

THE UK UNIVERSITY
INTEGRATION BEE

2023/24



ROUND TWO GROUP ROUND

Sponsored by



Jane Street

Group Round:

1. $\int_0^\pi \cos^2(\cos^2(x)) + \sin^2(\sin^2(x)) \, dx$
2. $\int_0^{\frac{\pi}{2}} \ln\left(\frac{1 + \sin(x)}{1 - \sin(x)}\right) \, dx$
3. $\int_0^1 \begin{vmatrix} 1 & 0 & \dots & 0 & x \\ 0 & 1 & \dots & 0 & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & \dots & 1 & 0 \\ x & 0 & \dots & 0 & 1 \end{vmatrix} dx$ where the matrix has dimensions 2024×2024
4. $\int_0^{\frac{\pi}{2}} \frac{x \tan(x) - 1}{\sqrt{\sec^2(x) - x^2}} \, dx$
5. $\int_0^\pi \int_0^{2\pi} \sin(y) e^{\sin(y)(\cos(x) - \sin(x))} \, dx \, dy$
6. $\int_0^\infty e^{-c(y+y^{-1})} y^{-\frac{1}{2}} \, dy$
7. $\int_0^1 \max_{n \in \mathbb{N}} \left(\frac{\lfloor 2^{n+1}x \rfloor}{2^n} - \frac{\lfloor 2^n x \rfloor}{2^{n-1}} \right) \, dx$
8. $\int \sqrt{(\sin(23x) + 10 \sin(24x) + \sin(25x))^2 + (\cos(23x) + 10 \cos(24x) + \cos(25x))^2} \, dx$
9. $\int_{-\infty}^\infty \binom{n}{x} \, dx$
10. $\int_0^\pi \tan^{-1}(1 + \cos(x)) \, dx$