Day 49	A Level Maths: S Tier 10-a-day
1 A uniform plank AB of length 8 m and mass 30 kg rests on supports at C and D, where AC = 3 m and DB = 2 m. A girl of mass 40 kg stands on it at distance x m from A. Find the range of x for which the plank stays in equilibrium on both supports.	
2 The curve $y = ab^x$ passes through (1, 8) and (4, 512). Find the exact values of a and b, and the value of y when x = 6.	
3 A bag has 4 yellow counters and some grey counters, n in total. Two are taken without replacement. P(both yellow) = $\frac{6}{55}$. Find n.	
4 Sam claims that $n^2 - n + 5$ is prime for every positive integer n. Show that Sam is wrong by finding the smallest value of n that is a counter-example.	
5 A box of mass 5 kg is at rest on rough horizontal ground ($\mu = 0.1$). A horizontal force of 11.9 N acts on it for 7 s and is then removed. Find (a) the speed when the force is removed, (b) the total distance travelled before the box stops. Take $g = 9.8$ m s^{-2}.	

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6 Find the exact value of $\sin(2\cos^{-1}(\frac{4}{5}))$.	
7 The sum of the first n terms of a sequence is $S_n = 2n^2 + 6n$. (a) Find an expression for u_n. (b) Find the least n for which $u_n > 165$.	
8 Solve simultaneously, giving integer x and y: $16^x \times 8^y = 1024$ $27^x \div 3^y = 3$	
9 $X \sim N(\mu, 100)$. H_0: $\mu = 71$ is tested against H_1: $\mu < 71$ using the mean of a sample of size 36 at the 5% level. (a) Find the critical region for the sample mean. (b) Find the probability of a Type II error when $\mu = 69.5$.	
10 $y = e^{2x}\cos x$. Show that $dy/dx = e^{2x}(2\cos x - \sin x)$. Find the x coordinate of the stationary point with the smallest positive x (3 s.f.), and its nature.	