

Functions HW Solutions

Higher

Total = 27 marks

Q1. $f(x) = 2x - 5 \quad \{ -3 \leq x \leq 3 \}$
 $f(-3) = -11 \quad f(-2) = -9 \quad f(-1) = -7 \quad f(0) = -5 \quad f(1) = -3 \quad f(2) = -1 \quad f(3) = 1$
 $\{-11, -9, -7, -5, -3, -1, 1\} \checkmark$

Q2. $f(x) = \frac{x-2}{5} \quad f(k) = 2 \quad \frac{k-2}{5} = 2 \quad k-2 = 10 \quad k = 12 \checkmark$

Q3. $f(x) = x^2 + 2 \quad g(x) = 2x + 3$

$$\begin{aligned} f(g(x)) &= (2x+3)^2 + 2 \checkmark \\ &= 4x^2 + 12x + 9 + 2 \\ &= 4x^2 + 12x + 11 \end{aligned} \quad \begin{aligned} g(f(x)) &= 2(x^2 + 2) + 3 \checkmark \\ &= 2x^2 + 4 + 3 \\ &= 2x^2 + 7 \end{aligned}$$

Q4. $f(x) = 6x^2 - 4x \quad g(x) = \frac{1}{3x-6}$

$$(a) \quad g(f(x)) = \frac{1}{3(6x^2-4x)-6} = \frac{1}{18x^2-12x-6} = \frac{1}{6(3x^2-2x-1)} = \frac{1}{6(3x+1)(x-1)} \checkmark$$

$$(b) \quad g(f(x)) \text{ domain } \{x \in \mathbb{R}, x \neq -\frac{1}{3}, 1\} \checkmark$$

Q5. $f(x) = (x-1)(x+3) \quad g(x) = x^2 + 3$

$$\begin{aligned} f(g(x)) &= (x^2+3-1)(x^2+3+3) \checkmark \\ &= (x^2+2)(x^2+6) \\ &= x^4 + 8x^2 + 12 \end{aligned} \quad \begin{aligned} g(g(x)) &= (x^2+3)^2 + 3 \checkmark \\ &= x^4 + 6x^2 + 9 + 3 \\ &= x^4 + 6x^2 + 12 \end{aligned}$$

$$\begin{aligned} x^4 + 8x^2 + 12 - (x^4 + 6x^2 + 12) \\ = x^4 + 8x^2 + 12 - x^4 - 6x^2 - 12 \\ = 2x^2 \end{aligned} \checkmark$$

Q6. $f(x) = \frac{4}{x+2} \quad g(x) = \frac{2}{x} - 2$

$$f(g(x)) = \frac{4}{(\frac{2}{x}-2)+2} = \frac{4}{2/x} = 4 \div \frac{2}{x} = 4 \times \frac{x}{2} = 4x/2 = 2x \checkmark$$

Q7. $f(x) = 3x - 10 \quad g(x) = 4 - 2x \quad h(x) = \frac{1}{6}(2-x)$

(a) $k(x) = f(g(x)) = 3(4-2x) - 10 = 12 - 6x - 10 = 2 - 6x \checkmark$

(b) $h(k(x)) = \frac{1}{6}(2-(2-6x)) = \frac{1}{6}(6x) = x \checkmark$

(c) h is the inverse of k \checkmark

Q8. (i) $f^{-1}(x) = \sqrt[3]{x-2}$

