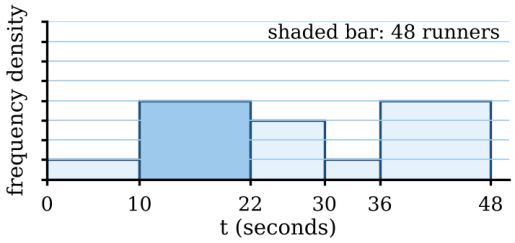
Day 339 **A Level Maths: S Tier 10-a-day**

1 The histogram shows the times, t seconds, of some runners.
Find (a) the total number of runners, (b) an estimate of the number with $15 \leq t < 39$.



2 A geometric series has first term 4 and common ratio $\frac{9}{10}$.
Find the least n for which S_n exceeds 90% of the sum to infinity.

3 A drug dose of 80 mg decays by 10% each hour.
Find the first whole number of hours after which less than 5 mg remains.

4 $f(x) = \frac{kx + 13}{x - 5}$ for $x \neq 5$. Given that f is self-inverse, find k, and hence solve $f(x) = x$.

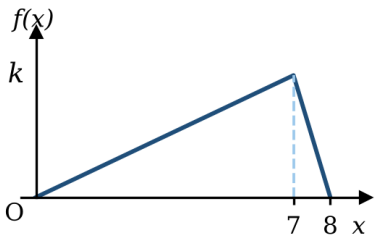
5 A particle P moves in a plane. At time t seconds its position vector relative to a fixed origin O is r metres, where
$\mathbf{r} = (-1.5t^2 + 6t)\mathbf{i} + (-1.5t^2 - 6t)\mathbf{j}$.
Find (a) the value of t at which P is moving parallel to $(\mathbf{i} + 2\mathbf{j})$, (b) the speed of P at this time (3 s.f. if not exact).

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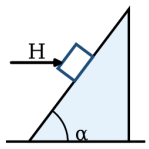
6 A curve is given by $x = y^3 - y^2 + y$.
Find dy/dx and d^2y/dx^2 when $y = -1$.

7 The function f is defined by $f(x) = x^2 - 6x + 10$ for $x \geq k$. Given that k is the least value for which
f is one-one, find k, $f^{-1}(x)$, and the domain of f^{-1}.

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



9 A particle of weight 125 N rests on a rough plane inclined at α to the horizontal, where $\tan\alpha = \frac{4}{3}$ and $\mu = 0.5$.
A horizontal force H N, in the vertical plane through a line of greatest slope, holds it in equilibrium. Find the range of possible values of H.



10 $\frac{dy}{dx} = 6xy$, and $y = 3$ when $x = 0$.
Solve the differential equation and find y when $x = 2$.