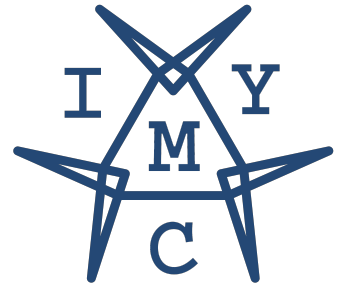


International Youth Math Challenge

Qualification Round 2021 - Solution



Problem A

$$\rightarrow \log(3) \cdot (x-2) \cdot (x^2-1) \implies \{-1, 1, 2\}$$

Problem B

$$\rightarrow 1 + 3 \left(-1 + 1 + \frac{1}{\pi} + \frac{1}{\pi^2} + \dots \right) = 1 + 3 \left(-1 + \frac{1}{1-\frac{1}{\pi}} \right) = \frac{3\pi}{\pi-1} - 2 = \frac{\pi+2}{\pi-1}$$

Problem C

$$\rightarrow \log [\log(3) \cdot (\log(2) \cdot (0+1)) - \log(2) \log(3) + 1] = \log[1] = 0$$

Problem D

$$\rightarrow p \geq 2 \implies p > 1 + 1/p \implies p^2 > 1 + p \implies 2p^2 > 1 + p + p^2 \implies 2p^2 > \sigma(p^2) \implies 2n > \sigma(n)$$

Problem E

$$\rightarrow \text{base: } a/2; \text{ height: } \left(\frac{a}{2}\right)^2 = h^2 + \left(\frac{a}{4}\right)^2; \text{ area: } A = \frac{1}{2} \cdot \frac{a}{2} \cdot \sqrt{\left(\frac{a}{2}\right)^2 - \left(\frac{a}{4}\right)^2} = a^2 \cdot \frac{1}{4} \cdot \sqrt{\frac{3}{16}} = a^2 \cdot \frac{\sqrt{3}}{16}$$