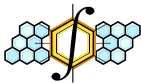


Semifinal 2

MWIT-KVIS Integration Bee

November 12, 2023



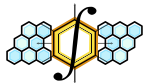
Rules

- 4 problems (+ sudden death)
- 3 minutes per problem
- CIRCLE your final answer



Problem 1

$$\int_{-2023}^{2023} e^{\overbrace{||| |x|-1|-1|\dots|-1|}^{2023 \text{ } (-1)\text{'s.}}} dx$$



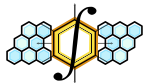
Problem 1 Answer

$$\int_{-2023}^{2023} e^{\overbrace{||| |x|-1|-1|\dots|-1|}^{2023 \text{ } (-1)\text{'s.}}} dx = \boxed{4046(e - 1)}$$



Problem 2

$$\int_0^2 \frac{(x-1)^2 e^{3x}}{e^2 e^x + e^4 e^{-x}} dx$$



Problem 2 Answer

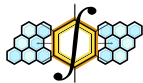
$$\int_0^2 \frac{(x-1)^2 e^{3x}}{e^2 e^x + e^4 e^{-x}} dx = \boxed{\frac{e^2}{4} - \frac{1}{3} - \frac{5e^{-2}}{4}}$$



Problem 3

$$\int_0^1 \left\{ \ln \left(\frac{1}{x} \right) \right\} dx$$

Note that $\{x\} = x - \lfloor x \rfloor$.



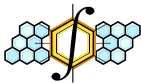
Problem 3 Answer

$$\int_0^1 \left\{ \ln \left(\frac{1}{x} \right) \right\} dx = \boxed{\frac{e-2}{e-1}}$$



Problem 4

$$\int_0^{\pi/3} \frac{dx}{1 + \sin x}$$



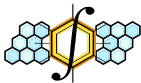
Problem 4 Answer

$$\int_0^{\pi/3} \frac{dx}{1 + \sin x} = \boxed{\sqrt{3} - 1}$$



Sudden Death Problem 1

$$\int_0^{2024\pi} \lfloor 2024 \sin(\sin(x) + \cos(x)) \rfloor dx$$



Sudden Death Problem 1 Answer

$$\int_0^{2024\pi} \lfloor 2024 \sin(\sin(x) + \cos(x)) \rfloor dx = \boxed{-1012\pi}$$



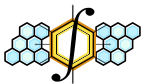
Sudden Death Problem 2

$$\int \frac{e^x}{(e^x + 1)^2} \ln \left(\frac{e^x}{e^x - 1} \right) dx$$



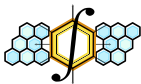
Sudden Death Problem 2 Answer

$$\int \frac{e^x}{(e^x + 1)^2} \ln \left(\frac{e^x}{e^x - 1} \right) dx = \boxed{-\frac{1}{e^x + 1} \ln \left(\frac{e^x}{e^x - 1} \right) - \frac{1}{2} \ln |e^{2x} - 1| + x + C}$$



Sudden Death Problem 3

$$\int e^{e^x} (e^{e^x} + e^{e^{2x}}) (e^x + e^{2x}) dx$$



Sudden Death Problem 3 Answer

$$\int e^{e^{e^x}} (e^{e^x} + e^{e^{2x}}) (e^x + e^{2x}) dx = \boxed{e^{e^{e^x}} e^{e^x} e^x + e^{e^{e^x}} e^{e^x} - e^{e^{e^x}} + C}$$



Sudden Death Problem 4

$$\int_{1/2}^1 \frac{x^3 - x + 1}{x^2 \sqrt{1 - x^2}} e^x dx$$



Sudden Death Problem 4 Answer

$$\int_{1/2}^1 \frac{x^3 - x + 1}{x^2 \sqrt{1 - x^2}} e^x dx = \boxed{\sqrt{3}e}$$