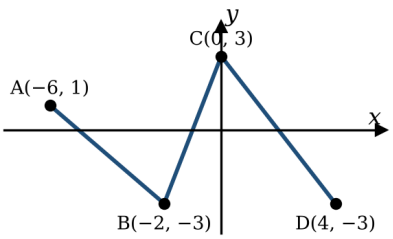
Day 271 **A Level Maths: S Tier 10-a-day**

1 20 recorded masses (grams) have mean 58 and standard deviation 2.
One value was recorded as 55 but should have been 53.
Find the correct mean and the correct standard deviation.

2 A ladder of length 25 m leans against a vertical wall. Its foot slides away from the wall at 3 m s^{-1}. When the foot is 7 m from the wall, find the rate at which the top is moving down.

3 The diagram shows y = f(x), made of three straight line segments. Find the coordinates of the images of A, B, C and D on the graph of $y = -f(-2x - 8) + 1$.



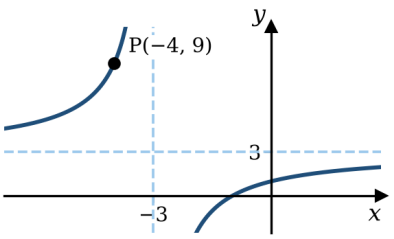
4 A radioactive sample has mass $m = m_0e^{-kt}$ grams, t in days.
Initially m = 200 and after 4 days $m = \frac{200}{3}$.
Find k, and the time for the mass to fall to 25 grams, to 3 s.f.

5 A particle P moves in a plane. At time t seconds its position vector relative to a fixed origin O is r metres, where
$\mathbf{r} = (2t^2 - 9t)\mathbf{i} + (1.5t^2 - 8t)\mathbf{j}$.
Find (a) the value of t at which P is moving parallel to $(3\mathbf{i} + \mathbf{j})$, (b) the speed of P at this time (3 s.f. if not exact).

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6 The curve $y = 2x\sqrt{108 - x}$, for $0 < x < 108$, has one
stationary point. Find its exact coordinates and determine its nature.

7 The diagram shows the curve C, its asymptotes (dashed) and a point P. C has equation $y = \frac{a}{x + p} + q$. Find a, p and q.



8 Faults in a cable occur at random at a mean rate of 1.5 per week. After a modification, 0 faults are found in 2 weeks.
Test at the 1% level whether the rate of faults has decreased.

9 The curve $y = x^2 - 3x - 5$ is translated by $\begin{pmatrix} 1 \\ 1 \end{pmatrix}$ and then a stretch, scale factor 3, parallel to the y-axis.
Find the equation of the resulting curve in the form $y = ax^2 + bx + c$.

10 A non-uniform rod AB of length 6 m and mass 12 kg rests on supports at C and D, where AC = 2 m and AD = 4 m, with R_C = 3 R_D.
Find (a) the distance of the centre of mass from A. A particle of mass m kg at B puts the rod on the point of tilting about D. (b) Find m.