Day 213	A Level Maths: S Tier 10-a-day
1 A sector of a circle has radius r cm and angle θ radians, where $\theta < 2\pi$. Its perimeter is 34 cm and its area is 70 cm^2. Find the two possible pairs of values of r and θ.	
2 Solve simultaneously, giving integer x and y: $4^x \times 16^y = 1024$ $3^x \div 9^y = 3$	
3 A seed supplier says that 10% of its seeds germinate. 15 seeds are planted, and 0 germinate. Test, at the 5% significance level, the claim that the proportion is lower. Give your conclusion in context.	
4 Solve $e^x + 30\,e^{-x} = 11$, giving your answers exactly in terms of natural logarithms.	
5 Particles of mass 6 kg and 4 kg hang on a light string over a smooth fixed pulley. The 6 kg particle is 0.75 m above the ground; the 4 kg one is on the ground. Released from rest, find (a) the tension, (b) the greatest height reached by the 4 kg particle. Take g = 9.8 m s^{-2}.	

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6 $f(x) = x^3 + 3x^2 + 11x + 18$.
Show that $(x + 2)$ is a factor of $f(x)$, and that the equation $f(x) = 0$ has exactly one real root.

7 $X \sim B(15, \frac{3}{10})$.

(a) Show that $P(X = r + 1) \div P(X = r) = \frac{15 - r}{r + 1} \times \frac{3}{7}$.

(b) Find the most likely value of X and its probability (3 s.f.).

8 Use integration by parts to find the exact value of

$$\int_1^3 x^2 \ln x \, dx$$

9 A car of mass 800 kg, with engine power 9.6 kW, climbs a straight road with $\sin \alpha = \frac{1}{14}$ against a constant resistance of 400 N.
Find (a) the greatest steady speed up the hill, (b) the acceleration at 5 m s^{-1}. Take $g = 9.8$ m s^{-2}.

10 The diagram shows the curve C, its asymptotes (dashed) and a point P. C has equation $y = \frac{a}{x + p} + q$. Find a, p and q.

