

CMIMC 2023 Integration Bee Answers

1. $\int_2^0 x^2 + 3 \, dx = \boxed{-\frac{26}{3}}$
2. $\int_0^1 \frac{1}{x + \sqrt{x}} \, dx = \boxed{2 \log(2)}$
3. $\int_0^{\frac{\pi}{4}} \cot(x) \sqrt{\sin(x)} \, dx = \boxed{2^{3/4}}$
4. $\int_0^\infty x e^{-\sqrt[3]{x}} \, dx = \boxed{360}$
5. $\int_1^\infty \frac{1}{x \sqrt{x^{2023} - 1}} \, dx = \boxed{\frac{\pi}{2023}}$
6. $\int_0^2 e^x (x^4 + 8x^3 + 18x^2 + 16x + 5) \, dx = \boxed{81e^2 - 1}$
7. $\int_0^{\frac{\pi}{2}} \left(\frac{1}{1 - \cos(x)} - \frac{2}{x^2} \right) \, dx = \boxed{\frac{4}{\pi} - 1}$
8. $\int_{-10}^{10} |4 - |3 - |2 - |1 - |x||| \, dx = \boxed{44}$
9. $\int_{-1}^1 x^{2022} \cos\left(\frac{\pi}{12} - x\right) \sin\left(\frac{\pi}{12} + x\right) \, dx = \boxed{\frac{1}{4046}}$
10. $\int_{\frac{1}{\sqrt{3}}}^{\sqrt{3}} \frac{\arctan(x) \log^2(x)}{x} \, dx = \boxed{\frac{1}{48} \pi \log^3(3)}$
11. $\int_{-1}^1 \frac{1}{(8 + x^2) \sqrt{1 - x^2}} \, dx = \boxed{\frac{\pi}{6\sqrt{2}}}$
12. $\lim_{n \rightarrow \infty} n^2 \int_0^1 x^n e^{-x} \log(x) \, dx = \boxed{-\frac{1}{e}}$
13. $\int_0^1 2^{\sqrt{x}} \log^2(2) + \log^2(1 + x) \, dx = \boxed{2 \log^2(2)}$
14. $\int_0^\infty e^{-\lfloor x \rfloor (1 + \{x\})} \, dx = \boxed{\log(1 + e)}$
15. $\int_0^\infty \left(1 - e^{-\pi/x^2}\right)^2 \, dx = \boxed{\pi(2 - \sqrt{2})}$