

LC 2014 (SET C): PAPER 1

QUESTION 8 (40 MARKS)

Question 8 (a)

Area $A = 12 \text{ cm} \times 12 \text{ cm} = 144 \text{ cm}^2$

Question 8 (b)

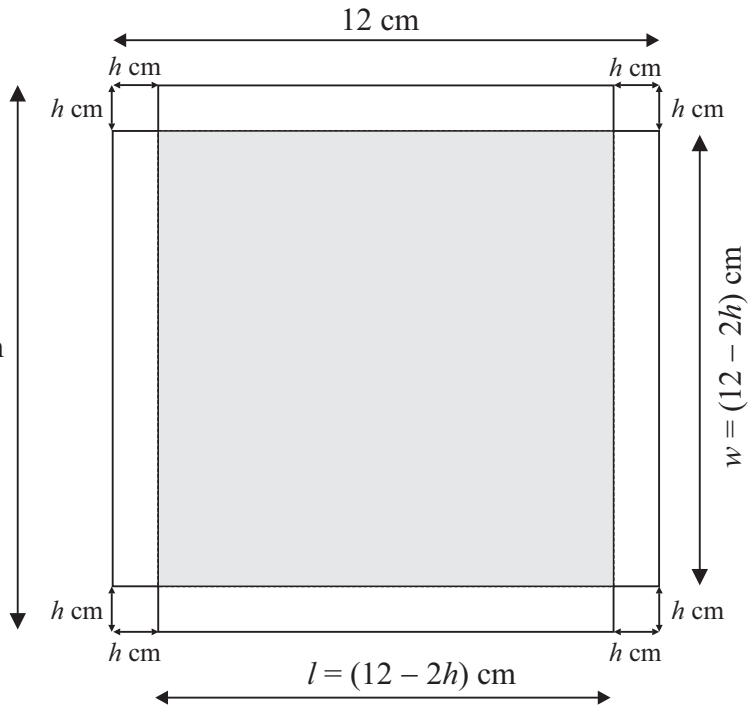
Length of box = $(12 - 2h) \text{ cm}$

Width of box = $(12 - 2h) \text{ cm}$

Question 8 (c)

Volume $V = \text{Length} \times \text{Width} \times \text{Height}$

$$\begin{aligned} V &= (12 - 2h)(12 - 2h)h \\ &= (144 - 24h - 24h + 4h^2)h \\ &= (144 - 48h + 4h^2)h \\ &= 4h^3 - 48h^2 + 144h \end{aligned}$$



MARKING SCHEME NOTES

Question 8 (a) [Scale 5B (0, 2, 5)]

2: • 12×12 and stops

Question 8 (b) [Scale 10C (0, 3, 7, 10)]

3: • $2h$ written

- $12 -$ (incorrect h)
- $12 + 2h$

7: • 1 value correct

- Width = length (where length was of some merit e.g. $(12 - h)$ in both)

Question 8 (c) [Scale 10C (0, 3, 7, 10)]

3: • Correct formula written

- Some relevant attempt at multiplying terms

7: • $l \times w \times h$ fully substituted and stops

- Errors in finding product

Note: If l and w in (b) were without merit LPC at most

Question 8 (d)

$V = 4h^3 - 48h^2 + 144h \leftarrow$ Differentiate

$$\frac{dV}{dh} = 12h^2 - 96h + 144 = 0$$

$h^2 - 8h + 12 = 0 \leftarrow$ Factorise the quadratic.

$$(h - 2)(h - 6) = 0$$

$$h - 2 = 0 \Rightarrow h = 2 \text{ cm}$$

$$h - 6 = 0 \Rightarrow h = 6 \text{ cm}$$

FINDTURNINGPOINTS(LOCALMAXIMUM/MINIMUM)

Put $\frac{dy}{dx} = 0$ and solve for x

FORMULAE AND TABLES BOOK
Calculus: Derivatives [page 25]

$$y = x^n \Rightarrow \frac{dy}{dx} = nx^{n-1}$$

Ignore the solution $h = 6$ cm, as this value of h would make the length and width of the box to be 0 cm.

ANSWER: 2 cm

Question 8 (e)

To find the maximum volume V_{Max} substitute the maximum height ($h = 2$ cm) into the formula for the volume V of the box.

$$h = 2 : V_{\text{Max}} = 4(2)^3 - 48(2)^2 + 144(2) = 128 \text{ cm}^3$$

MARKING SCHEME NOTES

Question 8 (d) [Scale 10D (0, 3, 5, 8, 10)]

- 3:**
- One or two terms differentiated correctly
 - Value found by trial and error
- 5:**
- Correct differentiation and stops
 - Correct structure to $f'(x) = 0$ but with errors, and continues
 - Correct max found graphically
- 8:**
- Correct derivative = 0 and stops or error(s) in solving it

Question 8 (e) [Scale 5B (0, 2, 5)]

- 2:**
- Value of h from (d) substituted into $V(h)$
 - More than one effort at trial and error
 - $l \times w \times h$ with some correct or relevant substitution
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