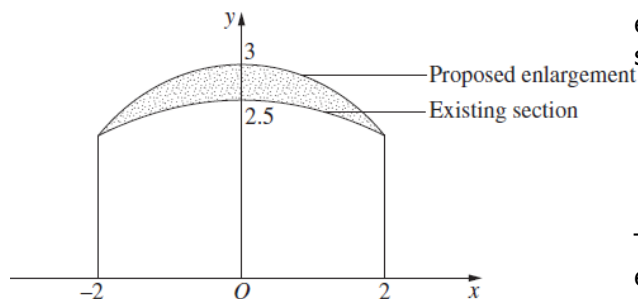




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- 2016 14 a** The diagram shows the cross-section of a tunnel and a proposed enlargement. **3**



The heights, in metres, of the existing section at 1 metre intervals are shown in Table A.

Table A: Existing heights

x	-2	-1	0	1	2
y	2	2.38	2.5	2.38	2

The heights, in metres, of the proposed enlargement are shown in Table B.

Table B: Proposed heights

x	-2	-1	0	1	2
y	2	2.78	3	2.78	2

Use Simpson's rule with the measurements given to calculate the approximate increase in area.

Form a table using the differences in the y -values:

x	-2	-1	0	1	2
Difference in y	0	0.4	0.5	0.4	0

Using two applications of Simpson's Rule:

$$\begin{aligned} \text{Increase} &= \frac{0 - (-2)}{6} [0 + 4(0.4) + 0.5] + \frac{2 - 0}{6} [0.5 + 4(0.4) + 0] \\ &= 1.4 \end{aligned}$$

\therefore the increase is 1.4 m^2

$$[\text{OR: Increase} = \frac{1}{3} [0 + 0 + 2(0.5) + 4(0.4 + 0.4)] = 1.4]$$

$$[\text{OR: Increase} = \frac{1}{3} [2 + 2 + 2(3) + 4(2.78 + 2.78)] - \frac{1}{3} [2 + 2 + 2(2.5) + 4(2.38 + 2.38)] = 1.4]$$

State Mean:

2.38

* These solutions have been provided by [projectmaths](#) and are not supplied or endorsed by BOSTES.

BOSTES: Notes from the Marking Centre

This information is released by BOSTES in late Term 1 2017.