Day 257	A Level Maths: A Tier 10-a-day
1 On each independent trial, the probability that a biased die shows a six is $\frac{1}{4}$. X is the number of trials up to and including the first success. (a) Find P(X = 5) and E(X). (b) Find the least m with P(X ≤ m) > 0.99.	
2 Car A passes P at constant speed 4 m s^{-1}. 6 s later car B leaves P from rest, in the same direction, with acceleration 1 m s^{-2}. B overtakes A at Q. Find (a) the time B takes to reach Q, (b) PQ, (c) the speed of B at Q.	
3 Solve $4\text{cosec}^2 x + 8\cot x - 1 = 0$ for $0° < x < 360°$. Give answers to 1 d.p.	
4 An arithmetic series has first term −7 and common difference 3. The sum of the first n terms is 333. Find n.	
5 Find the exact value of $\int_0^{\ln 5} (2e^{2x} + 4e^x)\,dx$.	

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6 Particles A (2 kg) and B (8 kg) move in the same direction on a smooth horizontal line at 3 m s^{-1} and 5 m s^{-1}. They collide and coalesce. Find (a) the speed of the combined particle, (b) the kinetic energy lost in the collision.	
7 X ~ B(20, p). H_0: p = 0.2 is tested against H_1: p ≠ 0.2 at the 5% level. (a) Find the critical region. (b) Find the actual significance level of the test (3 s.f.).	
8 The circle $x^2 + y^2 - 6x + 8y - 75 = 0$ passes through P(9, 4). (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 $g(\theta) = \frac{1}{22 + 15\sin\theta + 8\cos\theta}$ (a) Write 15 sin θ + 8 cos θ in the form R sin(θ + α), with α acute. (b) Find the greatest and least values of g(θ) and the smallest positive θ at which the greatest value occurs (1 d.p.).	
10 $f(x) = \frac{-21x + 8}{(1 - 2x)(1 - 3x)}$. (a) Express f(x) in partial fractions. (b) Hence expand f(x) up to x^2. (c) State the range of x for which the expansion is valid.	