Day 260	A Level Maths: S Tier 10-a-day
1 A binomial random variable X has mean 5 and variance 4.5. (a) Find n and p. (b) Find P(X = 6), correct to 3 significant figures.	
2 A population of bacteria is modelled by $P = P_0e^{kt}$, t in hours. Initially P = 120 and after 5 hours P = 150. Find k, and the time for the population to reach 1440, to 3 s.f.	
3 A pile of logs has 15 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.	
4 A box of mass 15 kg is at rest on rough horizontal ground ($\mu = 0.2$). A horizontal force of 50.4 N acts on it for 7 s and is then removed. Find (a) the speed when the force is removed, (b) the total distance travelled before the box stops. Take $g = 9.8$ m s^{-2}.	
5 For n = 12 pairs of values: $\Sigma x = 132$, $\Sigma y = 708$, $\Sigma x^2 = 1598$, $\Sigma xy = 7569$. (a) Find the equation of the regression line of y on x. (b) The x values lie between 7 and 16. Estimate y when x = 17 and comment on its reliability.	

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6 Given that $\sin 3\theta \equiv 3\sin\theta - 4\sin^3\theta$, solve $\sin 3\theta = 2\sin\theta$ for $0 < \theta < 180°$.	
7 Express $\frac{2x^3 + 3x^2 - 18x + 3}{(x-2)(x+3)}$ in the form $ax + b + \frac{C}{(x-2)} + \frac{D}{(x+3)}$.	
8 A particle P moves in a plane. At time t seconds its position vector relative to a fixed origin O is r metres, where $\mathbf{r} = (-2.5t^2 + 7t)\mathbf{i} + (1.5t^2 - 7t)\mathbf{j}$. Find (a) the value of t at which P is moving parallel to $(2\mathbf{i} - \mathbf{j})$, (b) the speed of P at this time (3 s.f. if not exact).	
9 The curve $y = ab^x$ passes through (0, 6) and (3, 750). Find the exact values of a and b, and the value of y when x = 5.	
10 The line $8y = 6x + k$ is a tangent to the circle $(x + 1)^2 + (y + 0)^2 = 4$. Find the two possible values of k.	