Day 254	A Level Maths: A Tier 10-a-day
1 A and B have position vectors $\begin{pmatrix}-4\\1\end{pmatrix}$ and $\begin{pmatrix}-4\\6\end{pmatrix}$. The point P lies on AB with AP : PB = 1 : 4. Find the position vector of P and the exact distance OP.	
2 A 2 kg particle is in equilibrium on a rough plane inclined at α, $\tan\alpha = \frac{4}{3}$, $\mu = 0.4$. A horizontal force of P N, in the vertical plane through a line of greatest slope, pushes it towards the plane. Find the least and greatest values of P. Take g = 9.8. Give answers to 3 s.f. if not exact.	
3 How many arrangements of the letters of NUMBERS have N and U not next to each other?	
4 Forces $F_1 = (-7\mathbf{i} - \mathbf{j})$ N, $F_2 = (5\mathbf{i} - 12\mathbf{j})$ N and $F_3 = (a\mathbf{i} + b\mathbf{j})$ N keep a 4 kg particle in equilibrium. Find (a) a and b. F_2 is then removed; (b) find the magnitude of the acceleration.	
5 (a) Express $\frac{3x+16}{(x+4)^2}$ in the form $\frac{A}{x+4} + \frac{B}{(x+4)^2}$. (b) Hence find the exact value of $\int_0^4 \frac{3x+16}{(x+4)^2}\,dx$.	

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6 The curve with equation $y = x^2 + 6x - 4$ is transformed by a translation of $\begin{pmatrix}3\\2\end{pmatrix}$, followed by a reflection in the x-axis. Find the equation of the image curve.	
7 Solve $4\text{cosec}^2 x - 14\cot x - 12 = 0$ for $0° < x < 180°$. Give answers to 1 d.p.	
8 The line $3x + 4y = -14$ meets the circle $(x + 4)^2 + (y + 4)^2 = 16$ at the points A and B. Find the exact length of AB.	
9 Eggs are defective with probability 0.15, independently. A tray of 8 eggs is rejected if it has at least 3 defective. From 9 such trays, find the probability that exactly 3 are rejected (3 s.f.).	
10 Solve $x(\sqrt{5} - 2) = 5 - 4\sqrt{5}$, writing x in the form $p + q\sqrt{5}$.	