2025 Troy Integration Bee Qualifying Exam

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NAME: _____ SCORE: _____

You have 20 minutes to complete as many of the following integrals as possible. The only allowed materials are a pencil, eraser, and scratch paper—no calculators. For indefinite integrals, the $+C$ term need not be included. The denominators of fractions need not be rationalized, but otherwise, answers must be in simplest form. i will denote the imaginary unit. Scratch work will not be considered and there is no partial credit; only your final answer on this sheet matters.

BOX YOUR ANSWERS!

1. $\displaystyle\int (20-25x)^{-\sqrt{\frac{2025}{25}}}\,dx$
2. $\displaystyle\int \ln\left((xe)^{2025}\right)\,dx$
3. $\displaystyle\int_0^5 2\pi x\sqrt{25-x^2}\,dx$
4. $\displaystyle\int_{-45/2}^{45}\sqrt{1+\left(\frac{x}{\sqrt{2025-x^2}}\right)^2}\,dx$
5. $\displaystyle\int_0^{\pi/3}\left(\tan^3(x)+\tan(x)\right)e^{\tan^2(x)}\,dx$
6. $\displaystyle\int \frac{2\sec^4(x)}{\tan(x)}\,dx$
7. $\displaystyle\int_0^{\sqrt{e}}(-2\ln(x)+1)\,x^{-\ln(x)}\,dx$
8. $\displaystyle\int_0^{\infty}\frac{d}{dx}\left(\frac{x+\sin x}{x}\right)\,dx$
9. $\displaystyle\int \left|x^2+ix\right|\,dx$
10. $\displaystyle\int\left(\begin{bmatrix}3x\\4x\\0\end{bmatrix}\times\begin{bmatrix}-4x^3\\3x^3\\0\end{bmatrix}\cdot\begin{bmatrix}\sqrt{2}\\1\\1\end{bmatrix}\right)\,dx$
11. $\displaystyle\int\sqrt{1-\sin(x)}\,dx$
12. $\displaystyle\int\begin{bmatrix}0&x\\4&0\end{bmatrix}^{14}\,dx$
13. $\displaystyle\int x\sqrt{x\sqrt[3]{x\sqrt[4]{x\sqrt[5]{\cdots}}}}\,dx$
14. $\displaystyle\int_0^{2025}\left(\left\lceil\frac{x+1}{2}\right\rceil-\left\lfloor\frac{x}{2}\right\rfloor\right)\,dx$
15. $\displaystyle\int_{\pi}^{45\pi}\left(\sin^5(x)+\sin^6(x)-\sin^7(x)\right)\,dx$
16. $\displaystyle\int_0^{\pi/2}\frac{dx}{1+\tan^{2025}(x)}$
17. $\displaystyle\int_{-1}^{1}x^2\cos^{-1}(x)\,dx$
18. $\displaystyle\int\frac{\sin(x)}{\sin(x)+\cos(x)}\,dx$
19. $\displaystyle\int_4^{9/2}\left(x^4+\frac{1}{x^4}\right)\,d\left(\left(x+\frac{1}{x}\right)^2\right)$
20. $\displaystyle\int_{-\infty}^{\infty}\cos\left(x^2\right)\,dx$