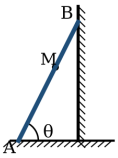
Day 349 **A Level Maths: S Tier 10-a-day**

1 A uniform ladder AB of length 4 m and weight 250 N has A on rough ground ($\mu = 0.5$) and B against a smooth vertical wall. It makes angle θ with the ground, $\tan\theta = \frac{4}{3}$.

A man of weight 500 N climbs the ladder. How far along the ladder can he go before it slips?



2 A geometric series has first term 6 and common ratio 5.
Find the least n for which $S_n > 62640$.

3 The times taken by a bus, in minutes are modelled by $N(39, \sigma^2)$. The probability of a value above 52 is 0.05.
(a) Find σ.
(b) Find the probability of a value below 51.

4 Find the term independent of x in the expansion of $(3x^2 + \frac{1}{x^2})^{10}$.

5 A binomial random variable X has mean 16 and variance 9.6.
(a) Find n and p.
(b) Find P(X = 17), correct to 3 significant figures.

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6 Find the exact value of $\cos(2\cos^{-1}(\frac{12}{13}))$.	
7 A box of weight 175 N is pulled at constant speed along rough horizontal ground ($\mu = \frac{7}{24}$) by a force P N at angle θ above the horizontal. (a) Find P when $\tan\theta = \frac{4}{3}$. (b) Find the least possible value of P as θ varies, and the corresponding θ to 1 d.p.	
8 A is acute and B is obtuse. $\cos A = \frac{15}{17}$ and $\sin B = \frac{3}{5}$. Find the exact values of $\tan(A - B)$ and $\cos(A + B)$.	
9 The function f is defined by $f(x) = 2x^2 - 12x + 26$ for $x \leq k$. Given that k is the greatest value for which f is one-one, find k, $f^{-1}(x)$, and the domain of f^{-1}.	
10 A curve has parametric equations $x = t^2$, $y = 3t(3 - t)$, for $0 \leq t \leq 3$. The curve meets the x-axis at O and at A. Find the area enclosed between the curve and the x-axis.	