Day 332	A Level Maths: S Tier 10-a-day
1 X and Y are independent, X ~ Po(4) and Y ~ Po(3). (a) State the distribution of X + Y. (b) Given that X + Y = 6, find the probability that X = 5.	
2 A sequence is defined by $u_1 = -1$ and $u_{n+1} = \frac{1}{1 - u_n}$. Show that the sequence is periodic and find $\sum_{r=1}^{75} u_r$.	
3 Solve 2 ln x = ln(x + 42) + ln 1, stating clearly why one root is rejected.	
4 A particle P moves in a plane. At time t seconds its position vector relative to a fixed origin O is r metres, where $\mathbf{r} = (-t^2)\mathbf{i} + (2.5t^2 - 6t)\mathbf{j}$. Find (a) the value of t at which P is moving parallel to $(\mathbf{i} - 2\mathbf{j})$, (b) the speed of P at this time (3 s.f. if not exact).	
5 The equation $x^3 = x + 15$ has a root α. (a) Show that the equation can be written as $x = \sqrt[3]{(x + 15)}$. (b) Use $x_{n+1} = \sqrt[3]{(x_n + 15)}$ with $x_0 = 2$ to find x_1, x_2, x_3 to 4 d.p., and hence state α to 3 d.p.	

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6 A pile of logs has 10 logs in its bottom row. Each row above has 1 fewer logs than the row below, and the pile has as many rows as possible, each with at least one log. Find the number of rows and the total number of logs.

7 The tangent to $y = \frac{x^2 + 5}{x + 2}$ at the point where $x = 4$ meets the axes at A and B. Find the exact area of triangle OAB, where O is the origin.

8 Particles A and B are projected from a point O at the same instant, with initial velocities $(16\mathbf{i} + 40\mathbf{j})$ m s^{-1} and $(8\mathbf{i} + 34\mathbf{j})$ m s^{-1} respectively (i horizontal, j vertically upwards). Both are still in flight after 2 s. Find (a) the distance AB at this time, (b) the angle AB makes with the horizontal, to 1 d.p.

9 $X \sim B(10, \frac{1}{5})$.

(a) Show that $P(X = r + 1) \div P(X = r) = \frac{10 - r}{r + 1} \times \frac{1}{4}$.

(b) Find the most likely value of X and its probability (3 s.f.).

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.

