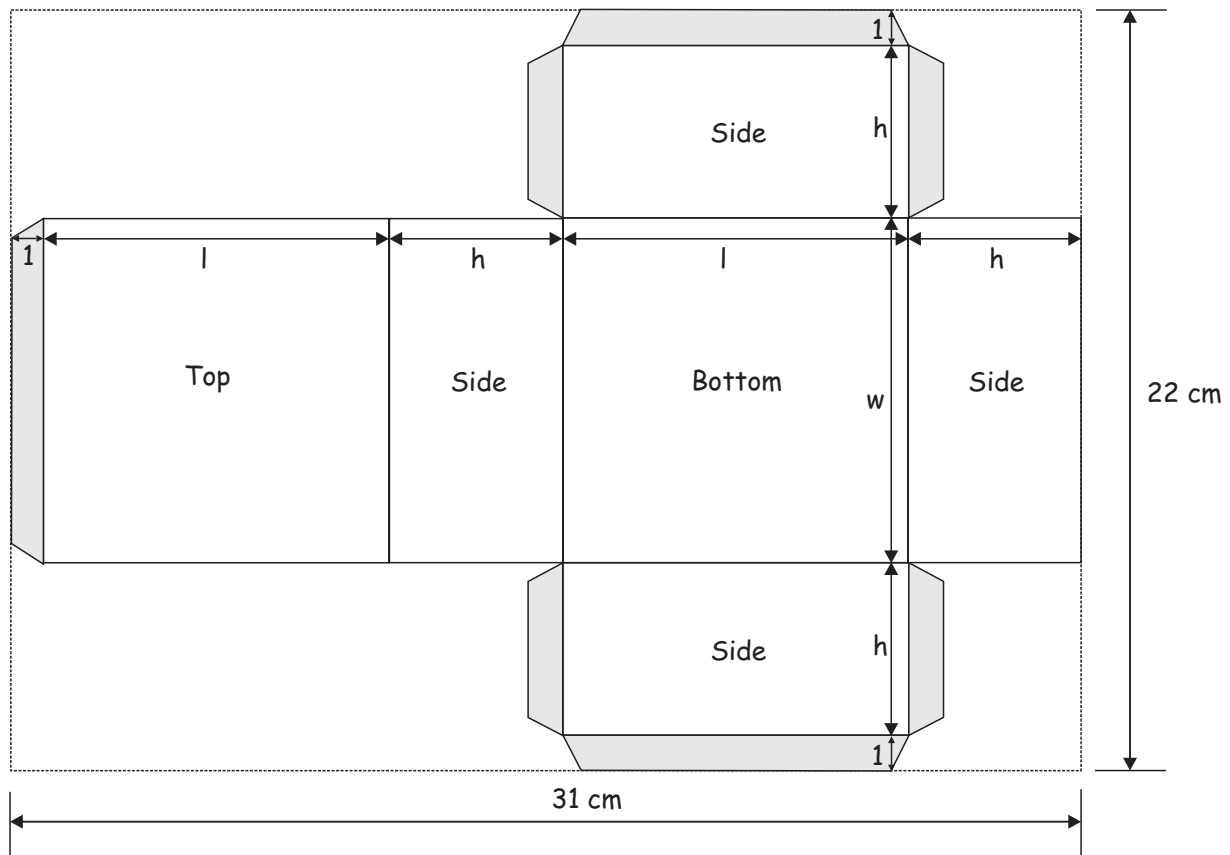


**SAMPLE PAPER 2014 (SET F): PAPER 1****QUESTION 7 (50 MARKS)****Question 7 (a)**

$$2h + 2l + 1 = 31$$

$$2l + 2h = 30$$

$$l + h = 15$$

$$l = (15 - h) \text{ cm}$$

$$2h + w + 2 = 22$$

$$2h + w = 20$$

$$w = (20 - 2h) \text{ cm}$$

**Question 7 (b)**

$$V = l \times b \times h = (15 - h)(20 - 2h)h$$

**Question 7 (c)**

Square bottom:  $l = w$

$$15 - h = 20 - 2h$$

$$2h - h = 20 - 15$$

$$\therefore h = 5 \text{ cm}$$

$$V = (15 - (5))(20 - 2(5))(5)$$

$$= (10)(10)(5)$$

$$= 500 \text{ cm}^3$$

**Question 7 (d)**

$$(15 - h)(20 - 2h)h = 500 \leftarrow \text{Form a cubic equation by putting the volume of the box equal to 500.}$$

$$(300 - 50h + 2h^2)h = 500$$

$$2h^3 - 50h^2 + 300h - 500 = 0$$

$$h^3 - 25h^2 + 150h - 250 = 0$$

$h = 5$  is a solution of this cubic. Therefore,  $(h - 5)$  is a linear factor. The other factor is a quadratic. Find the quadratic by lining up.

