THE UK UNIVERSITY INTEGRATION BEE 2022/23

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

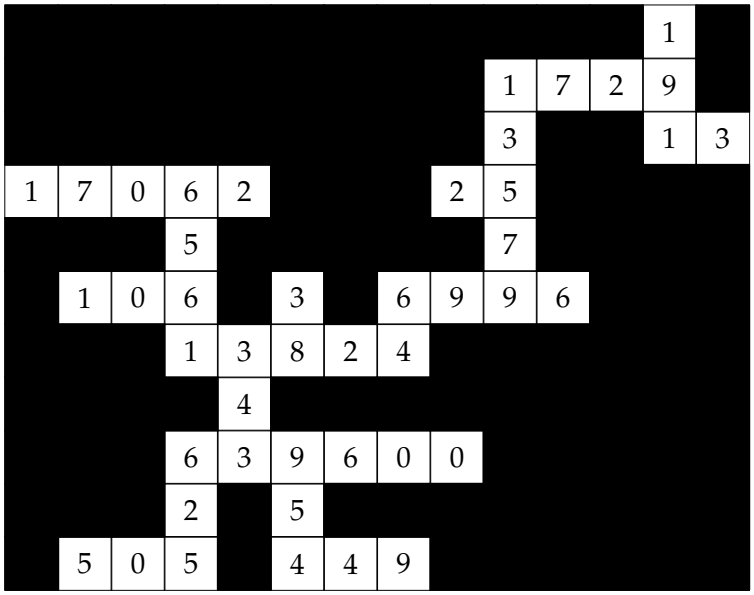
2 Crossnumber Round

In this round, mark as they go along. Each correct answer is worth 1 mark; when they submit an incorrect answer, put down the correct digit on the grid and don't award the mark.

From the markers guide: This is the most involved round to mark. Shortly before the event takes place, I'll send the completed crossnumber. To mark this, the team will say they want to submit an answer e.g '8 ACROSS'. Then they will either give the answer one digit at a time or all at once. If it's one at a time, mark each digit at a time, if it's all at once, mark all of them in a row.

Each half of the team has a copy of the crossnumber. When one of the halves submits an answer, write down the correct digit and put a little tick next to it if they submitted the right one. If they submit a wrong digit, put the correct one down on their crossnumber and put a cross next to it. The total marks at the end is the number of ticks.

2.1 Completed Crossnumber



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. $\dfrac{\pi}{2}$
3. $\dfrac{7}{16}\zeta(3) - \dfrac{\pi^2 \log 2}{8}$
4. $\dfrac{\pi}{2a\sqrt{a^2-1}}$
5. $\ln\left(\dfrac{2024}{24}\right) = \ln\left(\dfrac{253}{3}\right)$
6. $\dfrac{\pi \ln(3)}{12\sqrt{3}}$
7. $\ln 2$
8. $\sin(1)$
9. $f(x) = e^x$
10. $\dfrac{\log(1+a)}{a}$
11. $\ln 2$
12. $\ln 2$
13. 1
14. $-\ln 2$
15. $\dfrac{\pi}{2\cos\left(\frac{\pi}{n}\right)}$
16. $\dfrac{\pi}{4}$
17. $\dfrac{\pi}{2\sqrt{2(a+1)}}$
18. $\dfrac{\pi}{4}$
19. 0
20. 1