Minnesota State High School Mathematics League

Newsletter

Issue #8 November 12, 2018

A message from the Executive Director, Tom Young

Hello!

Meet one is in the books. It could have gone more smoothly but the scoring website was not functioning properly; thank you for adapting and using paper copies. It should be fixed now. Fingers crossed that it won't happen again!

We really appreciate the divisions (Canterbury, South Suburban, Suburban East, Minneapolis, and North Suburban) that provided feedback on the meet. It helps us gauge how well the meet went and helps us shape succeeding meets. If you haven't given feedback before, send us your thoughts in upcoming meets. Click on Meet Op > Meet Feedback.

Also, read about the Roberts Scholarship later in this newsletter. Scholarships 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. We want students to use these funds!

Go Math League!

Meet One: some pictures from the Mississippi Division

Dedicated Coaches

Thumbs up from Big Lake!

I am Happy about Math Team!!!!

Monticello Proud

Smiles from St. Michael Albertville

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

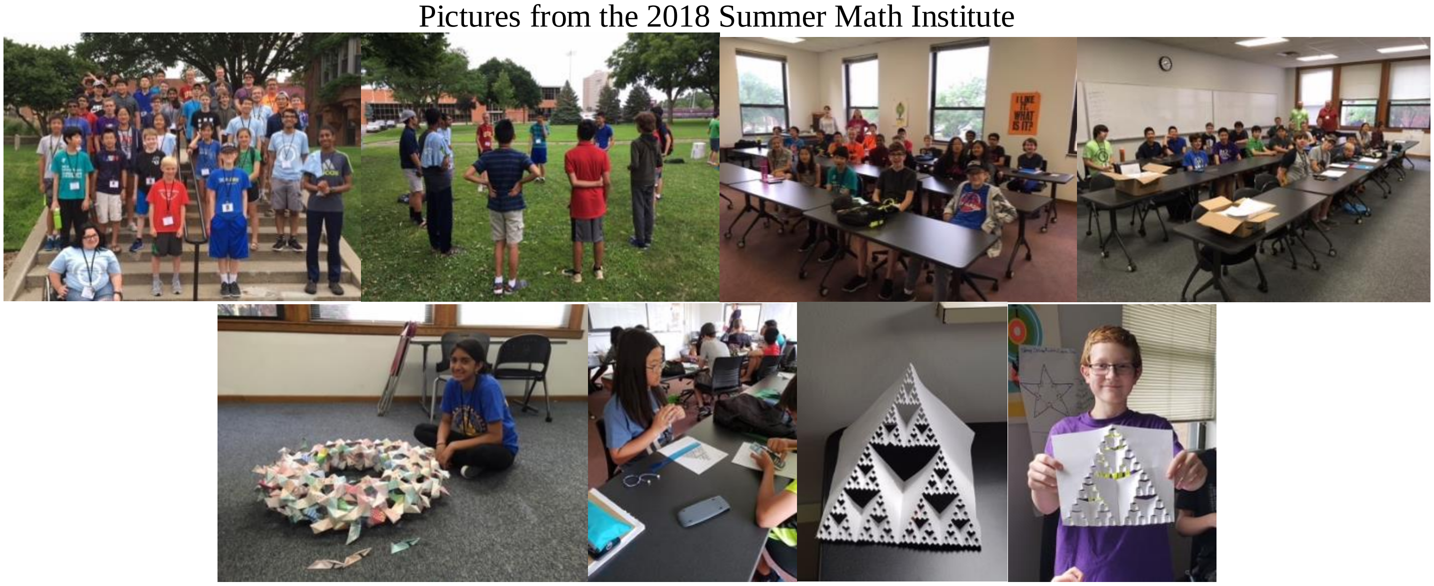
A much better start this year for the problem writing team ... last year there were 68 challenges at Meet 1 and this year only 5. Three of the challenges came on problem C2. We accepted $\sqrt{1+\left(\frac{a^2-b^2}{2ab}\right)^2}$ and $\frac{\sqrt{a^4+2a^2b^2+b^4}}{2ab}$. Seeing these alternate answers leads me to wonder whether mathletes are aware that $(a,b,c)=\left(2mn,\ m^2-n^2, m^2+n^2\right)$ is always a Pythagorean Triple, i.e. $a^2+b^2=c^2$ and $(2mn)^2+\left(m^2-n^2\right)^2=\left(m^2+n^2\right)^2$. These three expressions produce ALL Pythagorean Triples with no common factors when *m* and *n* are relatively prime and are of opposite parity (one even, one odd). I often use these expression when producing problems involving Pythagorean Triples. Are you also aware of the connection between the Fibonacci Numbers and Pythagorean Triples? Take any four consecutive Fibonacci numbers; the product of the outer terms and twice the product of the inner two terms are legs of a right triangle. The hypotenuse is also a Fibonacci number and its subscript is half the sum of the subscripts of the original four numbers! For example, $(F_4,F_5,F_6,F_7)=(3,5,8,13)$. $a=3\cdot 13=39$ and $b=2(5\cdot 8)=80$ and $c=\sqrt{39^2+80^2}=89=F_{11}=F_{\frac{4+5+6+7}{2}}$. Can you prove it?

