The table below gives the depth of water across a river measured at one meter intervals between banks.
Distance (m) 0 1 2 3 4
Water depth (m) 0 0.5 1.6 0.9 0

Use the Trapezium rule to estimate the cross-sectional area of the river. A river hydrologist estimates that at the place where this cross sectional data was measured the average speed of water flow is 0.6m/s. Estimate the volume of water which passes this section of the river in one minute.

Solution:

We have

h_i (distance, m)	d_i (water depth, m)
$h_0 = 0$	$d_0 = 0$
$h_1 = 1$	$d_1 = 0.5$
$h_2 = 2$	$d_2 = 1.6$
$h_3 = 3$	$d_3 = 0.9$
$h_4 = 4$	$d_4 = 0$

Because $h = h_1 - h_0 = h_2 - h_1 = h_3 - h_2 = h_4 - h_3 = 1$ then by the Trapezium rule we have

$$S = \frac{h}{2}(d_0 + 2(d_1 + d_2 + d_3) + d_4) = \frac{1}{2}(0 + 2 \cdot (0.5 + 1.6 + 0.9) + 0) = 3\ (m^2)$$

And finally

$$V = S \cdot v \cdot t = 3 \cdot 0.6 \cdot 60 = 108\ (m^3)$$

Answer: $108\ (m^3)$