

# UK University Integration Bee 2021 Round 1 Answers

1.  $\frac{x^{e-1}}{e-1}$
2.  $\frac{\pi}{2^{419}} \binom{420}{210}$
3.  $\frac{1}{6}$
4.  $\frac{\pi}{4}$
5. 0
6.  $\frac{\pi^2}{3}$
7.  $\frac{\pi \ln 2}{8}$
8.  $\frac{\pi}{9}$
9.  $2 \arctan \left( \sqrt{\frac{x^2 + x + 1}{x}} \right)$
10.  $2G$
11.  $\frac{2011!}{2010^{2012}}$
12. Either  $\sin \left( \frac{(1-n)\pi}{2} \right) \Gamma(1-n)$  or  $\cos \left( \frac{\pi n}{2} \right) \Gamma(1-n)$  or  $\frac{\pi \csc \left( \frac{n\pi}{2} \right)}{2\Gamma(n)}$  - all are equal.
13.  $\frac{1}{3}$
14.  $\pi \ln \left( \frac{\sqrt{7997} + \sqrt{7945}}{2} \right)$
15.  $x - \frac{2 \sin \left( \frac{x}{2} \right)}{\sin \left( \frac{x}{2} \right) + \cos \left( \frac{x}{2} \right)}$
16.  $\frac{1}{2} \left( \pi - \ln \left( \frac{\sinh(\pi)}{\pi} \right) \right)$
17.  $\frac{\pi(81 - 32\sqrt{3})}{36} - 2$
18.  $x \sqrt{\frac{1}{x} - 1} - \arctan \left( \sqrt{\frac{1}{x} - 1} \right)$
19.  $2\pi$
20.  $-\frac{\ln(|\sqrt{x^2-1}+x|) - x\sqrt{x^2-1}}{2}$
21.  $\frac{a \ln \sec a}{\sin a}$
22.  $\frac{\pi \ln 2}{8}$
23.  $-\frac{\pi^2}{8}$
24.  $x - \sqrt{1-x^2} \arcsin(x)$
25.  $\frac{\pi^2}{4}$

$$26. \cot^{-1}(1+e)$$

$$27. \frac{\pi}{2b}e^{-ab}$$

$$28. (1+\sqrt{2})\ln 2$$

$$29. \frac{1}{e-1}$$

$$30. \frac{1}{16}\ln^2(3-2\sqrt{2})$$

$$31. 2-\frac{\pi^2}{6}$$

$$32. \frac{\pi}{2}(b-a)$$

$$33. \frac{\pi}{120}$$

$$34. 2$$

$$35. e-1$$

$$36. \frac{\pi G}{2}-\frac{7}{8}\zeta(3)$$

$$37. 0$$

$$38. \ln(13824\pi)-7$$

$$39. \frac{\arctan\left(\frac{\tan(2x)}{\sqrt{2}}\right)}{\sqrt{2}}$$

$$40. \frac{\pi}{\sinh(\pi)}$$