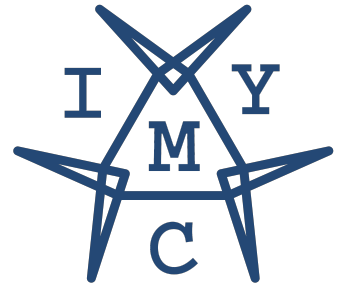


# International Youth Math Challenge

Qualification Round 2018



International Youth Math Challenge  
www.iymc.info | FB: theIYMC  
submission(at)iymc.info

## Problem A

Find the roots of  $f(x) = (e^x - e^\pi)(e^x - \pi)$  where  $e$  denotes Euler's number.

## Problem B

Show that  $n^4 - n^3 + n^2 - n$  is divisible by 2 for all positive integers  $n$ .

## Problem C

You have given a sphere with a volume of  $\pi^3$ . What is the radius of this sphere?  
Explain whether or not it is possible to build such a sphere in reality?

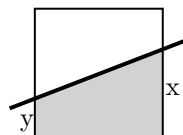
## Problem D

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

$$\log_2(2^2 + 5 \cdot 2^2 \cdot 3) \cdot \left(2 \log_3 2 + \log_3 \left(7 - \frac{1}{4}\right)\right) + \frac{(\log_2 128 - 2)^3}{3 + 2} + (-1)^{32 + \pi^0}$$

## Problem E

The square below has an edge length of  $a$ . A line intersects the square at a height of  $x$  and  $y$ . Find an expression for the surface area  $A(x, y)$  below the line (gray area).



### General Information

To qualify for the pre-final round you have to solve at least three to four problems correctly.  
Make sure to submit your solution until *30.09.2018 23:59 UTC+0* on the IYMC website!  
In case of questions or comments do not hesitate to contact the IYMC team. Good luck.