Day 218	A Level Maths: S Tier 10-a-day
1 Express $\frac{1+2\sqrt{2}}{4+\sqrt{2}}$ in the form $p + q\sqrt{2}$, where p and q are rational numbers.	
2 A binomial random variable X has mean 27 and variance 6.75. (a) Find n and p. (b) Find P(X = 26), correct to 3 significant figures.	
3 (a) Show that $\frac{1-\cos 2\theta}{1+\cos 2\theta} \equiv \tan^2\theta$. (b) Hence solve $\frac{1-\cos 2\theta}{1+\cos 2\theta} = \frac{3}{2}$ for $0 \leq \theta < 360°$ (1 d.p.).	
4 Find the binomial expansion of $(4 + 6x)^{-\frac{1}{2}}$ in ascending powers of x up to and including the term in x^3. State the values of x for which it is valid.	
5 A lift of mass M kg, carrying a passenger of mass 60 kg, hangs from a vertical cable. The tension in the cable is 5676 N and the floor exerts a force of 516 N on the passenger. Find (a) the acceleration of the lift, with its direction, (b) the value of M. Take g = 9.8 m s^{-2}.	

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6 Each bulb is faulty with probability 0.08, independently. Find the least number n of bulbs that must be tested so that the probability of finding at least one faulty is greater than 0.995.	
7 The curves $y = e^x$ and $y = 9\,e^{-x}$ meet at the point P. Find the exact area of the region bounded by the two curves and the y-axis.	
8 $\frac{dy}{dx} = e^{x-y}$, and $y = \ln 6$ when $x = 0$. Show that $e^y = e^x + 5$ and hence find y in terms of x.	
9 The curve C has parametric equations $x = 3t$, $y = 4t^2$. The line $y = -\frac{28}{3}x - 48$ meets C at A and B. Find the exact length AB.	
10 Two ships A and B move with constant velocities. At time t = 0 hours, A is at $(-5\mathbf{i} - 4\mathbf{j})$ km relative to a fixed origin and B is at $(-3\mathbf{i} - 15\mathbf{j})$ km. A has velocity $(5\mathbf{i} + 5\mathbf{j})$ km h^{-1} and B has velocity $(2\mathbf{i} + 9\mathbf{j})$ km h^{-1}. Find (a) the time at which the ships are closest together, (b) the least distance between them.	