



## A message from the Executive Director, Tom Young

Wow! What a year 2020 has been! It has been a tumultuous year on many fronts, especially with the pandemic turning education upside down and, by association, our Math League meets. So much has happened since the last newsletter.

You will see many updates throughout the rest of the newsletter:  
a recap of last spring's State Tournament,  
and a recap of the October Coaches' Conference,

Pay particular attention to a review of the standard procedures for holding online meets. We want to make sure everyone is following the same protocols. *And look for hints to Meet Two!*

I have said this before, but it bears repeating: I am impressed with the commitment to bringing extra-curricular math to Minnesota students! From Associate Director Dana Koletar, to Head Problem writer Tom Kilkelly, to Web Guru Gary Kannel, to President Stacy Paleen, to the members of the Executive Committee, to all the coaches in 165 schools, and to the people I'm sure I missed, I tip my cap to you!



Theif River Falls from Meet 1, 2020



Alexander Zhu and Timothy Alexander



Jason Wang, David Zhang, Ryan McGregor



St. Croix Lutheran, Class A Champs 2020



Tech HS, Class AA Champs 2020



Wayzata HS, Class AAA Champs 2020

### A message from Tom Kilkelly, Head of the Problem Writing Team

Meet one was a 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:*

#### Negative Rational Answers

*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.*

In Meet One, there was a challenge as to the definition of relatively prime integers. One student argued that  $\frac{-12}{-5}$  had two integers that were relatively prime and, therefore,  $-17$  was the answer. That challenge was denied. Relatively prime integers can only have a common factor of 1.

Good luck to students on Meet Two. A prepared student will have studied absolute value equations, Ceva's theorem, and be able to expand  $\sin(4x)$ . Good luck!

## 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 Number Theory in Math League and the AMC and taught by Ken Suman.**

Stay tuned!!

# Summer Coaches Conference 2020

**Date: October 3<sup>rd</sup>, 2020**

Coaches convened via Zoom for a session on conic sections given by Executive Director, Tom Young. Copies of the PowerPoints, which can be freely used, can be found at the scoring website, [scoringmnmthleague.org](http://scoringmnmthleague.org). Click on Coaches Corner > Topic Resources > Meet 4D Conics.

Also, coaches were trained in the usage of the online system and how to run a meet. The PowerPoint on changes for 2020 can be found at the scoring website: [scoringmnmthleague.org](http://scoringmnmthleague.org). Click on Coaches Corner > Intro > Changes for 2020.

# 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 next summer honoring our new Hall of Famers and toasting to another 40 years!

## Recap of Math League State Tournament 2020

Fortunately, and heeding advice from the State Department of Health, we were able to hold the state tournament in person. By our reckoning, we were the last State Tournament in any activity or sport in 2020! Here are the team results

1 Wayzata HS	Southwest Suburban AAA	107	554
2 Century HS	Big 9 AAA	104	512
3 St. Paul Academy	Tri-Metro AAA	104	484
4 Mounds View HS	North Suburban AAA	100	453
5 Minnetonka Senior HS	Southwest Suburban AAA	92	489
1 Tech HS	Central Gopher AA	65	357
2 Sartell HS	Central Gopher AA	62	290
3 Mankato West HS	MN Valley AA	56	270
4 International Sch MN/Eagle Ridge	Canterbury AA	55	284
5 Highland Park HS	St Paul City AA	51	297
1 St. Croix Lutheran HS	Tri-Metro A	68	276
2 Breck	Southwest Suburban A	52	228
3 Holy Family Catholic High School	Canterbury A	39	194
4 Parnassus Preparatory School	North Suburban A	32	191
5 Fairmont HS	MN Valley A	31	169

Photos from the state tournament can be found at [https://www.amazon.com/photos/shared/l2S\\_ETUuSFWQMcdzVv8uDA.q3\\_0\\_s3BVqB8nt57SsbUIS](https://www.amazon.com/photos/shared/l2S_ETUuSFWQMcdzVv8uDA.q3_0_s3BVqB8nt57SsbUIS)

# Common Meet Protocols

Coaches must verify each student's score, and mark team done with each event.

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  $3.6 \text{ E}-15$ . 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.

