

SAMPLE PAPER 5: PAPER 1

QUESTION 6 (25 MARKS)

Question 6 (a) (i)

$$\begin{aligned} f(x) &= x+3 \\ g(x) &= x^2+1 \\ f(g(x)) \\ &= f(x^2+1) \\ &= (x^2+1)+3 \\ &= x^2+4 \end{aligned}$$

Question 6 (a) (ii)

$$\begin{aligned} f(x) &= x+3 \\ g(x) &= x^2+1 \\ g(f(x)) \\ &= g(x+3) \\ &= (x+3)^2+1 \\ &= x^2+6x+9+1 \\ &= x^2+6x+10 \end{aligned}$$

Question 6 (a) (iii)

$$\begin{aligned} f(g(x)) &= g(f(x)) \\ x^2+4 &= x^2+6x+10 \\ 4-10 &= 6x \\ -6 &= 6x \\ \therefore x &= -1 \\ f(g(-1)) &= f(2) = 5 \\ g(f(-1)) &= g(2) = 5 \end{aligned}$$

Question 6 (b)

x	0.9	0.99	0.999	0.9999
$2x+1$	2.8	2.98	2.998	2.9998

$$\lim_{x \rightarrow 1} (2x+1) = 3$$

Question 6 (c) (i)

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

Question 6 (c) (ii)

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

Question 6 (c) (iii)

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