Day 297	A Level Maths: S Tier 10-a-day
1 A bag has 4 red, 3 blue and 2 green counters. A player takes two without replacement. Two reds win £3, two blues win £9, anything else wins nothing. (a) Find the expected winnings. (b) The player pays £1 to play. Find the expected profit.	
2 Solve $3^{2x} - 3 \times 3^{x} + 2 = 0$, giving each answer exactly and, where not an integer, to 3 s.f.	
3 Evaluate $\sum_{r=3}^{10}(4 \times 2^{r} + 2r)$.	
4 A drink cools according to $\theta = 15 + Ae^{-kt}$, where θ °C is the temperature after t minutes. Initially $\theta = 90$, and after 4 minutes $\theta = 60$. Find A and k, then find when $\theta = 30$ (3 s.f.).	
5 Solve $5^{2x} + 3 \times 5^{x} - 4 = 0$.	

Day 297	A Level Maths: S Tier 10-a-day
6 The curve C has equation $x e^y + y = 3$. Find the equation of the tangent to C at the point (3, 0), in the form $ax + by + c = 0$ with integers a, b, c.	
7 Two ships A and B move with constant velocities. At time t = 0 hours, A is at $(-4\mathbf{i} + 3\mathbf{j})$ km relative to a fixed origin and B is at $(-26\mathbf{i} - 18\mathbf{j})$ km. A has velocity $(-5\mathbf{i} - 2\mathbf{j})$ km h^{-1} and B has velocity $(\mathbf{i} + 6\mathbf{j})$ km h^{-1}. Find (a) the time at which the ships are closest together, (b) the least distance between them.	
8 A ball is projected from a point O on horizontal ground at 21 m s^{-1}, at angle θ above the horizontal. It passes through the point P, 18 m horizontally and 14 m vertically from O. Find the two possible values of $\tan\theta$, and the two possible values of θ to 1 d.p. Take g = 9.8 m s^{-2}.	
9 A box holds 7 components, each faulty with probability 0.05, independently. A box is rejected if it has at least 2 faulty components. (a) Find the probability that a box is rejected. (b) 14 boxes are inspected. Find the probability that at least 3 are rejected.	
10 The curve C has parametric equations $x = t$, $y = 3t^2$. The line $y = 15x - 12$ meets C at A and B. Find the exact length AB.	