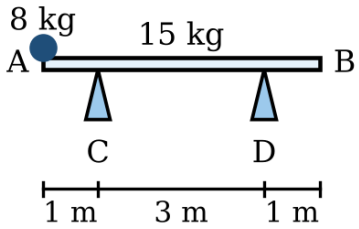
Day 278 **A Level Maths: A Tier 10-a-day**

1 By writing 15° as 45° − 30°, show that tan 15° = 2 − $\sqrt{3}$.

2 At one location, the daily mean wind speed is modelled by N(8.2, 2.9^2).
(a) Find the probability that on a randomly chosen day the value exceeds 12 knots.
(b) Estimate the number of such days in a period of 31 days.

3 Find the coefficient of x^2 in the expansion of $(-2 - x)^8$.

4 A uniform beam AB rests on supports at C and D, with a particle attached at A. Find the reactions at C and D. Take g = 9.8. Give answers to 3 s.f. if not exact.



5 $f(x) = \frac{-4x + 6}{4x + 4}$, $x \in \mathbb{R}$, $x \neq -1$.
Find $f^{-1}(x)$ and state its domain.

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6 The mean fill volume of bottles (ml) is normally distributed with standard deviation 2; it was previously 44. A random sample of 16 has mean 43.5. Test, at the 1% level, whether the mean has decreased.	
7 Use the substitution $u = x^2 + 1$ to find the exact value of $\int_0^2 x(x^2 + 1)^2 \, dx$.	
8 The line $3x + 4y = 27$ meets the circle $(x + 1)^2 + (y - 3)^2 = 16$ at the points A and B. Find the exact length of AB.	
9 Given that $\log_a 2 = p$ and $\log_a 3 = q$, express $\log_a(\frac{\sqrt{6}}{8})$ in terms of p and q.	
10 At t = 0, P and Q have position vectors $(12\mathbf{i} + 4\mathbf{j})$ m and $(-2\mathbf{i} - \mathbf{j})$ m and velocities $(2\mathbf{i} - 2\mathbf{j})$ m s^{-1} and $(3\mathbf{i} + 2\mathbf{j})$ m s^{-1}. Find (a) the time when they are closest, (b) the least distance between them. Give answers to 3 s.f. if not exact.	