

# THE UK UNIVERSITY INTEGRATION BEE

2022/23



## MARK SCHEME

Monday, 6 February 2023



Sponsored by



**Jane Street**

## 1 Group Round

Mark at the end of the round. Each correct answer is worth 6 marks.

From the markers guide: In this one, at the end when they have written down all their answers, I'll provide a sheet with the answers which you can just check. For the rest of the round, you don't need to be doing anything so feel free to go on your phone, study etc. There are some indefinite integrals; marking those is a bit complicated so you can leave those out, pass the answer sheet on to me and I'll mark it :).

1.  $-\ln(\sin 1)$

2.  $n!x - n! \ln \left( 1 + x + \frac{x^2}{2!} + \cdots + \frac{x^n}{n!} \right) + C$

3.  $1 - \frac{\pi^2}{6}$

4. 1

5.  $\ln \left( \frac{2}{\pi} \right)$

6.  $\frac{2}{3}$

7.  $-\ln 2 + 4 - 2G - \frac{\pi}{2}$

8. 0

9.  $\frac{\pi}{2}$

10.  $\frac{\pi}{2} \ln 2$



### 3 Relay Round

Each problem is worth 3 marks on the first attempt and any subsequent attempt is worth one mark. After completing a question they move onto the next one. They can skip questions but can't go back to any they've skipped. If they finish 15 or more questions, they're awarded an extra 10 marks.

1.  $I = J$

2.  $\frac{\pi}{2}$

3.  $\frac{7}{16}\zeta(3) - \frac{\pi^2 \log 2}{8}$

4.  $\frac{\pi}{2a\sqrt{a^2 - 1}}$

5.  $\ln\left(\frac{2024}{24}\right) = \ln\left(\frac{253}{3}\right)$

6.  $\frac{\pi \ln(3)}{12\sqrt{3}}$

7.  $\ln 2$

8.  $\sin(1)$

9.  $f(x) = e^x$

10.  $\frac{\log(1+a)}{a}$

11.  $\ln 2$

12.  $\ln 2$

13.  $1$

14.  $-\ln 2$

15.  $\frac{\pi}{2 \cos\left(\frac{\pi}{n}\right)}$

16.  $\frac{\pi}{4}$

17.  $\frac{\pi}{2\sqrt{2(a+1)}}$

18.  $\frac{\pi}{4}$

19.  $0$

20.  $1$