Day 112 **A Level Maths: S Tier 10-a-day**

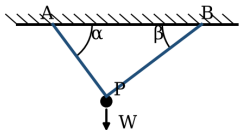
1 Express $\frac{x^3 - 3x^2 - 2x + 14}{(x + 1)(x - 3)}$ in the form $ax + b + \frac{C}{(x + 1)} + \frac{D}{(x - 3)}$.

2 A lift of mass M kg, carrying a passenger of mass 60 kg, hangs from a vertical cable. The tension in the cable is 3224 N and the floor exerts a force of 624 N on the passenger. Find (a) the acceleration of the lift, with its direction, (b) the value of M. Take g = 9.8 m s^{-2}.

3 For 20 observations x, $\Sigma(x - 30) = 40$ and $\Sigma(x - 30)^2 = 680$.
(a) Find the mean of x.
(b) Find the standard deviation of x.
(c) Find the value of Σx^2.

4 Solve $\tan(2\theta + 40°) = \frac{1}{\sqrt{3}}$
for $0° \leq \theta \leq 360°$.

5 A particle P of weight 32 N hangs in equilibrium from two light strings AP and BP attached to a horizontal ceiling at A and B (see diagram), where $\tan \alpha = \frac{4}{3}$ and $\tan \beta = \frac{3}{4}$.
Find (a) the tension in each string, (b) the greatest weight P could have if neither tension may exceed 41.6 N.



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6 $f(x) = e^x + 5x - 7$. (a) Show that $f(x) = 0$ has a root α with $0 < \alpha < 1$. (b) Use Newton-Raphson with $x_0 = 0$ to find x_1 and x_2 to 4 decimal places.	
7 $u_{n+1} = u_n + n - 4$, $u_1 = -5$. (a) Show that $u_n = an^2 + bn + c$ and find a, b, c. (b) Find the least n for which $u_n > 417$.	
8 An open-topped box has a square base of side x m and volume 32 m^3. Show that the surface area is $A = x^2 + \frac{128}{x}$, and find the minimum value of A, justifying that it is a minimum.	
9 The line $8y = 6x + k$ is a tangent to the circle $(x + 2)^2 + (y + 1)^2 = 1$. Find the two possible values of k.	
10 A test of H_0: $p = 0.2$ against H_1: $p < 0.2$ uses a sample of 50 at the 5% level. (a) Find the critical region for X, the number of successes. (b) Find the actual significance level. (c) Find P(Type II error) when in fact $p = 0.1$.	