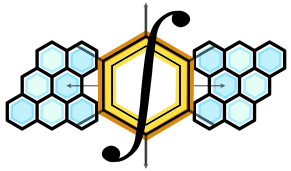


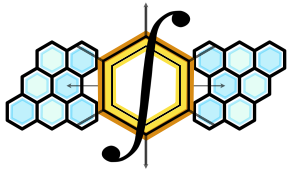
Quarterfinal 4

MWIT-KVIS Integration Bee

November 12, 2023

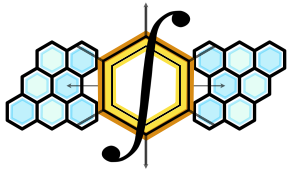
Rules

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



Problem 1

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

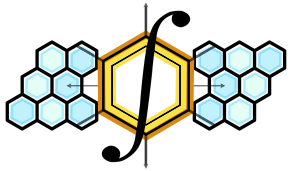


Problem 1 Answer

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

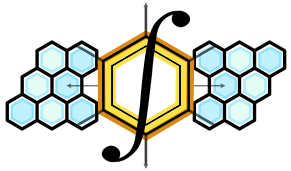
Problem 2

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



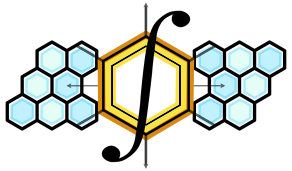
Problem 2 Answer

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



Problem 3

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



Problem 3 Answer

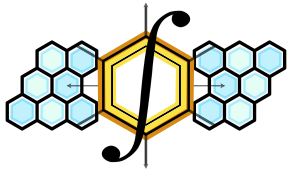
$$\int_0^\infty (x-1)(x-3)(x-5)x^4e^{-x}\,dx = \boxed{960.}$$

Problem 4

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

Problem 4 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 1

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

Sudden Death Problem 1 Answer

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

Sudden Death Problem 2

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

Sudden Death Problem 2 Answer

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

Sudden Death Problem 3

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

Sudden Death Problem 3 Answer

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

Sudden Death Problem 4

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

Sudden Death Problem 4 Answer

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