

THE UK UNIVERSITY INTEGRATION BEE

2022/23



ROUND ONE MIT TIEBREAKER

Monday, 12 December 2022



Sponsored by



Jane Street

1. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{\cos x}{1 + e^x} dx$
2. $\int \sqrt{x \sqrt{x^3 \sqrt{x^4 \sqrt{x^5 \sqrt{x \cdots}}}}} dx$
3. $\int_0^1 x^{\frac{1}{\ln x}} dx$
4. $\int e^{x+e^x} dx$
5. $\int_0^1 \ln \left(\frac{1+x}{1-x} \right) dx$
6. $\int_0^\infty \frac{1}{1 + e^{ax}} dx$
7. $\int_0^{2\pi} \sin(\sin(x) - x) dx$
8. $\int_0^{\frac{\pi}{2}} \frac{dx}{\tan^{\sqrt{2}}(x) + 1}$
9. $\int_0^\infty \frac{\arctan x}{1+x} \frac{dx}{\sqrt{x}}$
10. $\int_1^{\sqrt{3}} \frac{\arctan x + \operatorname{arccot} x}{x} dx$
11. $\int \frac{\ln(2x)}{x \ln x} dx$
12. $\int_0^1 \sqrt{-\ln x} dx$ - make sure they know formulas including Gaussian integral.
13. $\int_0^1 \frac{\ln(1-x)}{x} dx$
14. $\int_0^\pi \arctan(3^{\cos x}) dx$
15. $\int \sqrt{1 + \sin \frac{x}{2}}$
16. $\int_0^1 \ln x \ln(1-x) dx$
17. $\int \frac{x^n}{1+x+\frac{x^2}{2!}+\cdots+\frac{x^n}{n!}} dx$ - maybe replace this with Finn's question
18. $\int_{-2}^2 \left(x^3 \cos \frac{x}{2} + \frac{1}{2} \right) \sqrt{4-x^2} dx$
19. $\int \frac{dx}{1 - \sin x}$
20. $\int_0^\infty \lfloor x \rfloor e^{-x} dx$

21. $\int_0^1 \frac{x^5 - 1}{\ln x} dx$

22. $\int_0^{2\pi} \cos^{2022}(x) dx$

23. $\int \ln(x^2) - 2 \ln(2x) dx$

24. $\int_{-2}^0 x^3 + 3x^2 + 3x + 1 dx$

25. $\int_0^{169} \frac{\pi \sin(\pi \sqrt{x})}{\sqrt{x}} dx$

26. $\int_0^\infty x^3 e^{-x^2} dx$

27. $\int \frac{\ln(\ln(x))}{x \ln x} dx$

28. $\int_1^\infty \frac{dx}{x(x^2 + 1)}$

29. $\int_0^\infty \frac{dx}{(x + \frac{1}{x})^2}$

30. $\int_0^1 \sin(\cos^{-1}(x)) dx$