Day 285	A Level Maths: A Tier 10-a-day
1 A non-uniform rod AB (length 6 m, mass 8 kg) has its centre of mass at G, AG = 2.25 m. It hangs horizontally from vertical strings at A and B. A particle of mass m kg is fixed at P, AP = 3.75 m, making the tensions equal. Find (a) m, (b) the tension. Take g = 9.8.	
2 $f(x) = e^x - x - 7$. Show that the equation f(x) = 0 has a root α in the interval [2, 3].	
3 Express $\frac{x^2 + 6x - 13}{(x + 1)(x - 2)}$ in the form $1 + \frac{A}{(x + 1)} + \frac{B}{(x - 2)}$, where A and B are constants to be found.	
4 The vectors $\begin{pmatrix} k \\ k \\ 1 \end{pmatrix}$ and $\begin{pmatrix} k \\ 3 \\ 2 \end{pmatrix}$ are perpendicular. Find the possible values of k and, for the larger value, the exact length of the first vector.	
5 A stone is projected from a cliff top 86.4 m above the sea at 25 m s^{-1}, at angle α above the horizontal, $\tan \alpha = \frac{3}{4}$. Find (a) the time to reach the sea, (b) the horizontal distance travelled, (c) the speed on impact. Take g = 9.8. Give answers to 3 s.f. if not exact.	

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6 $f(x) = x^2 + 2x + 8$, $x \in \mathbb{R}$, and $g(x) = \frac{2}{x-5}$, $x > 5$. (a) Find the range of f. (b) Show that gf is defined and find its range.	
7 $X \sim Po(16)$. Use a suitable approximation to find $P(X \leq 24)$, to 3 significant figures.	
8 Expand $(3 - 2x)^{-1}$ in ascending powers of x, up to and including x^2. State the range of x for which the expansion is valid.	
9 The tangent to the curve $y = \ln(3x)$ at the point P passes through the origin. Find the exact coordinates of P and the equation of the tangent.	
10 $X \sim N(50, 8^2)$. Find $P(X > 59 \mid X > 55)$ to 3 significant figures.	