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/ongoing_events/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.

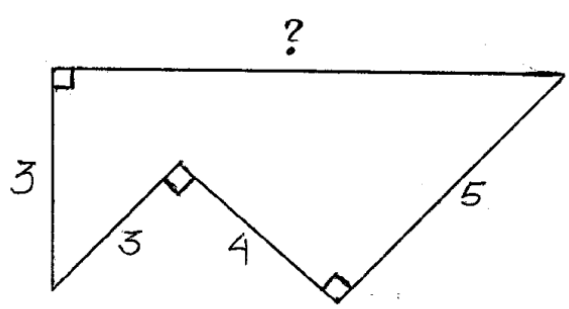
Please upload and submit your solutions by October 31, 2021, using the form on the website. Alternatively, solutions may be sent by regular mail to:

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. Find the length of the interval with question mark.



2. Show that the equation
$$x^4 + x^3 + 2x^2 + 2x + 3 = 0$$
has no real solutions.

3. A chocolate bar has the form of a rectangle six squares by ten squares. We start with the full bar. At each turn we break a piece of chocolate into two, and the break is always along the border of the squares. What is the minimal number of breaks you need to do to have at the end 60 separate squares?

4. Let K be the center of a circle inscribed in triangle ABC ($AB < BC$). Line l passes through K and is tangent to the circle circumscribed around triangle ACK. l crosses AB and BC at points M and N respectively, and length of MN is 10. Find the product of lengths AM and CN.

5. Find all the values of a for which equation

$$\sqrt{x + 2a - 1} + \sqrt{x - a} = 1$$

has at least one solution.