Day 83	A Level Maths: S Tier 10-a-day
1 For events A and B, P(A) = 0.9, P(B) = 0.8 and P(A | B) = 0.9. (a) Find P(A ∩ B). (b) Find P(A′ | B′).	
2 Solve $2^{2x} - 13 \times 2^{x} + 40 = 0$, giving each answer exactly and, where not an integer, to 3 s.f.	
3 The daily output of a machine is N(μ, 25) with known variance 25. The mean was claimed to be 61 units. A random sample of 36 has mean 59.75. Test at the 5% level whether the mean is greater than 61.	
4 Car P passes a point O travelling at a constant speed of 24.3 m s^{-1}. 2 s later, car Q leaves O from rest with constant acceleration 3 m s^{-2}, travelling in the same direction. Q overtakes P at the point X. Find (a) the time Q takes to reach X, (b) the distance OX, (c) the speed of Q at X.	
5 $y = e^{3x} \cos 3x$. Show that $dy/dx = e^{3x}(3 \cos 3x - 3 \sin 3x)$. Find the x coordinate of the stationary point with the smallest positive x (3 s.f.), and its nature.	

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6 The curve $y = 2x^2 + 2x + 5$ is translated by $\begin{pmatrix} 1 \\ -2 \end{pmatrix}$ and then a stretch, scale factor 2, parallel to the y-axis. Find the equation of the resulting curve in the form $y = ax^2 + bx + c$.	
7 The curve $y = x^3\sqrt{112 - x}$, for $0 < x < 112$, has one stationary point. Find its exact coordinates and determine its nature.	
8 A sequence is defined by $u_1 = 5$ and $u_{n+1} = \frac{1}{1 - u_n}$. Show that the sequence is periodic and find $\sum_{r=1}^{99} u_r$.	
9 A shell is projected from level ground with horizontal and vertical velocity components 34.3 and 53.9 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}.	
10 The curve C has parametric equations $x = 2t$, $y = 4t^2$. The line $y = 8x - 12$ meets C at A and B. Find the exact length AB.	