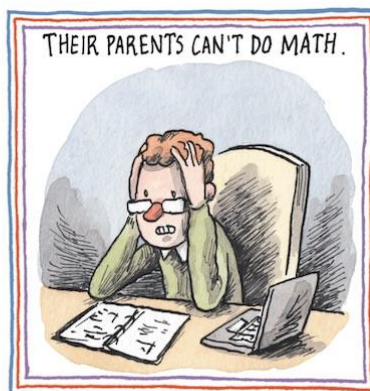
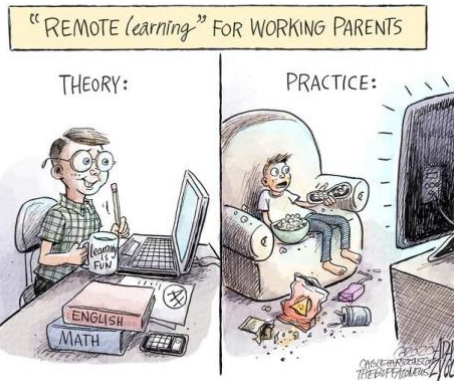
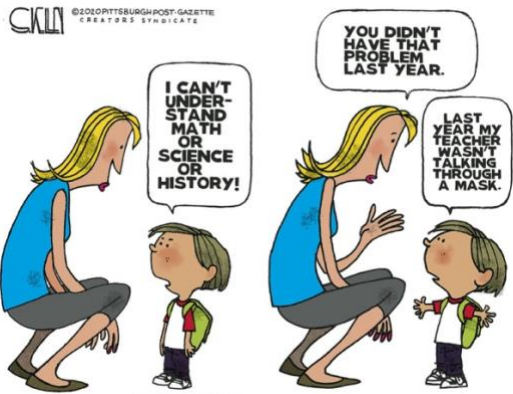
# The Roberts Award Scholarship

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](http://mnmathleague.org/?page_id=1033)



## Newsletter 19 Puzzler

### Problem Corner

an effort to spur conversation

If you'd like to contribute a problem or send in a solution, email [tomyoungmathman@gmail.com](mailto:tomyoungmathman@gmail.com)

Student solutions encouraged!

Prove that  $x^3 + y^3 = 3$  is unsolvable using integers for  $x$  and  $y$

**Solution:** Many different solutions were submitted. However, they were lost in an email transition. Our apologies!

Here is one method of solution:

By factoring,  $x^3 + y^3 = 3$  becomes  $(x + y)(x^2 - xy + y^2) = 3$ .

If  $x$  and  $y$  are integers, then the two factors  $(x + y)$  and  $(x^2 - xy + y^2)$  must be integers. The only possible integers that multiply to 3 are 1 and 3, 3 and 1, -1 and -3, or -3 and -1.

So, a case-by-case examination can prove  $x$  and  $y$  can't be integers.

For instance, the factor  $(x + y)$  could equal 1 which implies  $(x^2 - xy + y^2)$  must equal 3.

If  $x + y = 1$ , then  $y = 1 - x$ .

$$\begin{aligned} \text{Substituting yields } \quad & x^2 - x(1 - x) + (1 - x)^2 = 3 \\ & x^2 - x + x^2 + 1 - 2x + x^2 = 3 \\ & 3x^2 - 3x + 1 = 3 \\ & 3x^2 - 3x = 2 \\ & x^2 - x = \frac{2}{3} \quad \text{which is impossible if } x \text{ is an integer} \end{aligned}$$

Similar arguments for the other 3 cases show  $x$  and  $y$  can't be integers.

**NEWSLETTER # 20 PUZZLER:** (from <http://www.qbyte.org/puzzles/puzzle01.html>)

### 2. Triangular area ★★

In  $\triangle ABC$ , produce a line from  $B$  to  $AC$ , meeting at  $D$ , and from  $C$  to  $AB$ , meeting at  $E$ . Let  $BD$  and  $CE$  meet at  $X$ . Let  $\triangle BXE$  have area  $a$ ,  $\triangle BXC$  have area  $b$ , and  $\triangle CXD$  have area  $c$ . Find the area of quadrilateral  $AEXD$  in terms of  $a$ ,  $b$ , and  $c$ .

