Day 37	A Level Maths: A Tier 10-a-day
1 The line l has equation $\mathbf{r} = \begin{pmatrix} -7 \\ -6 \\ 4 \end{pmatrix} + t\begin{pmatrix} 2 \\ 3 \\ -2 \end{pmatrix}$. Find the coordinates of the foot of the perpendicular from P(2, 1, −2) to l, and the exact distance from P to l.	
2 The 5th term of an arithmetic sequence is −23 and the 8th term is −35. Find the first term and common difference, and the sum of the first 12 terms.	
3 X ~ B(13, 0.1). Find, to 3 significant figures: (a) P(4 ≤ X ≤ 6) (b) P(X > 4)	
4 Use the trapezium rule with 4 strips to estimate $\int_0^2 2^x \, dx$, giving your answer to 3 s.f. State, with a reason, whether your estimate is an overestimate or an underestimate.	
5 For 10 values of x, $\Sigma(x - 200) = 10$ and $\Sigma(x - 200)^2 = 20$. Find the mean and standard deviation of x.	

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6 A particle P has position vector $\mathbf{r} = (t^3 - 3t)\mathbf{i} + (4t^2 - 8t)\mathbf{j}$ metres at time t s. Find (a) the speed of P when t = 4, (b) the value of t when P is moving parallel to $\mathbf{i}$.	
7 $y = x^3 \ln x$ for $x > 0$. Find the exact coordinates of the stationary point and show that it is a minimum.	
8 The circle $x^2 + y^2 + 4x + 2y - 164 = 0$ passes through P(3, −13). (a) Find the equation of the tangent at P, in the form ax + by = c. (b) Find the coordinates of the point where this tangent crosses the x-axis.	
9 A ball is projected from the ground at 32 m s^{-1} at angle α above the horizontal, $\tan\alpha = \frac{15}{8}$. At time T s, while in flight, it is moving perpendicular to its initial direction. Find (a) T, (b) the height of the ball then. Take g = 9.8. Give answers to 3 s.f. if not exact.	
10 A sequence is defined by $u_1 = \frac{1}{2}$ and $u_{n+1} = -\frac{1}{u_n}$. (a) Find u_2 and u_3. (b) Find u_{99} and $\sum_{r=1}^{99} u_r$.	