

SAMPLE PAPER 6: PAPER 1

QUESTION 5 (25 MARKS)

Question 5 (a)

$$y = -x^3 + ax^2 + bx$$

$$x = 0: y = -(0)^3 + a(0)^2 + b(0) = 0$$

$$\therefore (0, 0) \in y = -x^3 + ax^2 + bx$$

Question 5 (b)

$$y = -x^3 + ax^2 + bx$$

$$\frac{dy}{dx} = -3x^2 + 2ax + b$$

$$\left(\frac{dy}{dx}\right)_{x=1} = 0 \Rightarrow -3(1)^2 + 2a(1) + b = 0$$

$$-3 + 2a + b = 0$$

$$2a + b = 3 \dots (1)$$

$$\left(\frac{dy}{dx}\right)_{x=-2} = 0 \Rightarrow -3(-2)^2 + 2a(-2) + b = 0$$

$$-12 - 4a + b = 0$$

$$-4a + b = 12 \dots (2)$$

Question 5 (c)

$$y = -x^3 - \frac{3}{2}x^2 + 6x$$

$$x = -2: y = -(-2)^3 - \frac{3}{2}(-2)^2 + 6(-2)$$

$$= -(-8) - \frac{3}{2}(4) - 12$$

$$= 8 - 6 - 12 = -10$$

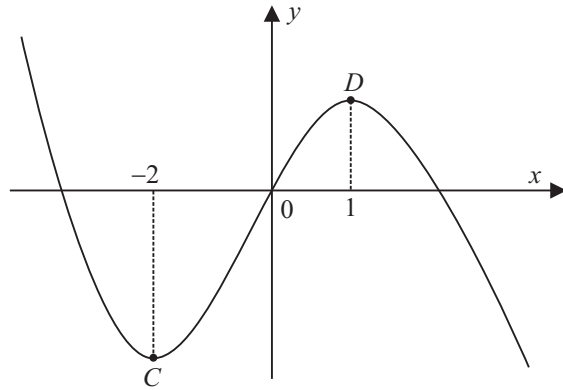
Local minimum: $C(-2, -10)$

Question 5 (d)

$$y = -x^3 - \frac{3}{2}x^2 + 6x$$

$$\frac{dy}{dx} = -3x^2 - 3x + 6$$

$$\left(\frac{dy}{dx}\right)_{x=0} = -3(0)^2 - 3(0) + 6 = 6 = m$$



Solve the simultaneous equation to find a and b :

$$2a + b = 3 \dots (1)$$

$$-4a + b = 12 \dots (2)$$

$$\underline{6a} \quad = -9 \Rightarrow a = -\frac{3}{2}$$

$$2a + b = 3 \dots (1) \Rightarrow 2(-\frac{3}{2}) + b = 3$$

$$-3 + b = 3$$

$$\therefore b = 6$$

$$y = -x^3 - \frac{3}{2}x^2 + 6x$$

$$x = 1: y = -(1)^3 - \frac{3}{2}(1)^2 + 6(1)$$

$$= -1 - \frac{3}{2} + 6 = \frac{7}{2}$$

Local maximum: $D(1, \frac{7}{2})$

Equation of t : $m = 6$, point $(x_1, y_1) = (0, 0)$

$$y - 0 = 6(x - 0) \quad \boxed{y - y_1 = m(x - x_1)}$$

$$y = 6x$$

$$6x - y = 0$$