

THE UK UNIVERSITY INTEGRATION BEE

2022/23



ROUND ONE

Monday, 7 November 2022



Sponsored by



Jane Street

1. $\int_0^1 \frac{1}{\sqrt{x-x^2}} dx$
2. $\int_0^{100} \lceil x \rceil \lfloor x \rfloor dx$, where $\lfloor x \rfloor$ & $\lceil x \rceil$ are the greatest integer less than x and the smallest integer greater than x , respectively.
3. $\int_0^\pi \cos(x + \cos(x)) dx$
4. $\int_0^1 \sqrt{x + \sqrt{x + \sqrt{x + \sqrt{x + \dots}}}} dx$
5. $\int_0^1 \frac{1}{x} - \left\lfloor \frac{1}{x} \right\rfloor dx$
6. $\int_0^1 \frac{\arctan x + \operatorname{arccot} x}{x^2 + 1} dx$
7. $\int_0^{\frac{\pi}{2}} x \prod_{i=1}^{\infty} \cos\left(\frac{x}{2^i}\right) dx$
8. $\int_0^{\frac{\pi}{4}} \ln(\cot x - 1) dx$
9. $\int_0^{\frac{\pi}{2}} \frac{\tan^{-1}(b \sin x)}{\sin x} dx$
10. $\int_0^\infty \frac{x^3}{e^x + 1} dx$
11. $\int_0^{\frac{1}{4}} \sum_{n=0}^{\infty} \binom{2n}{n} x^n dx$
12. $\int_0^\infty \cos(x^2) dx$
13. $\int_0^\infty \frac{\ln x}{1-x^2} dx$
14. $\int_0^{\frac{\pi}{2}} \frac{\ln(\sin x)}{\cos^2 x} dx$
15. $\int_0^{\frac{\pi}{2}} \frac{\cos^2 x (1 + \cos x)}{(1 + \cos x + \sin x)^2} dx$
16. $\int_1^\infty \frac{x - \lfloor x \rfloor}{x^2} dx$
17. $\int_{-\infty}^\infty \frac{\cos t}{\cosh t} dt$
18. $\int_0^\infty \frac{\ln(x+1)}{x^2+1} dx$
19. $\int_0^\pi \sec x \ln\left(1 + \frac{\cos x}{3}\right) dx$

$$20. \int_0^1 \frac{\ln(1+x+x^2)}{x} dx$$

$$21. \int_{\frac{1}{e}}^{\infty} \frac{\sqrt{\ln x + 1}}{x^2} dx$$

$$22. \int_0^{\infty} \ln\left(\frac{e^x + 1}{e^x - 1}\right) dx$$

$$23. \int_0^1 \sqrt[4]{\frac{1}{x} - 1} dx$$

$$24. \int_0^{2\pi} e^{\cos x} \cos(nx - \sin x) dx$$

$$25. \int_0^{\infty} \frac{\ln x \sin x}{x} dx$$

$$26. \int_0^1 \frac{x-1}{(x+1)\ln x} dx$$

$$27. \int_0^1 \frac{\sin(\log x) - \log x}{\log^2 x} dx$$

$$28. \int_0^1 \frac{1}{\sqrt{1-x^2}} \ln\left(\frac{\sqrt{1+x}+1}{\sqrt{1+x}-1}\right) dx$$

$$29. \int_0^{\frac{1}{2}} \ln(\sqrt{1-x} - \sqrt{x}) dx$$

$$30. \int_0^{\infty} \frac{\arctan x \ln(1+x^2)}{x(a^2+x^2)} dx$$