Minnesota State High School Mathematics League

Newsletter

Issue #18 January 27, 2020

A message from the Executive Director, Tom Young

The year 2020 is here! In fact, by the time meet 5 comes around, it'll be 1/12 over. We have some great sectional races yet to be decided: Sections 1A, 6A, 1AA, 3AA, 8AA, and 3AAA are up for grabs. And the Canterbury, Metro Alliance, MN Valley, and Rum River divisions are not over. Good luck to the teams!

You'll notice we have set the dates for the Summer Math Institute and Coaches Conference.

SMI: June 28 – July 3 at Augsburg

7 – 9 *Knots!* taught by Annie Perkins and Megan Schmidt
10 – 12 *Number Theory in the Math League and AMC* taught by Ken Suman

Coaches Conference: July 9 and 10 at Augsburg

40th Year State of the State: An examination of our rules and events

I encourage you to participate in both! I also encourage you to read the rest of the newsletter, paying special attention to: ***the hints about the next meet*** from Tom Kilkelly, the ***Video Contest***, and the ***State Meet T-Shirt Design Contest***.

Hiawatha Division Pictures from Meet 4

Coaches

Rochester Lourdes

Stewartville

Lake City

Cotter

Red Wing

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

Mathematics is often thought as being a universal language, but we have seen several examples this year where notation different from ours is used in other countries.

For example, $(\leftarrow, a]$ is equivalent to our $(-\infty, a]$

2 314 is equivalent to our 2,314

3,142 is equivalent to our 3.142

and log x is equivalent to our ln x.

Our solutions will always use common U.S. notation, but challenges can be made if a student uses a different notation.

In Meet 5 several specific number patterns are named although they don't specifically appear anywhere in the list of topics to be covered. All students should be familiar with the following sets of numbers:

Fibonacci Numbers (1, 1, 2, 3, 5, 8, 13, 21, …),

Square Numbers (1, 4, 9, 16, 25, 36, …),

Triangular Numbers (1, 3, 6, 10, 15, 21, …),

and Prime Numbers (2, 3, 5, 7, 11, 13, …)

Event D in Meet 5 is variations on problems from the 2019 AMC 12A and 12B exams. Studying the solutions to the first fifteen problems from each exam will greatly improve your chances of scoring a perfect seven on this event! It could also improve your team's score on the Team Event!! (The problems and solutions to these exams can be found on the Art of Problem Solving website.

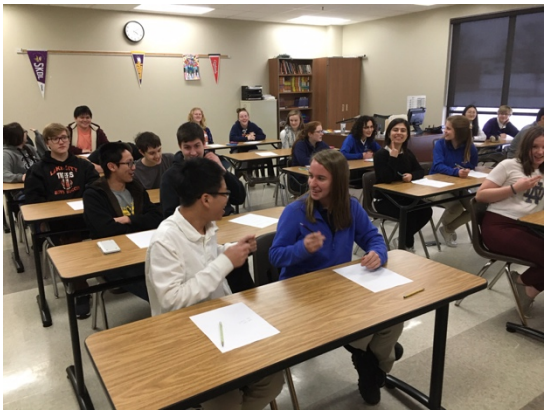
https://artofproblemsolving.com/wiki/index.php/2019_AMC_12A

https://artofproblemsolving.com/wiki/index.php/2019_AMC_12B

GOOD LUCK ON MEET 5!

More pix from meet 4 from Hiawatha Division

Rochester Lourdes HS



Hiawatha Students in action

2020 Summer Math Institute

June 28 – July 3, 2020 at Augsburg University

The League will offer two one-week programs of the Summer Mathematics Institute in 2020. Both programs run the same week: June 28 – July 3, 2020.

One is for students entering grades 7-9 in fall of 2020. **The topic will be Knots! and it will be taught by Annie Perkins and Megan Schmidt.** The other is for students entering grades 10-12 in fall of 2020. **The topic will be Number Theory in Math League and the AMC. It will be taught by Ken Suman.**

These mathematical topics are not typical taught in the regular high school curriculum. The 10-12 program is definitely aimed to prepare students for secondary mathematics competitions.

These are both one-week residential opportunities. Both programs are located at Augsburg University in Minneapolis. **Application deadline is April 15, 2020 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 mnmathleague.org later in January 2020 for an application.

