Day 107	A Level Maths: S Tier 10-a-day
1 Three forces $(8\mathbf{i} - 6\mathbf{j})$ N, $(1\mathbf{i} + k\mathbf{j})$ N and $(4\mathbf{j})$ N act on a particle of mass 5 kg. The resultant is parallel to $(9\mathbf{i} - 10\mathbf{j})$. Find (a) the value of k, (b) the magnitude of the acceleration of the particle, to 3 s.f.	
2 Sam claims that $n^2 + n + 11$ is prime for every positive integer n. Show that Sam is wrong by finding the smallest value of n that is a counter-example.	
3 A is acute and B is acute. $\sin A = \frac{5}{13}$ and $\sin B = \frac{8}{17}$. Find the exact values of $\cos(A + B)$ and $\tan(A - B)$.	
4 A shell is projected from level ground with horizontal and vertical velocity components 53.9 and 63.7 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}.	
5 For n = 15 pairs of values: $\Sigma x = 90$, $\Sigma y = 720$, $\Sigma x^2 = 610$, $\Sigma xy = 4180$. (a) Find the equation of the regression line of y on x. (b) The x values lie between 2 and 11. Estimate y when x = 11 and comment on its reliability.	

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6 Solve $x^4 - 9x^3 + 28x^2 - 36x + 16 < 0$.	
7 Solve $3^{2x} - 19 \times 3^x + 90 = 0$, giving each answer exactly and, where not an integer, to 3 s.f.	
8 X ~ B(150, 0.15). (a) State why a normal approximation is suitable for X. (b) Use a normal approximation to estimate P(X ≥ 36), to 3 significant figures.	
9 The region bounded by $y = \sqrt{\sin x}$, the x-axis and the lines $x = 0$ and $x = \pi$ is rotated through 2π about the x-axis. Find the exact volume of the solid formed.	
10 In the diagram, line l_1 passes through A and B. Line l_2 is perpendicular to l_1 at B and meets the x-axis at C. Find the coordinates of C and the area of triangle ABC. 	