Day 4	A Level Maths: S Tier 10-a-day
1 A bag has 3 red, 4 blue and 3 green counters. A player takes two without replacement. Two reds win £4, two blues win £7, anything else wins nothing. (a) Find the expected winnings. (b) The player pays £1 to play. Find the expected profit.	
2 A lift of mass 450 kg, carrying a passenger of mass 85 kg, is supported by a vertical cable. The lift is moving downwards and accelerating at 0.4 m s^{-2}. Find (a) the force the floor exerts on the passenger, (b) the tension in the cable. Take g = 9.8 m s^{-2}.	
3 Prove that the difference between the squares of any two odd integers is a multiple of 8.	
4 $f(\theta) = \frac{4}{29 + 7\sin\theta + 24\cos\theta}$ (a) Write $7\sin\theta + 24\cos\theta$ as $R\sin(\theta + \alpha)$, $R > 0$, $0 < \alpha < 90°$. (b) Find the greatest and least values of $f(\theta)$, and the smallest positive θ at which the greatest value occurs, to 1 d.p.	
5 For n = 20 pairs of values: $\Sigma x = 180$, $\Sigma y = 1040$, $\Sigma x^2 = 1805$, $\Sigma xy = 9212$. (a) Find the equation of the regression line of y on x. (b) The x values lie between 5 and 14. Estimate y when x = 15 and comment on its reliability.	

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6 (a) Express $24 \sin \theta - 7 \cos \theta$ in the form $R \sin(\theta - \alpha)$, where $R > 0$ and $0 < \alpha < 90°$. Give α to 1 d.p.
(b) Hence solve $24 \sin \theta - 7 \cos \theta = -11$ for $0 \leq \theta < 360°$, giving answers to 1 d.p.

7 Evaluate $\sum_{r=5}^{11}(2 \times 2^r + 2r)$.

8 When a polynomial f(x) is divided by $(x - 1)$ the remainder is -4; when divided by $(x - 2)$ the remainder is -1. Find the remainder when f(x) is divided by $(x - 1)(x - 2)$.

9 The curve $y = 2x\sqrt{75 - x}$, for $0 < x < 75$, has one
stationary point. Find its exact coordinates and determine its nature.

10 Particles A (4 kg) and B (8 kg) are joined by a light string over a smooth pulley (see diagram). A lies on a smooth slope, $\sin \alpha = \frac{4}{5}$, and B is 1 m above the ground.
Released from rest, find the further distance A moves up the slope after B lands (A does not reach the pulley).

