

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 November 30, 2024, 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. Write 100 as a sum of positive real numbers such that the product is maximal.
2. (a) How many ways are there to place three balls labeled (1), (2), (3) into 10 holes?
(b) How many ways are there to place three unlabeled identical balls into 10 holes?
(c) How many ways are there to place k unlabeled identical balls into n holes?
3. How should a rook move along the chess board so that it visits every position exactly once and makes the least number of turns?
4. Prove that $2^{2^{2024}} - 1$ is divisible by 3 without using a calculator or computer (explain all your work).
5. We are given a square with sidelength 1. Find the locus of the points (*i.e. describe all the points*) such that the sum of distances from each point to all 4 sides of this square (or to the lines obtained by extending the sides) is equal to 4.