ken Suman.**

Stay tuned!!

The Roberts Award Scholarship

The Roberts Award Scholarship(s) were established in honor of the League founder, Dr. Wayne Roberts of Macalester College.

The Scholarship(s) are offered to help offset the costs for students interested in attending an out-of-state math opportunity. They are offered once each year. A set amount of funds will be available each year, and multiple awards are possible.
Deadline to apply for this season is April 30, 2021

Applications can be found on our web site at: http://mnmathleague.org/?page_id=1033

2020 – 2021 State Tournament will be Online

Plans are being made to hold the State Tournament via Zoom or like product. To help practice the uncharted waters of holding an online state tournament, **we are holding the Invitational Event a week before the tournament on Monday, March 8th, from 4:00 to 5:30.** The Invitational Event includes the top 50 students in the state, individual division winners, and other top state students. Students and their coaches will be notified if they qualify. *Students and coaches that think they will qualify should reserve that time now*. More details will follow after Meet Five.

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MN State High School Math League Math Team Video Contest

1st place: $200 to school's math team
2nd place: $150 to school's math team
3rd place: $100 to school's math team

Video Guidelines:

Produce a 90 second video explaining why you like to be involved in the Math League. Videos might include: student interviews, teacher endorsements, sample problems, or video of practices/meets.

Video Entry Submission:

**Videos are due to the Math League Office
(mathleague@augsburg.edu)
by *March 1st, 2021*.**

- **Videos contest entries must be sent and approved by the school math team coach.**
- **Winning schools will be notified by March 6, 2021.**
- **Winning videos will be shown at the State Tournament on March 15, 2021, uploaded to the Math League Facebook page, and may be used for other promotional purposes.**

Questions? Email mathleague@augsburg.edu

Common Meet Protocols

Coaches can give credit if:
- the student includes units in the answer. (e.g. 6 degrees when the answer should be 6)
- there is an issue like adding a space to the answer (SPACE 6 instead of 6).
- the student writes something akin to x = 6.

All other discrepancies should be challenged. For instance, coaches should **not** give credit to mistyped answers even if the students have the correct answer on their scratch work.   Challenges regarding incorrectly typed answers were denied unless there were issues with the computer system not working.

Students should be reminded that all answers are integers.
> Also, the students should be told how the computer system registers their answers. The textbox for submitting the answer is blank when the event starts. When students enter an answer, the textbox turns yellow. (NOTE: this is a change in the color) When they click away from that textbox, it will turn white and the answer should stay displayed. This indicates that the system has registered their answer. When students finish the event, only then should they hit submit. If they hit submit before they are done, they are locked out. When the 15-minute time limit expires, answers are automatically submitted. Students do not have to hit submit if they are timed out. Students that ask to enter an answer after the time limit expires, claiming that they didn't get a chance to enter their answer, should not be allowed to challenge that.

Students should be reminded that calculators are not allowed on individual events.
> When auditing student responses, we noted instances of answers like 3.6 E–15. That is worrisome. One coach remarked that we are actually only "wink, wink" enforcing that rule. That is **not** our position. We see this as an opportunity to show students that ethical behavior is valued. It is up to each coach to monitor their students and help them see the value in maintaining the integrity of the process.

Even if coaches verify results, mistakes will be made.
> We are able to see all the answers submitted for a particular problem. Coaches missed correct answers and didn't give the student credit and, on the flip side, gave credit when it shouldn't have been given. We sent emails to those coaches noting the discrepancies. We will do this for each meet to make the scores are as accurate as possible.

Certain online calculators are allowed on the team event.
> Some students argued that since they are in distance learning mode, they cannot access their school's calculators and therefore should be allowed to access online calculators. We feel that students can use the calculators at http://minnesota.pearsonaccessnext.com/stand-alone-calculators/ during the team event.

Zoom-like tools are allowed on the team event.
> Teams can use the share screen, or other Zoom-like tools when they are working as a team. However, if the meeting platform contains a calculator, it cannot be accessed.

Newsletter 22 Puzzler:

What is the longest sequence of *distinct* numbers between 1 and 99 [inclusive] you can find such that if X immediately follows Y then either X divides Y or Y divides X?

For instance: 1, 5, 10, 20, 40, 8, 16, 4, 12, 24, 3, 9, 18 is such a sequence with 13 terms.

submitted to seqfan list-serv 12/26/2020 by Peter Luschny from "Xmas-challenge from Thien An."

Solution from the Online Encyclopedia of Integer Sequences (OEIS) A337125

The sequence contains 76 integers. Here is one possible answer

93, 31, 62, 1, 87, 29, 58, 2, 92, 46, 23, 69, 3, 57, 19, 38, 76, 4, 68, 34, 17, 85, 5, 35, 70, 10, 50, 25, 75, 15, 45, 90, 30, 60, 20, 40, 80, 16, 64, 32, 96, 48, 24, 12, 6, 78, 26, 52, 13, 91, 7, 49, 98, 14, 56, 28, 84, 42, 21, 63, 9, 81, 27, 54, 18, 36, 72, 8, 88, 44, 22, 66, 33, 99, 11, 55

New Puzzler:
from ZIML Math Competition Book Varsity Division 2018 – 2019 January 2019 problem 6

In Δ ABC, ∠ BAC = 30°, ∠ ABC = 50°.   Let Point P be in Δ ABC, such that ∠ BAP = ∠ ABP = 20° as shown in the diagram. Find the measure of ∠ BPC in degrees.