THE UK UNIVERSITY INTEGRATION BEE 2021/22

$$\int$$

ROUND ONE

Wednesday, 20 October 2021

Sponsored by

1. $\int \sqrt{x\sqrt[3]{x\sqrt[4]{x\sqrt[5]{x\cdots}}}}\mathrm{d}x$
2. $\int_0^{2\pi} \cos^{420}(x)\mathrm{d}x$
3. $\int_0^{\frac{\pi}{2}} \frac{\sqrt{\cos\theta}}{(\sqrt{\cos\theta}+\sqrt{\sin\theta})^5}\mathrm{d}\theta$
4. $\int_0^1 \frac{\sin(\ln x)}{\ln x}\mathrm{d}x$
5. $\int_0^4 \frac{\ln(x)}{\sqrt{4x-x^2}}\mathrm{d}x$
6. $\int_0^\infty \left(\frac{\ln x}{1+x}\right)^2 \mathrm{d}x$
7. $\int_0^\infty \frac{\ln(x)}{x^2+2x+2}\mathrm{d}x$
8. $\int_{-\infty}^\infty \frac{\mathrm{d}x}{\left(x^3+\frac{1}{x^3}\right)^2}$
9. $\int \frac{x-1}{(x+1)\sqrt{x^3+x^2+x}}\mathrm{d}x$
10. $\int_0^{\frac{\pi}{2}} \frac{x}{\sin(x)}\mathrm{d}x$
11. $\int_1^\infty \left(\frac{\ln x}{x}\right)^{2011} \mathrm{d}x$
12. $\int_0^\infty \frac{\sin x}{x^n}\mathrm{d}x \ (0<n<2)$
13. $\int_0^{\frac{\pi}{2}} \frac{\cos x}{(1+\sqrt{\sin(2x)})^2}$
14. $\int_0^{\frac{\pi}{2}} \ln(7997\sin^2\theta + 7945\cos^2\theta)$
15. $\int \frac{\mathrm{d}x}{\csc x+1}$
16. $\int_0^{\frac{\pi}{2}} \frac{\{\tan(x)\}}{\tan(x)}\mathrm{d}x$, where $\{x\}$ is the fractional part of x
17. $\int_0^{\frac{\pi}{2}} \frac{\sin^3 x}{2+\sin x}\mathrm{d}x$
18. $\int \sqrt{\frac{1}{x}-1}\mathrm{d}x$
19. $\int_0^{2\pi} e^{3\cos\theta}\cos(3\sin\theta)\mathrm{d}\theta$

20. $\int \sqrt{x^2-1}\mathrm{d}x$
21. $\int_0^a \frac{x\mathrm{d}x}{\cos(x)\cos(a-x)}$
22. $\int_0^1 \frac{\arctan x}{1+x}\mathrm{d}x$
23. $\int_0^{\frac{\pi}{2}} \frac{\ln(\cos x)}{\sin x}\mathrm{d}x$
24. $\int \frac{x\arcsin x}{\sqrt{1-x^2}}\mathrm{d}x$
25. $\int_0^\infty \frac{\arctan(x)}{x(\log(x)^2+1)}\mathrm{d}x$
26. $\int_1^e \frac{x-x\ln x+1}{x(x+1)^2+x\ln^2 x}\mathrm{d}x$
27. $\int_0^\infty \frac{\cos(ax)}{x^2+b^2}\mathrm{d}x$
28. $\int_1^\infty \frac{\mathrm{d}x}{x+x^{\sqrt{2}}}$
29. $\int_0^\infty \lfloor x\rfloor e^{-x}\mathrm{d}x$
30. $\int_0^1 \frac{\arctan(x^2)}{1+x^2}\mathrm{d}x$
31. $\int_0^1 \frac{\mathrm{d}x}{1+\lfloor\frac{1}{x}\rfloor}$
32. $\int_0^\infty \frac{\cos(ax)-\cos(bx)}{x^2}\mathrm{d}x$
33. $\int_0^{2\pi} e^{\cos x}\cos(\sin x)\cos(5x)\mathrm{d}x$
34. $\int_{-\infty}^\infty \frac{\mathrm{d}x}{\cosh^2(x)}$
35. $\int_0^e W(x)\mathrm{d}x$, where W is the Lambert W function, the solution to $W(x)e^{W(x)}=x$
36. $\int_0^1 \frac{\arctan^2 x}{x}\mathrm{d}x$
37. $\int_0^{\frac{\pi}{2}} \cos x^{\sin x^{\cos x}} - \sin x^{\cos x^{\sin x}}\mathrm{d}x$
38. $\int_3^5 \ln\Gamma(x)\mathrm{d}x$
39. $\int \frac{\mathrm{d}x}{\sin^4(x)+\cos^4(x)}$
40. $\int_0^\infty \frac{\cos(\ln x)}{(1+x)^2}\mathrm{d}x$