

SAMPLE PAPER 6: PAPER 1

QUESTION 6 (25 MARKS)

Question 6 (a)

$$f(x) = 5 + 4x - x^2$$

$$\begin{aligned} f(x+h) &= 5 + 4(x+h) - (x+h)^2 \\ &= 5 + 4x + 4h - x^2 - 2hx - h^2 \end{aligned}$$

$$\begin{aligned} f(x+h) - f(x) &= 5 + 4x + 4h - x^2 - 2hx - h^2 - 5 - 4x + x^2 \\ &= 4h - 2hx - h^2 \end{aligned}$$

$$\frac{f(x+h) - f(x)}{h} = \frac{4h - 2hx - h^2}{h} = 4 - 2x - h$$

$$\frac{dy}{dx} = \lim_{h \rightarrow 0} \left[\frac{f(x+h) - f(x)}{h} \right] = 4 - 2x$$

Question 6 (b)

$$\begin{aligned} y &= 5 + 4x - x^2 \\ &= -(x^2 - 4x - 5) \\ &= -(x^2 - 4x + 4 - 9) \\ &= -((x-2)^2 - 9) \\ &= 9 - (x-2)^2 \end{aligned}$$

Local maximum: $y = 9$, $x = 2$

Local maximum: $(2, 9)$

Question 6 (c)

$$\begin{aligned} y &= 5 + 4x - x^2 \\ \frac{dy}{dx} &= 4 - 2x \end{aligned}$$

Question 6 (d)

It is not injective because it is not strictly increasing or decreasing for all $x \in \mathbb{R}$. This means that there are y values that correspond to more than one value of x .
