International Youth Math Challenge

Qualification Round 2019

Problem A

Find the maximum value of the function $f(x) = x + x^2 - x^3$ for $x \geq 0$.

Problem B

Show that $1n^3 + 2n + 3n^2$ is divisible by 2 and 3 for all positive integers n.

Problem C

Find at least two x that make this equation true:

$$\sin\left(x + \frac{\pi^3 + 2\sqrt{\pi^6}}{\pi^2 + \pi^2} + \pi^{\pi^0}\right) = \cos\left(x + \frac{(-1)^{16}}{2} - \frac{\log_2(\sqrt{8})}{3}\right)$$

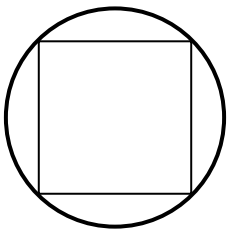
Problem D

You have given following three equations below with $\alpha, \beta, \gamma \in \mathbb{R}$. What is the value of α?

$$\alpha + \beta + \gamma = 1$$
$$\beta + \gamma + \beta = 1$$
$$\gamma + \beta + \gamma = 1$$

Problem E

The circle in the drawing below has a surface area of $A_1 = 1m^2$. Determine the surface area A_2 of the square that was placed inside of the circle.



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 *Sunday 29. September 2019 23:59 UTC+0* online! Further information and materials are available on the IYMC website: www.iymc.info