2019 Summer Math Institute

Look for more information in subsequent newsletters about the 2019 sessions. Tentatively they are:

7 – 9 Mathematics and Art **10 – 12 Theory of Equations**

Pictures from the 2018 Summer Math Institute



More Teacher Tidbits (presented at the Coaches Conference)

Look for more to come in subsequent newsletters!

– Keys to a Great Math Team –
Recruiting ideas (in no particular order)

1. New students don't need to pay activity fee until after the first meet
2. Contact new students with personal letter from coach
3. Have captains visits freshmen in accelerated classes and sell program
4. Visit Junior high math team or MathCounts students
5. Tell parents of student potential at fall conferences
6. Get other HS teachers to advertise team and recommend students
7. Get Middle School teachers to recommend students, too
8. Look at AMC 8 and AMC 10 high scorers
9. Never underestimate the power of personal connection

– Keys to a Great Math Team –
Creating and Sustaining a Team

1. Make sure you have a Junior High Math League team http://mnjhml.com
2. Find a Geometry specialist
3. Create a calendar of practices and have students sign up to bring food
4. Bringing snacks and/or leading practice worth lettering points
5. Have a lettering policy
6. Create a "Math Rocks" culture of learning and growing in mathematical understanding
7. Cultivate support from the other departments in your school
8. Cultivate support from the AD and principal
9. Look for business partnerships to cover activity fees and transportation fees

A guide to finding the n^{th} digit in the decimal representation of a fraction

Example: Find the 18^{th} digit of $\frac{207}{61}$ (could be 60 repeating digits)

Calculator shows: 3.3934 **42623**
First 5 — uncertain digit, could be rounded

$.42623 \cdot 61 = 26\ldots.$

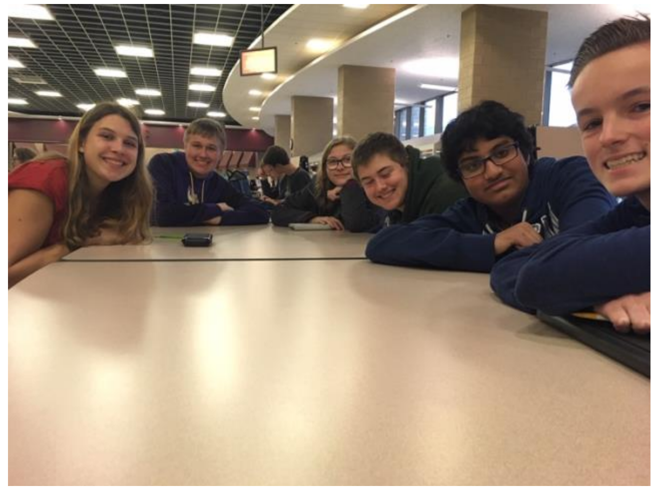
$\frac{26}{61} = .42622$ **95082**
Second 5 — uncertain digit, could be rounded

$.95082 \cdot 61 = 58\ldots$

$\frac{58}{61} = .95081$ **96** **7** **21**
third 5 — 18^{th} digit — uncertain digit, could be rounded

More Pictures from the Mississippi Division at Meet One

The pride of Elk River



Rogers Rocks the House

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

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

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

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!

A solution to the problem from Newsletter 7

FROM: http://www.universityofcalicut.info/SDE/VI%20Sem.%20B.Sc%20Maths%20-%20Additional%20Course%20in%20lie%20of%20Project%20-Theory%20of%20equations%20&%20fuzzy%20set.pdf

If $\alpha + \beta + \chi = 1$, $\alpha^2 + \beta^2 + \chi^2 = 2$, and $\alpha^3 + \beta^3 + \chi^3 = 3$ Find $\alpha^4 + \beta^4 + \chi^4$

Solution:

Let $x^3 + P_1x^2 + P_2x + P_3 = 0$ be the equation whose roots are α, β, γ, then

$$\alpha + \beta + \gamma = -P_1 \Rightarrow P_1 = -1$$

By Newton's theorem,

$$S_2 + S_1P_1 + 2P_2 = 0$$

i.e., $2 + 1.(-1) + 2P_2 = 0 \Rightarrow P_2 = {}^{-1}/_2$

Again, by Newton's theorem

$$S_3 + S_2P_1 + S_1P_2 + 3P_3 = 0$$

i.e., $3 + 2.-1 + 1.{}^{-1}/_2 + 3.P_3 = 0$

$$\Rightarrow P_3 = {}^{-1}/_6$$

Also $S_4 + S_3P_1 + S_2P_2 + S_1P_3 = 0$ (By Newton's theorem for the case $r < n$)

Substituting and simplifying, we obtain $S_4 = {}^{25}/_6$

NEW PROBLEM
https://college.lclark.edu/live/files/25503-sp18-pow-1

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

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

Please justify your answer.