Email mathleague@augsburg.edu with questions.

Summer Coaches Conference 2020

Dates: July 9 and 10

40th Year State of the State: An examination of our rules and events

Many activities are being planned, including Hall of Fame Induction and Alumni gathering. If you know of alumni who might be interested, send us contact information. If you have nominees for the Hall of Fame, send them to tyoung@district16.org

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, 2020

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

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.

See winning videos by

Following us on Facebook "Minnesota State High School Mathematics League" @MNSHSML

Video Entry Submission:

Videos are due to the Math League Office (mathleague@augsburg.edu) by *March 1st, 2020*.

- **Videos contest entries must be sent and approved by the school math team coach.**
- **Winning schools will be notified by March 6, 2020.**
- **Winning videos will be shown at the State Tournament on March 9, 2020, uploaded to the Math League Facebook page, and may be used for other promotional purposes.**

Questions? Email mathleague@augsburg.edu

MN State High School Math League

2020 State Tournament T-shirt Design Contest

Prize: $50 VISA Gift Card and a Free T-shirt

How to enter:

Submit a **one-color** design for the t-shirt front.
The design should include the words:

"MN State High School Math League"
"State Tournament"
"March 9, 2020"

- Email your *original* design by **Feb. 10th** to: mathleague@augsburg.edu
- Accepted file format: pdf only
- Include your name, grade and school in the email submission.
- Winner will be notified by Feb. 17th via email.

Email mathleague@augsburg.edu with questions

Problem Corner

an effort to spur conversation

If you'd like to contribute a problem or send in a solution, email tyoung@district16.org

Student solutions encouraged!

Newsletter 17 Puzzle

In Meet Three, Team Event #4 stated:

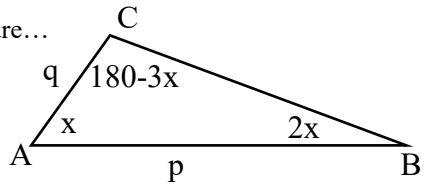
In $\triangle ABC$, $m\angle B = 2m\angle A$, $AB = 4$, and $AC = 3$. Determine exactly the value of cos A.

What if, instead, it had stated: (note, this is worded more precisely, and more what was intended, than in newsletter 17)

In $\triangle ABC$, $AB = p$, and $AC = q$. Prove or disprove that there exists, for all possible such triangles, a configuration of the triangle where $\angle B$ is twice the measure of $\angle A$.

Can you prove or disprove that?

Here's my attempt to disprove that this always happens. ***Do you think it's valid??*** I'm not sure…



Look at triangle ABC at right, with side p significantly bigger than side q. Let's assume that angle B **is** twice the size of angle A

Then

$$\frac{\sin 2x}{q} = \frac{\sin(180-3x)}{p}$$

$$\frac{\sin 2x}{q} = \frac{\sin(3x)}{p}$$

$$\frac{2\sin x\cos x}{q} = \frac{\sin(2x+x)}{p}$$

$$\frac{2\sin x\cos x}{q} = \frac{\sin(2x)\cos x+\cos(2x)\sin x}{p}$$

$$\frac{2\sin x\cos x}{q} = \frac{2\sin(x)\cos^2 x+(2\cos^2 x-1)\sin x}{p}$$

$$\frac{2\cos x}{q} = \frac{2\cos^2 x+(2\cos^2 x-1)}{p}$$

$$\frac{p}{q} = \frac{2\cos^2 x+(2\cos^2 x-1)}{2\cos x}$$

Line 8 $$\frac{p}{q} = 2\cos x - \frac{1}{2\cos x}$$

Looking at the ratio of p:q, if p is significantly larger than q, I don't see how it's possible for line 8 to be true. Therefore I conclude there are many triangles where B can't be twice A

New Puzzle: from Monroe Community College.

https://sites.monroecc.edu/mathpuzzler/2019/10/01/october-2019-puzzle/

You are equipped with two 2's, two 3's, and the ability to combine them using addition, subtraction, multiplication, division, and exponentiation.

Your job is to create all of the integers from 0 to 36.

You may use any number of parentheses to control the order of operations and **when possible, all four of the numbers must be used to create a given integer.**

For example: 11 = 2^3+3, however, 11 can be created using all four numbers and therefore, this solution would not be sufficient.