

1. (a) attempt to form any composition (even if order is reversed) (M1)
 correct composition $h(x) = g\left(\frac{3x}{2} + 1\right)$ (A1)

$$h(x) = 4 \cos\left(\frac{\frac{3x}{2} + 1}{3}\right) - 1 \quad \left(4 \cos\left(\frac{1}{2}x + \frac{1}{3}\right) - 1, 4 \cos\left(\frac{3x + 2}{6}\right) - 1\right)$$
 A1 N3
- (b) interchanging x and y (M1)
 evidence of correct manipulation (A1)
 e.g. $y - 1 = \frac{3}{2}x, x - 1 = \frac{3}{2}y, 2x = 3y - 2$

$$f^{-1}(x) = \frac{2(x - 1)}{3}$$
 A1 N3 3
- (c) range is $-5 \leq h(x) \leq 3$ ($[-5, 3]$) A1A1 N2

[6]

2. (a) attempt to form composite (M1)
 e.g. $f(2x - 5)$
 $h(x) = 6x - 15$ A1 N2 2
- (b) interchanging x and y (M1)
 evidence of correct manipulation (A1)
 e.g. $y + 15 - 6x, \frac{x}{6} = y - \frac{5}{2}$

$$h^{-1}(x) = \frac{x + 15}{6}$$
 A1 N3 3

[5]

3. (a) $(f \circ g): x \mapsto 3(x + 2) \quad (= 3x + 6)$ A2 N2
- (b) **METHOD 1**
 Evidence of finding inverse functions M1
 e.g. $f^{-1}(x) = \frac{x}{3} \quad g^{-1}(x) = x - 2$
 $f^{-1}(18) = \frac{18}{3} (= 6)$ (A1)
 $g^{-1}(18) = 18 - 2 (= 16)$ (A1)
 $f^{-1}(18) + g^{-1}(18) = 6 + 16 = 22$ A1 N3

METHOD 2

- Evidence of solving equations M1
 e.g. $3x = 18, x + 2 = 18$
 $x = 6, x = 16$ (A1)(A1)
 $f^{-1}(18) + g^{-1}(18) = 6 + 16 = 22$ A1 N3

[6]