# THE UK UNIVERSITY INTEGRATION BEE 2021/22

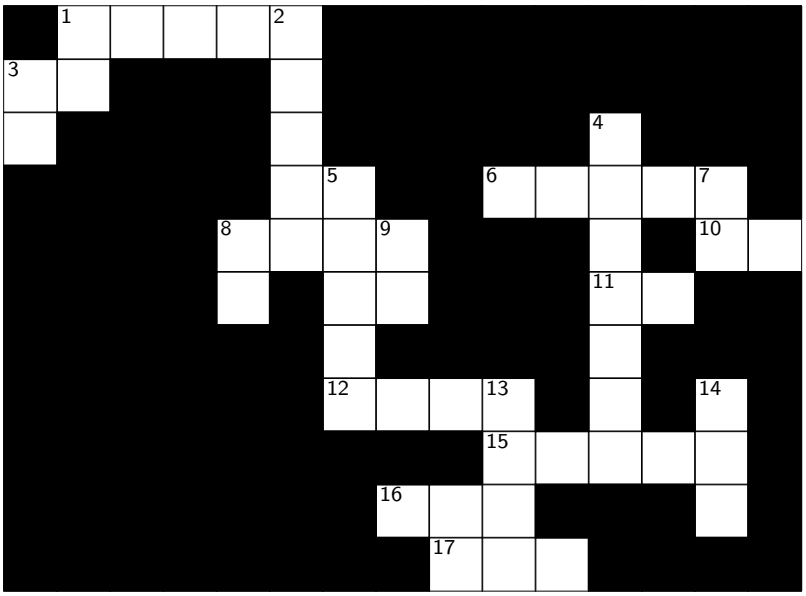
$$\int$$

# ROUND TWO CROSSNUMBER

**Saturday, 20 November 2021**

**Sponsored by**

Jane Street



**Across**

1. Smallest palindrome bigger than 17 ACROSS $\cdot\,(8\text{ DOWN}+1)^2$

3. $\displaystyle\int_0^2 f(x)\mathrm{d}x$ where $3\displaystyle\int_1^2 f(x)\mathrm{d}x - 5\int_0^1 f(x)\mathrm{d}x = 17$ and $21\displaystyle\int_0^1 f(x)\mathrm{d}x - 7\int_1^2 f(x)\mathrm{d}x = 35$

6. $\dfrac{1+16\text{ ACROSS}^{\,4}+(16\text{ ACROSS }+1)^4}{1+16\text{ ACROSS}^{\,2}+(16\text{ ACROSS }+1)^2}$

8. The year the Riemann Integral was first published

10. $\displaystyle\lim_{n\to\infty}\int_0^{14}\arctan(x^n)\mathrm{d}x$ to 2 significant figures

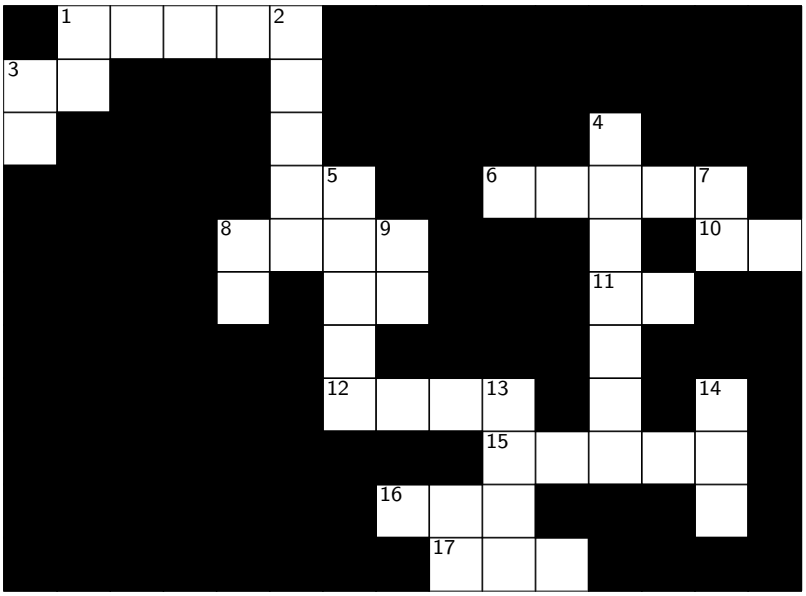
11. Sum of the three smallest clues

12. A Fibonacci number

15. $\dfrac{1+310^2+310^4}{1+310+310^2}$

16. 7 DOWN $\times$ 10 ACROSS $-$ 10

17. A power of 7



**Down**

1. $\dfrac{16 \text{ ACROSS } + 1}{3}$

2. The nearest integer to $\dfrac{279^4 + 4}{279^2 + 2 \cdot 279 + 2} + \displaystyle\int_0^\infty \frac{\ln(\sqrt{1+x})}{x\sqrt{x}} \mathrm{d}x$

3. The $x^{\text{th}}$ triangular number where $x$ is $7^{9 \text{ DOWN}} \mod 7 \text{ DOWN} + 1$

4. Palindromic number whose product of digits is 1764 and whose digit sum is $x$ mod 9 where $x$ is a solution of the quadratic $x^2 - 7 \text{ DOWN } x + 32 = 0$

5. The largest $n$ such that $I_n = \displaystyle\int_0^1 \frac{x^n}{1+x} \mathrm{d}x > \frac{1}{6 \text{ ACROSS} - 1}$

7. $\displaystyle\int_0^1 f(x)\mathrm{d}x$ where $5\displaystyle\int_0^2 f(x)\mathrm{d}x + 4\int_0^1 f(x)\mathrm{d}x = 143$ and $7\displaystyle\int_0^2 f(x)\mathrm{d}x + 11\int_1^2 f(x)\mathrm{d}x = 210$

8. The expected number of coin flips to get three heads in a row on a fair coin

9. 14 DOWN - 16 ACROSS

13. The year the Lebesgue Integral was published

14. $f(6)$ where $f$ is such that $f(x) + \displaystyle\int_2^5 f(t)\mathrm{d}t = 12x^2$