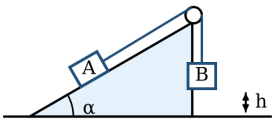
Day 102 **A Level Maths: S Tier 10-a-day**

1 Calls arrive at a switchboard at an average rate of 6 per hour, independently and at random.
(a) Find the probability of at least 3 in a 20-minute period.
(b) Find the probability that, of 7 separate 20-minute periods, exactly 3 have no arrivals.

2 Show that $\frac{5+\sqrt{5}}{5-\sqrt{5}} - \frac{5-\sqrt{5}}{5+\sqrt{5}}$ can be written in the form $k\sqrt{5}$, and find k.

3 Particles A (9 kg) and B (9 kg) are joined by a light string over a smooth pulley (see diagram). A lies on a smooth slope, $\alpha = 30°$, and B is 3.5 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).



4 Solve $2 \ln x = \ln(x + 10) + \ln 5$,
stating clearly why one root is rejected.

5 A uniform plank AB of length 8 m and mass 30 kg rests on supports at C and D, where AC = 2 m and DB = 3 m. A girl of mass 40 kg stands on it at distance x m from A.
Find the range of x for which the plank stays in equilibrium on both supports.

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6 Large Data Set, daily mean air temperature (°C), Hurn, October 2015 (n = 31): mean 16.9, sd 2.3. (F = 1.8C + 32)
(a) Find the mean and sd in °F.
(b) Is a reading of 20.8 more than 2 sd above the mean?

7 (a) Expand $(8 + x)^{\frac{1}{3}}$ up to and including the term in x^2.
(b) Use x = 0.01 to estimate $\sqrt[3]{8.01}$ to 5 decimal places.

8 A is acute and B is obtuse. $\cos A = \frac{20}{29}$ and $\cos B = -\frac{3}{5}$.
Find the exact values of tan(A + B) and tan(A − B).

9 Solve $\frac{-2x - 6}{-2x - 4} \geq 2$.

10 (a) Show that $\frac{x^2 + 2x - 11}{(x + 3)(x + 5)} \equiv 1 + \frac{A}{x + 3} + \frac{B}{x + 5}$.
(b) Hence find the exact value of $\int_0^3 \frac{x^2 + 2x - 11}{(x + 3)(x + 5)}\,dx$.