Daily Question Pure Mathematics Day 2 Solutions

Question Number	Scheme	Marks
(a)	$f(x) \geqslant 3$	M1A1
		(2)
(b)	An attempt to find $2\lvert 3 - 4x \rvert + 3$ when $x = 1$	M1
	Correct answer $fg(1) = 5$	A1
		(2)
(c)	$y = 3 - 4x \Rightarrow 4x = 3 - y \Rightarrow x = \dfrac{3 - y}{4}$	M1
	$g^{-1}(x) = \dfrac{3 - x}{4}$	A1
		(2)
(d)	$\left[g(x) \right]^2 = (3 - 4x)^2$	B1
	$gg(x) = 3 - 4(3 - 4x)$	M1
	$gg(x) + \left[g(x) \right]^2 = 0 \Rightarrow -9 + 16x + 9 - 24x + 16x^2 = 0$	
	$\qquad\qquad\qquad\qquad 16x^2 - 8x = 0$	A1
	$\qquad\qquad 8x(2x - 1) = 0 \Rightarrow x = 0,\ 0.5 \qquad$ oe	M1A1
		(5)
		(11 marks)

Notes for Question

(a)

M1   Attempt at calculating f at $x=0$. Sight of 3 is sufficient. Accept $f(x) > 3$ and $x > 3$ for M1,

A1 $f(x) \geqslant 3$. Accept $y \geqslant 3$, range $\geqslant 3$, $[3, \infty)$

     Do not accept $f(x) > 3$, $x \geqslant 3$

     The correct answer is sufficient for both marks.

(b)

M1   A full method of finding fg(1). The order of substituting into the expressions must be correct and $2|x| + 3$

     must be used as opposed to $2x + 3$

     Accept an attempt to calculate $2|x| + 3$ when $x = -1$.

     Accept an attempt to put $x=1$ into $3 - 4x$ and then substituting their answer to $3 - 4x\big|_{x=1}$ into $2|x| + 3$

     Do not accept the substitution of $x=1$ into $2|x| + 3$, followed by their result into '3-4x'

     This is evidence of incorrect order.

A1   fg(1)=5.

     Watch for $1 \xrightarrow{3-4x} 1 \xrightarrow{2|x|+3} 5$ which is **M1A0**

(c)

M1   Award for an attempt to make x or a swapped y the subject of the formula. It must be a full method and cannot finish $4x = ..$

     You can condone at most one 'arithmetic' error for this method mark.

     $y = 3 - 4x \Rightarrow 4x = 3 + y \Rightarrow x = \dfrac{3+y}{4}$ is fine for the M1 as there is only one error

     $y = 3 - 4x \Rightarrow 4x = 3 - y \Rightarrow x = \dfrac{3}{4} - y$ is fine for the M1 as there is only one error

     $y = 3 - 4x \Rightarrow 4x = 3 + y \Rightarrow x = \dfrac{3}{4} + y$ is M0 as there are two arithmetic errors

A1   Obtaining a correct expression $g^{-1}(x) = \dfrac{3-x}{4}$ oe such as $g^{-1}(x) = \dfrac{x-3}{-4}$, $g^{-1}(x) = \dfrac{3}{4} - \dfrac{x}{4}$

     It must be in terms of x, but could be expressed 'y=' or $g^{-1}(x) \to$

(d)

B1   Sight of $\left[g(x)\right]^2 = (3-4x)^2$. If only the expanded version appears it must be correct

M1   A full attempt to find $gg(x) = 3 - 4(3 - 4x)$

     Condone invisible brackets. Note that it may appear in an equation

A1 $16x^2 - 8x = 0$ Accept other alternatives such as $2x^2 = x$

M1   For factorising their quadratic or cancelling their $Ax^2 = Bx$ by x to get $\geqslant 1$ value of x

     If they have a 3TQ then usual methods are applicable.

A1   Both values correct $x = 0, 0.5$ oe