Day 113	A Level Maths: S Tier 10-a-day
1 The first row of a theatre has 22 seats. Each row has 4 more seats than the row in front. Find (a) the number of seats in row 36, (b) the least number of rows for at least 604 seats.	
2 X ~ B(10, p). It is given that $P(X = 2) = \frac{9}{8} \times P(X = 1)$. (a) Find the value of p. (b) Find P(X = 0), correct to 3 significant figures.	
3 Use the substitution $u = 1 + \ln x$ to find the exact value of $\int_1^{e^3} \frac{1}{x(1 + \ln x)}\, dx$	
4 A sequence is defined by $u_1 = 4$ and $u_{n+1} = \frac{1}{1 - u_n}$. Show that the sequence is periodic and find $\sum_{r=1}^{60} u_r$.	
5 A ball is projected from level ground with horizontal and vertical velocity components 34.3 and 53.9 m s^{-1}. Find (a) the two times at which it moves at 45° to the horizontal, (b) the horizontal distance between those two points. Take g = 9.8 m s^{-2}.	

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6 Data satisfy $y = ab^x$. The line of best fit for lg y against x is lg y = 0.7 + 0.5x.
(a) Find a and b to 3 significant figures.
(b) Estimate y when x = 17, to 3 significant figures.
(c) Interpret the value of b.

7 The curve C has equation $y = \frac{3x + 18}{x + 3}$.
(a) Write down the equations of the asymptotes of C.
(b) The line $y = -x + k$ is a tangent to C.
Find the possible values of k.

8 The tangent to $y = \frac{24}{x^2 + 3}$ at the point where x = 3
meets the axes at A and B. Find the exact area of triangle OAB,
where O is the origin.

9 A particle P of mass 2 kg moves under a single force F N, where $\mathbf{F} = (12t + 10)\mathbf{i} + (18t^2 - 10)\mathbf{j}$ and t is the time in seconds. At t = 0, P is at the origin with velocity $(3\mathbf{i} + 2\mathbf{j})$ m s^{-1}.
Find (a) the velocity of P at t = 2, (b) the position vector of P at t = 2.

10 $\frac{dy}{dx} = \frac{3x^2}{y}$, y > 0, and y = 3 when x = 0.
Find y in terms of x, and the value of y when x = 2.