Day 187	A Level Maths: S Tier 10-a-day
1 A student's time on a task, in minutes, is N(42, 7^2). Given that it exceeds 49, find the probability that it exceeds 55.	
2 Solve the simultaneous equations $\log_3 x - \log_3 y = 1$ $x + y = 12$	
3 A tennis ball is projected from a point O on horizontal ground with speed 49 m s^{-1} at an angle θ above the horizontal, where $\tan\theta = \frac{4}{3}$. Find (a) the greatest height, (b) the speed when it is at half of this height (3 s.f.). Take g = 9.8 m s^{-2}.	
4 (a) Express $8\cos\theta - 6\sin\theta$ in the form $R\cos(\theta + \alpha)$, where $R > 0$ and $0 < \alpha < 90°$. Give α to 1 d.p. (b) Hence solve $8\cos\theta - 6\sin\theta = 7$ for $0 \leq \theta < 360°$, giving answers to 1 d.p.	
5 Sam claims that $n^2 - n + 17$ is prime for every positive integer n. Show that Sam is wrong by finding the smallest value of n that is a counter-example.	

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6 The breaking strength of a cable is N(μ, 64) with known variance 64. The mean was claimed to be 31 kN. A random sample of 64 has mean 28.5. Test at the 5% level whether the mean is different from 31.	
7 The region bounded by $y = e^x$, the x-axis and the lines $x = 0$ and $x = 1$ is rotated through 2π about the x-axis. Find the exact volume of the solid formed.	
8 A sequence is defined by $u_1 = -3$ and $u_{n+1} = \frac{3u_n + 4}{3u_n - 3}$. Show that the sequence is periodic and find $\sum_{r=1}^{99} u_r$.	
9 A particle P of mass 4 kg moves under a single force F N, where $F = (24t - 12)\mathbf{i} + (36t^2 - 8)\mathbf{j}$ and t is the time in seconds. At $t = 0$, P is at the origin with velocity $(4\mathbf{i} + 2\mathbf{j})$ m s^{-1}. Find (a) the velocity of P at $t = 2$, (b) the position vector of P at $t = 2$.	
10 Solve simultaneously, giving integer x and y: $4^x \times 16^y = 64$ $9^x \div 3^y = 3$	