Day 14	A Level Maths: A Tier 10-a-day
1 Emails arrive at a mean rate of 6 per hour, as a Poisson process. Find the probability that in one such period there are (a) exactly 8 (b) at least 8 (c) fewer than 8 (3 s.f.).	
2 A driver at constant speed sees a hazard 60 m ahead. After a reaction time of 0.5 s she brakes with deceleration 4 m s^{-2} and stops exactly at the hazard. Find (a) her initial speed, (b) the total time from seeing the hazard to stopping.	
3 $y = 3^{2x}$. The gradient of the curve at P is 162 ln 3. Find the x-coordinate of P.	
4 A is (5, −3) and B is (−1, −1). (a) Find the equation of the perpendicular bisector of AB, in the form ax + by = c. (b) The perpendicular bisector meets the x-axis at P. Find the area of triangle ABP.	
5 $y = \ln(x^2 + 6)$. Find $\frac{dy}{dx}$ and the gradient of the curve at x = 3.	

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6 A sequence is defined by $u_1 = 3$ and $u_{n+1} = \frac{1}{1 - u_n}$. (a) Find u_2 and u_3. (b) Find u_{101} and $\sum_{r=1}^{101} u_r$.	
7 X ~ B(30, 0.25). Find the largest value of c such that $P(X \leq c) < 0.01$.	
8 Solve $x(\sqrt{3} - 3) = -1 + \sqrt{3}$, writing x in the form $p + q\sqrt{3}$.	
9 Solve the differential equation $y\frac{dy}{dx} = e^x$, given that y = 4 when x = 0 (y > 0). Give y in terms of x.	
10 A ball is projected from a point O on horizontal ground at angle α above the horizontal, $\tan\alpha = \frac{3}{4}$, and passes through A, 16 m horizontally from O and 9.5 m above the ground. Find the speed of projection. Take g = 9.8.	