Integration Bee

Finals

Mathematics Club

CFI, IITM

September 15, 2025

Question 1

$$A = \int_0^\infty \ln^2(1+e^{-x})\mathrm{d}x \quad B = \int_0^{\frac{\pi}{4}} \frac{\ln(\sin x)\ln(\cos x)}{\sin x \cos x}\,\mathrm{d}x$$

Find $\frac{A}{B}$

Question 2

$$A = \int_0^1 \int_0^1 \frac{\ln\left(x^2\right) \ln\left(y^2\right)}{1-xy} \, \mathrm{d}x\mathrm{d}y$$

$$B = \int_0^1 \int_0^1 \frac{(xy \ln(xy))^2}{1-xy} \, \mathrm{d}x\mathrm{d}y$$

Evaluate $\sqrt{\dfrac{3A-2B+1}{3A-2B+4}}$

Question 3

$$\int_0^\infty \frac{\sin^3 x}{x^2}\,\mathrm{d}x$$

Question 4

$$\int_0^{\frac{\pi}{4}} \sqrt{\frac{\tan x}{\tan 2x}}\,\mathrm{d}x$$

Question 5

Tie Breaker - 1

$$\int_0^\infty \frac{x}{\sqrt{e^x - 1}}\,\mathrm{d}x$$

Question 6

Tie Breaker - 2

$$\int e^{\cos x}\left(\frac{1}{\sqrt{2}}+\sin\left(2x-\frac{\pi}{4}\right)+2\sin\left(x-\frac{\pi}{4}\right)\right)\mathrm{d}x$$

Question 7

First To Solve

$$\int_0^1 \frac{\ln(1+x)}{x}\,\mathrm{d}x$$