Day 294	A Level Maths: S Tier 10-a-day
1 The line $8y = 6x + k$ is a tangent to the circle $(x + 3)^2 + (y + 1)^2 = 4$. Find the two possible values of k.	
2 Find the exact value of $\tan(2\cos^{-1}(\frac{21}{29}))$.	
3 A pile of logs has 19 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 drink cools according to $\theta = 20 + Ae^{-kt}$, where θ °C is the temperature after t minutes. Initially $\theta = 100$, and after 10 minutes $\theta = 68$. Find A and k, then find when $\theta = 43$ (3 s.f.).	
5 A box holds 8 components, each faulty with probability 0.15, independently. A box is rejected if it has at least 2 faulty components. (a) Find the probability that a box is rejected. (b) 12 boxes are inspected. Find the probability that at least 2 are rejected.	

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6 A curve has parametric equations $x = t^2$, $y = 2t^3 + 36t$. Find the coordinates of the points on the curve where the gradient is 15.	
7 The masses of apples, in grams are modelled by $N(69, \sigma^2)$. The probability of a value above 78 is 0.15. (a) Find σ. (b) Find the probability of a value below 60.	
8 A plank of mass 5 kg lies on a smooth horizontal table, with a block of mass 3 kg on it ($\mu = 0.5$ between them). A horizontal force P N acts on the block. (a) Find the greatest P for which the block does not slip. (b) Find the accelerations of block and plank when P = 70.56. Take g = 9.8 m s^{-2}.	
9 Solve simultaneously: $x - y = 5$ $x^2 + 2xy - y^2 = -7$	
10 Two ships A and B move with constant velocities. At time t = 0 hours, A is at $(9\mathbf{i} - 8\mathbf{j})$ km relative to a fixed origin and B is at $(19\mathbf{i} - 13\mathbf{j})$ km. A has velocity $(2\mathbf{i} + 3\mathbf{j})$ km h^{-1} and B has velocity $(-\mathbf{i} + 7\mathbf{j})$ km h^{-1}. Find (a) the time at which the ships are closest together, (b) the least distance between them.	