

2. The functions  $f$  and  $g$  are defined by

$$f(x) = 7 - 2x^2 \quad x \in \mathbb{R}$$

$$g(x) = \frac{3x}{5x-1} \quad x \in \mathbb{R} \quad x \neq \frac{1}{5}$$

(a) State the range of  $f$

(1)

(b) Find  $gf(1.8)$

(2)

(c) Find  $g^{-1}(x)$

(2)

(a)

$$x^2 \geq 0$$

$$2x^2 \geq 0$$

$$-2x^2 \leq 0$$

$$7 - 2x^2 \leq 7 \quad \text{so } f(x) \leq 7 \quad (1 \text{ mark})$$

(b)  $gf(1.8) = g(f(1.8))$

$$f(1.8) = 7 - 2(1.8)^2 = 0.52$$

$$g(0.52) = \frac{3(0.52)}{5(0.52) - 1} = 0.975 \quad (2 \text{ marks})$$

(c)  $y = \frac{3x}{5x-1} \Rightarrow y(5x-1) = 3x$

$$5yx - y = 3x$$

$$5yx - 3x = y$$

$$x(5y-3) = y$$

$$x = \frac{y}{5y-3} \quad (1 \text{ mark})$$

$$\text{so, } g^{-1}(x) = \frac{x}{5x-3} \quad (1 \text{ mark})$$