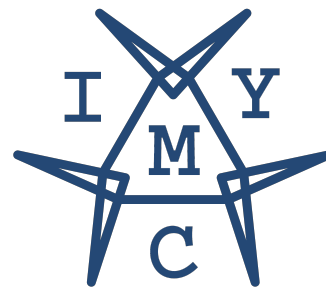# International Youth Math Challenge

**Qualification Round 2023 – Solution**

### Problem A

$\rightarrow f(x) = (\pi^x - \pi^{-1}) \cdot x^\pi \cdot (\pi^{-2} - \pi^x) \implies \{-2, -1, 0\}$

### Problem B

$\rightarrow n \equiv 0: \ 2^0 - (-1)^0 = 0, \ \ n \equiv 1: \ 2^1 - (-1)^1 = 3, \ \ n \equiv 2: \ 2^2 - (-1)^2 = 3$

### Problem C

$\rightarrow \log_3\left[\ 0 + \sum_{n=0}^{10}(1-2)^n\ \right] = \log_3[1] = 0$

### Problem D

$\rightarrow \sigma(p^m) = 1 + p + ... + p^m = 1 + p \cdot (1 + ... + p^{m-1}) = 1 + p \cdot \sigma(p^{m-1})$

### Problem E

$\rightarrow A = \frac{1}{2} \cdot b \cdot \left(\frac{b}{2} \cdot \tan(60°)\right) = \frac{1}{2} \cdot b \cdot \left(\frac{b}{2} \cdot \sqrt{3}\right) = \frac{\sqrt{3}}{4} \cdot b^2$