The Department of Mathematics at NDSU is happy to announce the start of the annual North Dakota Mathematics Talent Search.The Talent Search poses sets of challenging mathematical problems throughout the year which will be posted on our website at

https://www.ndsu.edu/math/outreach/nd_talent_search/

Interested students are strongly encouraged to send in solutions even if they only solve one problem in a set; **finding a good solution to a problem is always an achievement**. The problems do not require advanced mathematical knowledge – just creativity and a feeling or taste for problem solving.

The students who submit a significant number of mathematically sound solutions for each of the three rounds will be rewarded with various prizes.

Please upload and submit your solutions by October 31, 2023, using the form on the website. Alternatively, solutions may be sent by regular mail to:

Talent Search
c/o Maria Alfonseca
Mathematics NDSU Dept.# 2750
PO BOX 6050
Fargo, ND 58108-6050

Please do not forget to include your name, postal address, school, and e-mail address.

Here is the first set of problems:

1. Anna and Ben want to buy a comic book at a garage sale. Anna is short 7 cents, and Ben is short 1 cent. If they put their money together, they still don't have enough money to buy it. How much does the comic book cost?

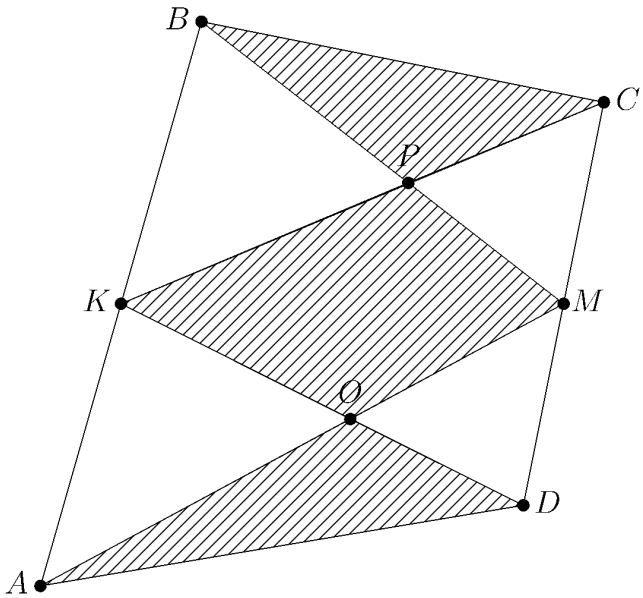
2. Prove without using a calculator or computer (explain all your work)
$$1+\frac{1}{37}\cdot\left(1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\cdots\frac{1}{37}\right) > \sqrt[37]{38}.$$

3. Amy has 4 black, 5 ginger and 1 white kittens.
   (i) In how many ways can she arrange the kittens in a circle if all are distinguisable?
   (ii) In how many ways can she arrange the kittens in a circle if kittens of the same color are indistinguisable?

4. If we write all numbers from 0 to 9 on a paper and rotate the paper by 180 degrees, the numbers 0, 1, 8 will not change (1 should be written as |), 6 and 9 will be exchanged with each other, and the rest will no longer be numbers.

   How many nine-digit numbers are there which remain unchanged after a 180 degree rotation?

5. Let ABCD be a quadrilateral, as in the figure on the next page. Let K and M be the midpoints of AB and CD, respectively. Let O be the intersection of the segments AM and DK, and let P be the intersection of BM and CK be P. Show that the area of MOKP is equal to the sum of areas BPC and AOD.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