$$h^3 - 25h^2 + 150h - 250 = (h - 5)(h^2 + kh + 50)$$

$$h^3 - 25h^2 + 150h - 250 = h^3 + (k - 5)h^2 + (50 - 5k)h - 250$$

$$\therefore -25 = k - 5 \Rightarrow k = -20$$

$$h^3 - 25h^2 + 150h - 250 = (h - 5)(h^2 - 20h + 50) = 0$$

$h^2 - 20h + 50 = 0 \leftarrow$  Solve the quadratic using the formula.

$$a = 1, b = -20, c = 50$$

$$h = \frac{-(-20) \pm \sqrt{(-20)^2 - 4(1)(50)}}{2(1)}$$

$$= \frac{20 \pm \sqrt{400 - 200}}{2}$$

$$= \frac{20 \pm \sqrt{200}}{2}$$

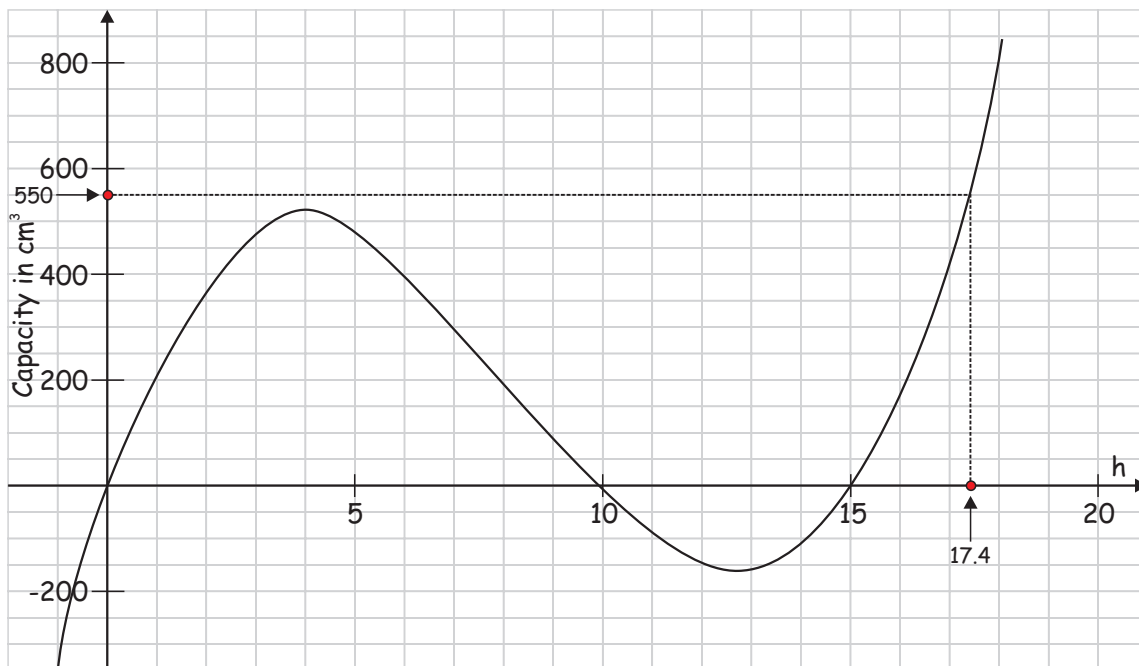
$$= \frac{20 \pm 10\sqrt{2}}{2}$$

$$= 10 \pm 5\sqrt{2}$$

$$= 17.1, 2.9 \text{ cm} \text{ [Discard the solution of } h = 17.1 \text{ cm. The length } l \text{ of the box is equal to } (15 - h). \text{ The length is not long enough to accommodate a value of } 17.1 \text{ cm.}]$$

**ANSWER:**  $h = 2.9 \text{ cm}$

### Question 7 (e)



**EXPLANATION:**

10% extra volume:  $500 \times 1.1 = 550 \text{ cm}^3$

Go to  $550 \text{ cm}^3$  on the  $y$ -axis and read off the  $h$  value.

$\therefore h \approx 17.4 \text{ cm}$

A height  $h = 17.4 \text{ cm}$  is too long to make a box from this piece of cardboard. The length  $l$  of the box is equal to  $(15 - h)$ . The length is not long enough to accommodate a value of  $17.4 \text{ cm}$ .

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