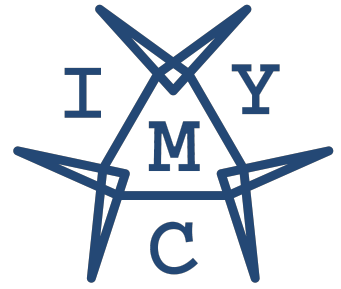


# International Youth Math Challenge

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:

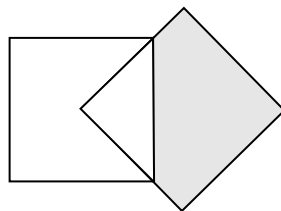
$$\left( \sqrt{2} + (3^2)^{1/4} + \sum_{m=1}^3 \left( \frac{1}{m!} - \sqrt{m} \right) \right) \cdot \left( 2^{\log_2(8)} + \frac{1}{2^3} - \prod_{k=1}^8 \left( 1 + \frac{1}{k} \right) \right)$$

## 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  $45^\circ$  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

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, 22 December 2024, 23:59 UTC+0* online!

Further information and the submission form is available on the competition website: [www.iymc.info](http://www.iymc.info)