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 15, 2025, 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. A train moving 45 miles per hour meets and is passed by a train moving 36 miles per hour in the opposite direction. A passenger in the first train sees the second train take 6 seconds to pass him. How long is the second train?

2. Let a, b be natural numbers. Prove that if $A = (a^2 + b^2)/(ab - 1)$ is an integer, then it is 5.

3. Let $ABCD$ be a square, let E be a point on BC and F be a point on CD, the angle EAF is 45 degrees. Let P and Q be the points of intersection of AE and AF respectively with diagonal BD. Prove that the area of AEF is twice the area of APQ.

4. We want to find all integer numbers with initial digit 6 which have the following property: If the initial digit is deleted, the remaining number is 1/25 of its original value.

   (a) Try first with numbers of 2, 3 and 4 digits.

   (b) Write a representation of numbers with initial digit 6, then use the representation to state the property as an equation.

5. Given a standard rectangular paper, explain how to build the given figure (see next page) using only scissors (no gluing or taping).