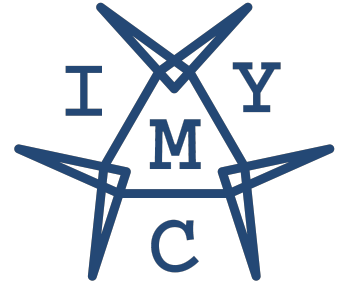


International Youth Math Challenge

Qualification Round 2024



Problem A

Continue the two sequences of numbers below and find an equation to calculate the n -th value:

n	1	2	3	4	5	6	7	Equation
a_n	2	5	10	17	26	37		
b_n	1	2	8	48	384	3840		

Problem B

Find all $x \in \mathbb{R}$ that solve this equation: $x^4 + x^2 - x - 1 = 1 - x - x^2 - x^4$

Problem C

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

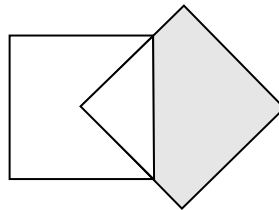
$$\left(\sqrt{2} + (3^2)^{1/4} + \sum_{m=1}^3 \left(\frac{1}{m!} - \sqrt{m} \right) \right) \cdot \left(2^{\log_2(8)} + \frac{1}{2^3} - \prod_{k=1}^8 \left(1 + \frac{1}{k} \right) \right)$$

Problem D

Prove that $n^5 - n$ is divisible by 5 for all positive integers n .

Problem E

The drawing below shows two squares with side lengths a . One of the squares is rotated by 45° and placed in the centre of the second square. Find the surface area of the rotated square not overlapping the non-rotated square (grey area).



Submission Information

To qualify for the next round, you have to solve at least three/four (under/over 18 years) problems correctly. Show your steps! Make sure to submit your solution until *Sunday 15. December 2024 23:59 UTC+0* online!

Further information and the submission form is available on the competition website: www.iymc.info