A message from the Executive Director, Tom Young

Happy New Year! I hope you enjoyed your holiday break.

Our season is more than halfway over! Meet three went well. Our change to sections seems to be creating new rivalries – most all sections are very much up in the air as to the eventual champions.

We are already looking forward to meets 4, 5, and the state tournament. The state tournament will be here sooner than you think.

Here are some things that you (especially division coordinators) can do to make meets four and five run smoothly:

1. be most prompt in getting your challenges in to Dana Koletar so that I and Tom Kilkelly can make rulings. Challenges should be registered by noon Tuesday. This will be especially important after meet 5. After meet five, our goal is to get all challenges ruled by Wednesday and then get teams invited to the state tournament by Friday, February 15th.
2. Division coordinators should always mark the meet finished once all scores are entered, even if there are challenges. That gives us the signal that you are done, pending changes due to challenges. We can fix scoring changes even if the division scoring is closed.

Mark your calendars now for the two summer activities that we coordinate: *The Summer Math Institute and the Coaches Conference.* **SMI runs the week of June 23 – 28** and the **Coaches Conference is July 11 and 12.** *See more information on these later in the newsletter.*

Another two items to look for: At the state tournament we will be awarding prizes for best t-shirt design and for best Math League promotional video. *See more information on these later in the newsletter.*

And another item to look for: We give the AMC 10 and AMC 12 to students whose school does not. See article for registration information.

Go Math League!   **PS: Competitive coaches and students should read Tom Kilkelly's column!!!!!!!**

Meet Three photos from the Metro Alliance Division

Benilde-St. Margaret's getting ready

Columbia Heights gathering energy

Potential T-shirt Design Winner

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

The problem writers are sorry for the oversight on problem B1 of Meet 3. The alternate answer, challenged by 41 students, was actually part of our solution but not given as an alternate answer. **Thank you to all graders and coaches** who followed the leagues challenge policy.

As a coach I always found that preparing my students for Meet 4 was the biggest challenge of the season. Although the topics were known to the students, there were so many formulas and theorems in each event that needed reviewing.

In Event A, although the difference of squares is well known and practiced, oftentimes the sum and difference of cubes were not so familiar.

Similarly **in Event B**, theorems for cyclic quadrilaterals, formulas for the volume of a cone, and relations between measures of arcs and angles need refreshing.

Event C requires reviewing the formulas for the sum of an infinite geometric sequence and the sum of the first n counting numbers, the binomial expansion theorem, and the notations $f(x)$ and $f^{-1}(x)$.

In Event D students need to know the standard equations for each of the conics and review the relationships between a, b, and c in each case, and *the area of an ellipse*.

Hopefully you and your students will be able to review the topics listed above before coming to Meet 4.

2019 Summer Math Institute
June 23 – 28, 2019 at Augsburg University

Spread the word!

7 – 9 Mathematics and Art
Taught by Annie Perkins, Southwest HS

10 – 12 Theory of Equations

The League will offer two one-week programs of the Summer Mathematics Institute in 2019. Both programs run the same week in June June 23-28, 2019. One is for students entering grades 7-9 in fall of 2019 and the other is for students entering grades 10-12 in fall of 2019.

Students will investigate mathematical topics not typical taught in the regular high school curriculum in preparation for secondary mathematics competitions.   For grades 7 – 9, the area of study will be Mathematics and Art. For grades 10 – 12, the area of study will be Theory of Equations.

These are both one week residential opportunities. Both programs are located at Augsburg University in Minneapolis. **Application deadline is April 15, 2019 or until the camp is full.** Returning students are eligible for a $25 discount. Cost is $600. Tuition includes room and board and a field trip experience. Check http://mnmathleague.org/?page_id=444 later in January 2019 for an application.

Email mathleague@augsburg.edu with questions.

More Pictures from the Metro Alliance Division at Meet Three

Cheers from Friendly Fridley

Sublime St. Anthony students

Providence Academy – Practically Perfect in every way

Orono – math, soccer, cards – they do it all!

Mound Westonka – miles of smiles

We say THANKS to the dedicated coaches

More Teacher Tidbits

Teachers recommend these web sites; check them out!!

Class Pad by Casio   https://classpad.net/us

Dan Meyer's 3 ACT Math Tasks   https://whenmathhappens.com/3-act-math/

Free Self-Paced Quizzes   https://quizizz.com

Remind App: A way to communicate with students and parents   https://www.remind.com

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, 2019

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

You can take the AMC 10 or AMC 12 at Augsburg through the Math League

Math League now offering AMC 10 and 12 Competitions!

