Day 27 **A Level Maths: S Tier 10-a-day**

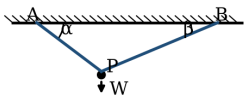
1 The equation $x^3 = 5x + 2$ has a root α.
(a) Show that the equation can be written as $x = \sqrt[3]{(5x + 2)}$.
(b) Use $x_{n+1} = \sqrt[3]{(5x_n + 2)}$ with $x_0 = 1$ to find x_1, x_2, x_3
to 4 d.p., and hence state α to 3 d.p.

2 The first row of a theatre has 8 seats. Each row has 3 more seats than the row in front. Find
(a) the number of seats in row 36,
(b) the least number of rows for at least 1830 seats.

3 Find the exact value of

$$\int_0^{\pi/2} \frac{\cos x}{5 + \sin x}\, dx$$

4 A particle P of weight 91 N hangs in equilibrium from two light strings AP and BP attached to a horizontal ceiling at A and B (see diagram), where $\tan \alpha = \frac{3}{4}$ and $\tan \beta = \frac{5}{12}$.
Find (a) the tension in each string, (b) the greatest weight P could have if neither tension may exceed 135 N.

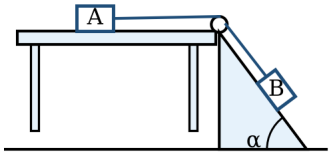


5 $f(x) = x^3 - 4x^2 + 8x - 32$.
Show that $(x - 4)$ is a factor of f(x), and that the equation f(x) = 0 has exactly one real root.

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6 Particle A (9 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 (6 kg) on a smooth slope, $\sin\alpha = \frac{4}{5}$.

Released from rest, the string is cut when B has moved 2 m. Find the further distance A slides before stopping.



7 Each shot Amira takes scores with probability $\frac{3}{4}$, independently.

(a) Find the probability that her fourth score comes on shot number 8.
(b) Find the probability that her fourth score comes on or before shot number 8.

8 The region bounded by $y = xe^{-x}$, the x-axis and the lines
$x = 0$ and $x = 1$ is rotated through 2π about the x-axis.
Find the exact volume of the solid formed.

9 Find the remainder when x^6 is divided by $(x + 1)(x + 2)$.

10 X and Y are independent, X ~ Po(1) and Y ~ Po(2).

(a) State the distribution of X + Y.
(b) Given that X + Y = 5, find the probability that X = 1.