

SAMPLE PAPER 7: PAPER 1**QUESTION 9 (50 MARKS)****Question 9 (a) (i)**

$$x + x + h = 18$$

$$\therefore h = 18 - 2x$$

Question 9 (a) (ii)

$$V = (x)(x)(h)$$

$$= x^2(18 - 2x)$$

$$= 18x^2 - 2x^3$$

Question 9 (a) (iii)

$$V = 18x^2 - 2x^3$$

$$\frac{dV}{dx} = 36x - 6x^2$$

$$\frac{dV}{dx} = 0 \Rightarrow 36x - 6x^2 = 0$$

$$6x - x^2 = 0$$

$$x(6 - x) = 0$$

$$\therefore x = 6 \text{ m}$$

Question 9 (a) (iv)

$$V = 18x^2 - 2x^3$$

$$V_{\text{Max}} = 18(6)^2 - 2(6)^3 = 216 \text{ m}^3$$

Question 9 (b) (i)

$$V = 195 - 2t - t^2$$

$$t = 0: V = 195 - 2(0) - (0)^2 = 195 \text{ m}^3$$

Question 9 (b) (ii)

$$V = 195 - 2t - t^2$$

$$t = 10: V = 195 - 2(10) - (10)^2 = 75 \text{ m}^3$$

Question 9 (b) (iii)

$$V = 195 - 2t - t^2$$

$$V = 0: 0 = 195 - 2t - t^2$$

$$t^2 + 2t - 195 = 0$$

$$0 = (t - 13)(t + 15)$$

$$\therefore t = 13 \text{ s}$$

Question 9 (b) (iv)

$$V = 195 - 2t - t^2$$

$$\frac{dV}{dt} = -2 - 2t$$

$$\left(\frac{dV}{dt}\right)_{t=7} = -2 - 2(7) = -16 \text{ m}^3 \text{ min}^{-1}$$

Question 9 (b) (v)

$$\frac{dV}{dt} = -2 - 2t < 0$$

The rate of change of volume V is negative for all values of t . Therefore, the volume is always decreasing.