The MN State HS Math League will be offering the AMC 10 A and B and AMC 12 B to students whose school does not offer the test. The AMC 10 A is Thursday, February 7th and the AMC 10/12 B is Wednesday, February 13th. Tests will be $10.00 per person. Tests will be given at Augsburg University in Minneapolis from 4:00-5:30 PM. Maximum number of students per test is 10. A wait list will be kept if more than 10 per test register.

Email mathleague@augsburg.edu for a registration form.

More information on the AMC tests

Don't Forget to enter this Contest!

There's money to be made! Calling all schools to produce a 90 second video explaining why you like to be involved in the Math League. Student interviews, teacher endorsements, sample problems, or video of practices/meets are all possible components of such a video. Videos are due to the League Office (mathleague@augsburg.edu) by March 1st, 2019. Videos must be sent by, and approved by, the school math team coach. A committee will decide the winners and the winning videos will be shown at the State Tournament.

First prize: $200 to the math team at winning school
Second Prize: $150 to the math team at 2nd place school
Third Prize: $100 to the math team at 3rd place school

Spread the word!

And Don't Forget this Contest!!

State Meet T – shirt Design Contest returning!

Each year, the league provides t-shirts for sale to the tournament participants. Do you want to design the t-shirt for the 2019 State Tournament?

If so, the one-color design should include these words: "MN State High School Math League", "State Tournament", and "March 11, 2019".

Your one-color design should be emailed to mathleague@augsburg.edu in pdf file format by February 4th, 2019. Include name, grade, and school in your email submission. Winner will be notified by February 11th, 2019. The prize? A $50 VISA gift card

follow us on Facebook "Minnesota State High School Mathematics League" @MNSHSML and Twitter @MNHSMathLeague

No solution to the problem from Newsletter 9 (which was the same as the problem from Newsletter 8!) was submitted. Here's my attempt at the answer. Do you think it's right?

Lewis & Clark College
Department of Mathematical Sciences

Problem of the Week #1 (Spring 2018)

Let $x_1, x_2, \ldots, x_{2018}$ be positive integers. Find the smallest possible value for the quantity

$$(x_1 + x_2 + \cdots + x_{2018}) \cdot \left(\frac{1}{x_1} + \frac{1}{x_2} + \cdots \frac{1}{x_{2018}}\right).$$

Please justify your answer.

Solution: When stumped, I implement the "examine a smaller case" technique.

$$(x_1 + x_2)\left(\frac{1}{x_1} + \frac{1}{x_2}\right) = 2 + \frac{x_2}{x_1} + \frac{x_1}{x_2}$$ which is 2 plus 1 fraction and its reciprocal $= n + {}_nC_2$ fractions $+ {}_nC_2$ reciprocals

$$(x_1 + x_2 + x_3)\left(\frac{1}{x_1} + \frac{1}{x_2} + \frac{1}{x_3}\right) = 3 + \frac{x_2}{x_1} + \frac{x_1}{x_2} + \frac{x_2}{x_3} + \frac{x_3}{x_2} + \frac{x_3}{x_1} + \frac{x_1}{x_3}$$ which is 3 plus 3 fractions and their reciprocals

$$(x_1 + x_2 + x_3 + x_4)\left(\frac{1}{x_1} + \frac{1}{x_2} + \frac{1}{x_3} + \frac{1}{x_4}\right) = 4 + \frac{x_2}{x_1} + \frac{x_1}{x_2} + \frac{x_2}{x_3} + \frac{x_3}{x_2} + \frac{x_3}{x_1} + \frac{x_1}{x_3} + \frac{x_4}{x_1} + \frac{x_1}{x_4} + \frac{x_3}{x_4} + \frac{x_4}{x_3} + \frac{x_2}{x_4} + \frac{x_4}{x_2}$$

So, the supposition is that:

$$(x_1 + x_2 + x_3 + x_4 + \ldots + x_n)\left(\frac{1}{x_1} + \frac{1}{x_2} + \frac{1}{x_3} + \frac{1}{x_4} + \cdots + \frac{1}{x_n}\right) = n + {}_nC_2 \text{ fractions} + {}_nC_2 \text{ reciprocals}$$

A fraction and its reciprocal have a minimum sum if both are equal to 1. Therefore to minimize the total sum, all x_n must $= 1$.

Therefore the answer to the question is $2018 + {}_{2018}C_2 + {}_{2018}C_2 = 2018 + 2035153 + 2035153 = 4072324$

New Problem: Find the formula for the pattern described by OEIS A165217