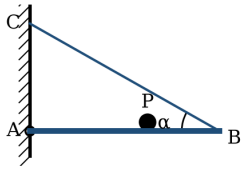
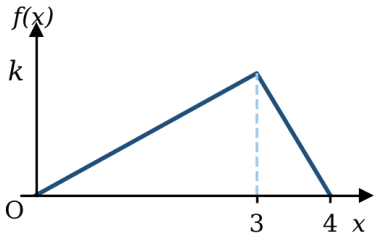
Day 208 **A Level Maths: S Tier 10-a-day**

1 A uniform rod AB (2 m, 100 N) is hinged at A to a vertical wall and held horizontal by a string BC, C on the wall above A, with $\tan\alpha = \frac{4}{3}$, 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 Solve $2^{2x} - 6 \times 2^{x+1} + 20 = 0$,
giving each answer exactly and, where not an integer, to 3 s.f.

3 The diagram shows the pdf of X.
Find (a) k, (b) E(X), (c) the median of X (3 s.f.).



4 Use the trapezium rule with 4 strips to estimate $\int_1^3 \sqrt{x}e^x \, dx$, to 4 s.f.
Is it an overestimate or an underestimate? Explain.

5 $u_{n+1} = u_n + n - 3$, $u_1 = -4$.
(a) Show that $u_n = an^2 + bn + c$ and find a, b, c.
(b) Find the least n for which $u_n > 1144$.

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6 A particle P moves with constant acceleration. At t = 0 seconds P is at $(-3\mathbf{i} - \mathbf{j})$ m with velocity $(-12\mathbf{i} - 7\mathbf{j})$ m s^{-1}. At t = 8, P has velocity $(20\mathbf{i} + 17\mathbf{j})$ m s^{-1}. Find (a) the acceleration of P, (b) the time at which P moves parallel to $(\mathbf{j})$, (c) the position vector of P at that time.	
7 A curve has parametric equations $x = -1 + 5\cos t$, $y = 4 + 5\sin t$. Find its Cartesian equation.	
8 The circle with equation $(x + 3)^2 + (y - 1)^2 = 100$ passes through P(5, 7). The tangent at P meets the axes at A and B. Find the area of triangle OAB.	
9 A biased coin lands on 'win' with the same unknown probability p each time. It is used 6 times in round 1 and 8 times in round 2. Given that exactly 5 wins occur altogether, find the probability that exactly 2 of them were in round 1.	
10 Line l_1: $\mathbf{r} = \begin{pmatrix} 1 \\ -6 \\ 8 \end{pmatrix} + s\begin{pmatrix} 0 \\ 3 \\ -1 \end{pmatrix}$, line l_2: $\mathbf{r} = \begin{pmatrix} -3 \\ 7 \\ 9 \end{pmatrix} + t\begin{pmatrix} 2 \\ -2 \\ -2 \end{pmatrix}$. Show whether the lines meet, giving the point of intersection if they do, and find the acute angle between them to 1 d.p.	