International Youth Math Challenge

Qualification Round 2025

Problem A

A sequence is defined by $a_1 = 1$ and $a_{n+1} = a_n + n + 1$. Find a closed-form equation to calculate the value of a_n and determine a_{100}.

Problem B

Show that there is no $x \in \mathbb{R}$ that solves the equation $\sqrt{3+x} + \sqrt{7-x} = 5$.

Problem C

Determine the numerical value of the following expression without the use of a calculator:

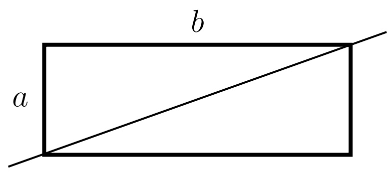
$$\sum_{k=1}^{3} \frac{\sin\left(\frac{k\pi}{12}\right) + \sin\left(\frac{(6-k)\pi}{12}\right)}{\cos\left(\frac{k\pi}{12}\right) + \cos\left(\frac{(6-k)\pi}{12}\right)} - \prod_{m=1}^{2} \frac{\tan\left(\frac{\pi}{4} + \frac{m\pi}{12}\right) - \tan\left(\frac{\pi}{4} - \frac{m\pi}{12}\right)}{1 + \tan\left(\frac{\pi}{4} + \frac{m\pi}{12}\right)\tan\left(\frac{\pi}{4} - \frac{m\pi}{12}\right)}$$

Problem D

Prove that for every positive integer n, the number $n^4 + 4$ is a composite number, except for one value of n.

Problem E

A rectangle with side lengths a and b is cut by a diagonal as shown in the drawing below. Find the perimeter and the area of the two triangles formed.



Submission Information

Each problem gives 5 points. To qualify for the next round, you have to score at least 15/17/20 points as a Junior/Youth/Senior participant. Submit your solution by *Sunday, 30 November 2025, 23:59 UTC+0* online! Further information and the submission form is available on the competition website: `www.iymc.info`