Day 202	A Level Maths: A Tier 10-a-day
1 A non-uniform rod AB (length 2 m, mass 6 kg) has its centre of mass at G, AG = 0.75 m. It hangs horizontally from vertical strings at A and B. A particle of mass m kg is fixed at P, AP = 1.75 m, making the tensions equal. Find (a) m, (b) the tension. Take g = 9.8.	
2 A stratified sample of 80 people is taken from three groups. 9 of the sample are from Sales, which has 135 people. (a) Find the total number of people. (b) Admin has 210 people. How many are sampled?	
3 l_1: $\mathbf{r} = \begin{pmatrix} -2 \\ 3 \\ -3 \end{pmatrix} + \lambda \begin{pmatrix} 2 \\ 3 \\ 1 \end{pmatrix}$ l_2: $\mathbf{r} = \begin{pmatrix} -2 \\ 6 \\ -1 \end{pmatrix} + \mu \begin{pmatrix} 0 \\ 3 \\ 0 \end{pmatrix}$ Determine whether l_1 and l_2 intersect. If they do, find the point of intersection.	
4 P(A) = 0.8 and P(A ∪ B) = 0.9. (a) Given that A and B are independent, find P(B). (b) Given instead that A and B are mutually exclusive, find P(B). (c) In the case in (a), find P(A′ ∩ B).	
5 Express $\frac{-5x^2 - 10x - 4}{(x+2)(x+1)^2}$ in the form $\frac{A}{(x+2)} + \frac{B}{(x+1)} + \frac{C}{(x+1)^2}$, and find A, B and C.	

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6 A 6 kg block is released from rest on a rough plane inclined at α, $\tan\alpha = \frac{3}{4}$, $\mu = 0.25$, and slides 8 m down a line of greatest slope. Use work and energy to find (a) the work done against friction, (b) its speed after 8 m. Take $g = 10$.	
7 A curve has equation $-2x^2 - 2xy + 3y^2 + 4y = 15$. Show that $P(3, -3)$ lies on the curve and find the equation of the tangent at P in the form $ax + by + c = 0$ with integer a, b, c.	
8 Express $\frac{-1 + 2\sqrt{2}}{3 - 3\sqrt{2}}$ in the form $p + q\sqrt{2}$, where p and q are rational numbers.	
9 Prove by contradiction that $\sqrt{7}$ is irrational.	
10 Solve $4\text{cosec}^2 x + 16\cot x + 8 = 0$ for $-180° < x < 180°$, $x \neq 0$. Give answers to 1 d.p.	