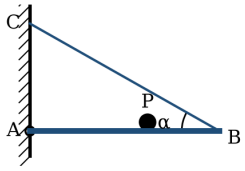
Day 64	A Level Maths: S Tier 10-a-day

1 A uniform rod AB (2 m, 40 N) is hinged at A to a vertical wall and held horizontal by a string BC, C on the wall above A, with $\tan\alpha = \frac{5}{12}$, where α is the angle between string and rod. A 40 N particle hangs at P, AP = 0.5 m.
Find (a) the tension, (b) the magnitude and direction of the hinge force (3 s.f. and 1 d.p.).



2 The scores in an aptitude test are modelled by $N(61, \sigma^2)$. The probability of a value above 73 is 0.10.
(a) Find σ.
(b) Find the probability of a value below 70.

3 $f(x) = \frac{kx - 5}{x - 6}$ for $x \neq 6$. Given that f is self-inverse, find k, and hence solve $f(x) = x$.

4 $f(x) = x^3 + x - 7$.
(a) Show that $f(x) = 0$ has a root α with $1 < \alpha < 2$.
(b) Use Newton-Raphson with $x_0 = 2$ to find x_1 and x_2
to 4 decimal places.

5 Prove by contradiction that $\sqrt{7}$ is irrational.

Day 64	A Level Maths: S Tier 10-a-day
6 A particle P moves in a plane. At time t seconds its position vector relative to a fixed origin O is r metres, where $\mathbf{r} = (-0.5t^2 - t)\mathbf{i} + (-2t^2 + 2t)\mathbf{j}$. Find (a) the value of t at which P is moving parallel to $(\mathbf{i} + \mathbf{j})$, (b) the speed of P at this time (3 s.f. if not exact).	
7 The curve $y = ax^n$ passes through (1, 12) and (2, 48). Find the values of a and n.	
8 Use a suitable trigonometric identity to find the exact value of $\int_0^{\pi/9} \sec^2 3x + \sin 3x \cos 3x \, dx$	
9 Solve $\frac{-2}{(x-1)} > \frac{4}{(x-4)}$.	
10 A and B take turns, A first, to score; the first to score wins. P(A scores) = $\frac{2}{5}$, P(B scores) = $\frac{1}{4}$ each attempt. Find P(A wins (a) on attempt 1 or 2, (b) overall).	