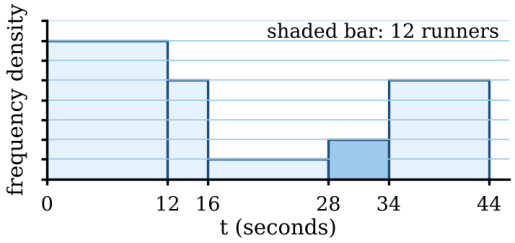
Day 139 **A Level Maths: S Tier 10-a-day**

1 Describe a sequence of two transformations that maps the curve $y = x^2$ onto the curve $y = 2x^2 + 20x + 56$.

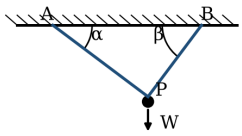
2 The histogram shows the times, t seconds, of some runners.
Find (a) the total number of runners, (b) an estimate of the number with $15 \leq t < 41$.



3 (a) Expand $(4 - x)^{-\frac{1}{2}}$ up to and including the term in x^2.

(b) Use $x = 0.04$ to estimate $\frac{1}{\sqrt{3.96}}$ to 5 decimal places.

4 A particle P of weight 72 N hangs in equilibrium from two light strings AP and BP attached to a horizontal ceiling at A and B (see diagram), where $\tan\alpha = \frac{3}{4}$ and $\tan\beta = \frac{4}{3}$.
Find (a) the tension in each string, (b) the greatest weight P could have if neither tension may exceed 81.6 N.



5 A chord AB of a circle, centre O and radius 4 cm, subtends an angle of $\frac{\pi}{2}$ at O.
Find the exact area and the exact perimeter of the minor segment cut off by AB.

Day 139	A Level Maths: S Tier 10-a-day
6 Solve $x^{\frac{2}{3}} + 4x^{\frac{1}{3}} + 3 = 0$.	
7 Find the exact coordinates of the stationary point of $y = \frac{e^x}{x}$ for $x > 0$, and determine its nature.	
8 A plank of mass 3 kg lies on a smooth horizontal table, with a block of mass 6 kg on it ($\mu = 0.5$ between them). A horizontal force P N acts on the block. (a) Find the greatest P for which the block does not slip. (b) Find the accelerations of block and plank when P = 264.6. Take g = 9.8 m s^{-2}.	
9 Two boats P and Q move so that, t hours after noon, their position vectors in km are $\mathbf{r}_P = \begin{pmatrix}4\\5\end{pmatrix} + t\begin{pmatrix}0\\-2\end{pmatrix}$ and $\mathbf{r}_Q = \begin{pmatrix}2\\1\end{pmatrix} + t\begin{pmatrix}-1\\1\end{pmatrix}$. Find the time at which they are closest and the exact minimum distance between them.	
10 X ~ B(80, 0.4). (a) State why a normal approximation is suitable for X. (b) Use a normal approximation to estimate $P(28 \leq X \leq 40)$, to 3 significant figures.	