Integration Bee

Round 2

Mathematics Club

CFI, IITM

September 4, 2024

Instructions

Connect to one of three networks as informed:

SSID1 : password1

SSID2 : password2

SSID3 : password3

Then navigate to `http://intbee.arpa/`

Question 0

$$\int_1^2 x \; dx$$

Question 1

$$\int_0^{\pi/2} \ln(2 + \tan^2 x) dx$$

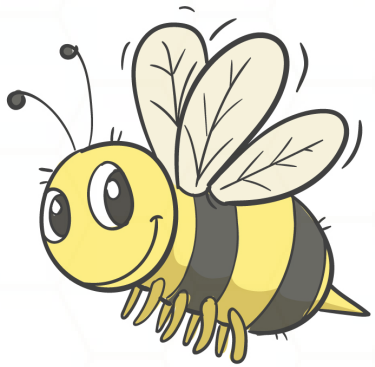
Question 2

Find the value of

$$\int_{\pi/6}^{\pi/2} \frac{(\cos(x))^{\psi^2}}{(\sin(x))^{\psi}} (1 + \operatorname{cosec}^2(x))\, dx$$

where $\psi = 1 + \sqrt{2}$

Question 3



Find the value of $\int_0^1 (-1)^{\left\lfloor \frac{1}{x} \right\rfloor} \, dx$

Question 4

Find the value of

$$\int_{-\infty}^{a} \frac{\sin^{-1}(e^x) + \sec^{-1}(e^{-x})}{(\cot^{-1}(e^{-a}) + \tan^{-1}(e^x))(e^x + e^{-x})} dx$$

Question 5

If $\alpha = \int_0^\infty \frac{\{x\}^{\lfloor x \rfloor}}{\lfloor x \rfloor !} dx$

Find the value of $\frac{2}{\alpha} \int_0^{\lfloor \alpha \rfloor} x e^{\log \lfloor x+1 \rfloor + x^2} dx$

Question 6

Find the value of

$$\int_0^2 \log_9(x+\sqrt{x^2+1})\,dx + \int_0^{\log_9(2+\sqrt{5})} \frac{9^x - 9^{-x}}{2}\,dx$$

Question 7

Find the value of

$$\int_0^{\pi/4046} \sin(2024x)\sin^{2022} x\,dx$$

Question 8

Find the value of

$$\int_{-\frac{1}{2}}^{\frac{1}{2}} \sqrt{x^2+1+\sqrt{x^4+x^2+1}}\,dx$$

Question 9

Find the value of

$$\int_0^{\frac{\pi}{4}} e^{x\sin(x)}\left(\tan(x)+\tan(x)\sec(x)+x\right)dx$$

Question 10

Find the value of

$$\int_0^1 \ln\left(x - x^2\right)\left[\left(\ln\left(\frac{x}{1-x}\right)\right)^2 + \ln(x)\ln(1-x)\right] dx$$

Question 11

Find the value of

$$\int_0^{2\pi} \frac{\cos(2x)\cos(4x)\cos(6x)}{1+e^{2\sin(2x)}}\,dx$$

Question 12

Find the value of

$$\int_0^1 \binom{n}{k} x^k (1-x)^{n-k}\, dx$$