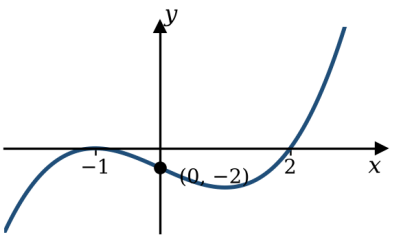
Day 228 **A Level Maths: S Tier 10-a-day**

1 A uniform plank AB of length 6 m and mass 50 kg rests on supports at C and D, where AC = 2 m and DB = 2 m. A girl of mass 50 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.

2 The diagram shows the cubic y = f(x), which touches the x-axis once. Find f(x), giving your answer in expanded form.



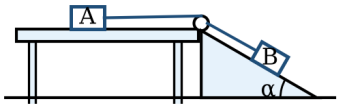
3 Find the exact coordinates of the stationary point of
$y = \frac{e^x}{x^2}$ for $x > 0$,
and determine its nature.

4 Evaluate $\sum_{r=4}^{12}(5 \times 3^r + 2r)$.

5 A chord AB of a circle, centre O and radius 9 cm, subtends an angle of $\frac{2\pi}{3}$ at O.
Find the exact area and the exact perimeter of the minor segment cut off by AB.

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6 Particle A (4 kg) lies on a rough table with $\mu = 0.2$, and is joined by a light string over a smooth pulley (see diagram) to particle B (3 kg) on a smooth slope, $\alpha = 30°$.
Released from rest, the string is cut when B has moved 1.5 m. Find the further distance A slides before stopping.



7 X takes values 1, 2, 3, 4 with $P(X = x) = k(x + 1)$. X_1 and X_2 are independent copies of X.
(a) Find k.
(b) Find $P(X_1 + X_2 = 5)$.
(c) Find $P(X_1 = X_2)$ and $E(X_1 + X_2)$.

8 $X \sim B(26, \frac{1}{5})$.
(a) Show that $P(X = r + 1) \div P(X = r) = \frac{26 - r}{r + 1} \times \frac{1}{4}$.
(b) Find the most likely value of X and its probability (3 s.f.).

9 A rectangle has its base on the x-axis and its upper vertices on the curve $y = 27 - x^2$, symmetric about the y-axis.
Find the maximum area of the rectangle, with justification.

10 Find the remainder when x^5 is divided by $(x - 1)(x + 1)$.