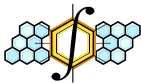


Quarterfinal 3

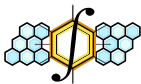
MWIT-KVIS Integration Bee

November 12, 2023



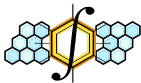
Rules

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



Problem 1

$$\int \frac{e^x \cos(\ln(\arctan(e^x)))}{(1 + e^{2x}) \arctan(e^x)} dx$$



Problem 1 Answer

$$\int \frac{e^x \cos (\ln (\arctan \left(e^x\right)))}{\left(1+e^{2 x}\right) \arctan \left(e^x\right)} d x=\sin (\ln (\arctan \left(e^x\right)))+C$$



Problem 2

$$\int \frac{e^x dx}{\sqrt{3e^x - 2 - e^{2x}}}$$



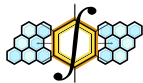
Problem 2 Answer

$$\int \frac{e^x dx}{\sqrt{3e^x - 2 - e^{2x}}} = \boxed{\arcsin(2e^x - 3) + C}$$



Problem 3

$$\int (x^2 + 2) \frac{\sin x}{x^3} dx$$



Problem 3 Answer

$$\int (x^2 + 2) \frac{\sin x}{x^3} dx = \boxed{-\frac{\cos x}{x} - \frac{\sin x}{x^2} + C}$$



Problem 4

$$\int \arcsin (\sqrt{x}) \, dx$$



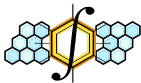
Problem 4 Answer

$$\int \arcsin(\sqrt{x}) \, dx = \boxed{\frac{1}{2} \left((2x - 1) \arcsin(\sqrt{x}) + \sqrt{x(1-x)} \right) + C}$$



Sudden Death Problem 1

$$\int (11x^{11} + 10x^5 + 9x^3) \sqrt{x^9 + 2x^3 + 3x} dx$$



Sudden Death Problem 1 Answer

$$\int (11x^{11} + 10x^5 + 9x^3) \sqrt{x^9 + 2x^3 + 3x} dx = \boxed{\frac{2}{3}(x^{11} + 2x^5 + 3x^3)^{3/2} + C}$$



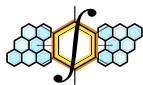
Sudden Death Problem 2

$$\int \frac{x^{2023}}{x^2 + 1} dx$$



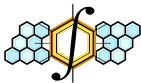
Sudden Death Problem 2 Answer

$$\int \frac{x^{2023}}{x^2 + 1} dx = \boxed{\sum_{k=1}^{1011} \frac{(-1)^{k+1} x^{2k}}{2k} - \frac{1}{2} \ln(x^2 + 1) + c}$$



Sudden Death Problem 3

$$\int \frac{\ln(x+1)}{\sqrt{x}} dx$$



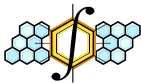
Sudden Death Problem 3 Answer

$$\int \frac{\ln(x+1)}{\sqrt{x}} dx = \boxed{2 \ln(x+1)\sqrt{x} - 4\sqrt{x} - 4 \arctan \sqrt{x} + C}$$



Sudden Death Problem 4

$$\int_0^{\infty} (x-1)(x-3)(x-5)x^4 e^{-x} dx$$



Sudden Death Problem 4 Answer

$$\int_0^{\infty} (x-1)(x-3)(x-5)x^4 e^{-x} dx = \boxed{960}$$