Functions 2

1) (a) Evidence of attempting to form composition *(M1)*

Correct substitution $(h \circ g)(x) = \dfrac{5(3x-2)}{(3x-2)-4}$ *A1*

$= \dfrac{5(3x-2)}{3x-6} \quad \left(= \dfrac{15x-10}{3x-6}\right) \quad \left(= \dfrac{5(3x-2)}{3(x-2)}\right)$ *A1* *N2*

(b) Evidence of using numerator $= 0$ *(M1)*

e.g. $15x - 10 = 0 \quad (3x - 2 = 0)$

$x = \dfrac{2}{3} \quad (= 0.667)$ *A2* *N3*

2) (a) $f^{-1}(x) = \ln x$ *A1* *N1*

(b) (i) Attempt to form composite $(f \circ g)(x) = f(\ln(1+2x))$ *(M1)*

$(f \circ g)(x) = e^{\ln(1+2x)} \; (= 1 + 2x)$ *A1* *N2*

(ii) Simplifying $y = e^{\ln(1+2x)}$ to $y = 1 + 2x$ (may be seen in part (i) or later) *(A1)*

Interchanging x and y (may happen any time) *M1*

e.g. $x = 1 + 2y \qquad x - 1 = 2y$

$(f \circ g)^{-1}(x) = \dfrac{x-1}{2}$ *A1* *N2*

3) (a) **METHOD 1**

$f(3) = \sqrt{7}$ *(A1)*

$(g \circ f)(3) = 7$ *A1* *N2*

METHOD 2

$(g \circ f)(x) = \sqrt{x+4}^{\,2} \quad (= x + 4)$ *(A1)*

$(g \circ f)(3) = 7$ *A1* *N2*

(b) For interchanging x and y (seen anywhere) *(M1)*

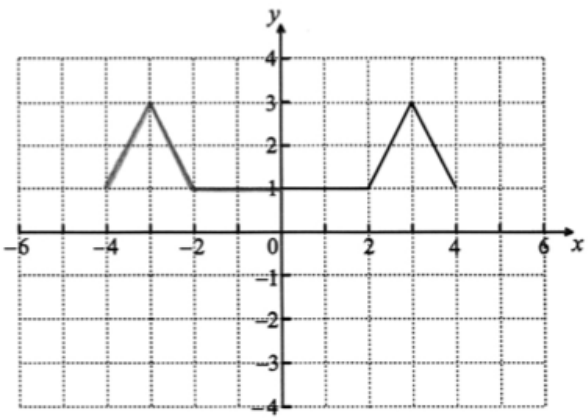
Evidence of correct manipulation *A1*

e.g. $x = \sqrt{y+4}$, $x^2 = y + 4$

$f^{-1}(x) = x^2 - 4$ *A1* *N2*

(c) $x \geq 0$ *A1* *N1*

4) (a)



A2 *N2*

(b)

Description of transformation	Diagram letter
Horizontal stretch with scale factor 1.5	**C**
Maps f to $f(x)+1$	**D**

A1A1 *N2*

(c) translation (accept move/shift/slide *etc.*) with vector $\begin{pmatrix} -6 \\ -2 \end{pmatrix}$ *A1A1* *N2*

[6 marks]

5) (a) (i) $g(0) = e^0 - 2$ *(A1)*

$= -1$ *A1* *N2*

(ii) **METHOD 1**

substituting answer from (i) *(M1)*

e.g. $(f \circ g)(0) = f(-1)$

correct substitution $f(-1) = 2(-1)^3 + 3$ *(A1)*

$f(-1) = 1$ *A1* *N3*

METHOD 2

attempt to find $(f \circ g)(x)$ *(M1)*

e.g. $(f \circ g)(x) = f(e^{3x} - 2) \quad = 2(e^{3x} - 2)^3 + 3$

correct expression for $(f \circ g)(x)$ *(A1)*

e.g. $2(e^{3x} - 2)^3 + 3$

$(f \circ g)(0) = 1$ *A1* *N3*

(b) interchanging x and y (seen anywhere) *(M1)*

e.g. $x = 2y^3 + 3$

attempt to solve *(M1)*

e.g. $y^3 = \frac{x-3}{2}$

$f^{-1}(x) = \sqrt[3]{\frac{x-3}{2}}$ *A1* *N3*

[8 marks]