Day 165	A Level Maths: S Tier 10-a-day
1 A pile of logs has 8 logs in its bottom row. Each row above has 1 fewer logs than the row below, and the pile has as many rows as possible, each with at least one log. Find the number of rows and the total number of logs.	
2 Solve $\log_2(x + 10) + \log_2(x - 2) = 6$, justifying clearly any root that you reject.	
3 Express $\frac{-4 - 3\sqrt{7}}{3 + \sqrt{7}}$ in the form $p + q\sqrt{7}$, where p and q are rational numbers.	
4 The scores in an aptitude test are normally distributed. 30% are less than 45 and 5% are greater than 76. Find the mean and standard deviation, each correct to 3 significant figures.	
5 A ball is projected from level ground with horizontal and vertical velocity components 34.3 and 49 m s^{-1}. Find (a) the two times at which it moves at 45° to the horizontal, (b) the horizontal distance between those two points. Take g = 9.8 m s^{-2}.	

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6 Solve $4\sec^2\theta + 7\tan\theta - 6 = 0$ for $0 \leq \theta < 360°$, giving answers to 1 d.p.	
7 Faults in a cable occur at random at a mean rate of 5 per week. After a modification, 19 faults are found in 2 weeks. Test at the 5% level whether the rate of faults has increased.	
8 The equation $x^3 = 5x + 14$ has a root α. (a) Show that the equation can be written as $x = \sqrt[3]{(5x + 14)}$. (b) Use $x_{n+1} = \sqrt[3]{(5x_n + 14)}$ with $x_0 = 3$ to find x_1, x_2, x_3 to 4 d.p., and hence state α to 3 d.p.	
9 The curve C has parametric equations $x = t$, $y = 4t^2$. The line $y = -20x - 24$ meets C at A and B. Find the exact length AB.	
10 Particles of mass 12 kg and 9 kg hang on a light string over a smooth fixed pulley. The 12 kg particle is 1.75 m above the ground; the 9 kg one is on the ground. Released from rest, find (a) the tension, (b) the greatest height reached by the 9 kg particle. Take $g = 9.8$ m s^{-2}.	