1)

1	6.5 $4x - 5 = -21$ or $(4x-5)^2 = 21^2$ -4	B1 M1 A1 [3]

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2)

10 [9]	(i) $f^{-1} : x \mapsto \frac{1}{2}(x+2)$	B1
	$x = \frac{7y-a}{y+1} \Rightarrow xy + x = 7y - a \Rightarrow g^{-1} : x \mapsto \frac{a+x}{7-x} \quad (x \neq 7)$	M1 A1
	(ii) $f^{-1}g(4) = \frac{\frac{28-a}{5}}{3} + 2$ or $f^{-1}g(x) = \frac{\frac{7x-a}{x+1}}{3} + 2$	M1
	Equate to 2 and reduce fractions properly	DM1
	[Or $g(4) = f(2) \Rightarrow \frac{28-a}{5} = 4$] $\Rightarrow a = 8$	[M1A1] A1
	(iii) $\frac{7x-9}{x+1} = \frac{9+x}{7-x}$ [Or, with $a = 9$, $g(x) = x$, or $g^{-1}(x) = x$, or $g^2(x) = x$]	M1
	$\Rightarrow x^2 - 6x + 9 = 0 \Rightarrow (x-3)^2 = 0 \Rightarrow x = 3$ only [Or shows $b^2 - 4ac = 0$]	A1 A1

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3)

6	(i)	Completely correct idea of modulus quadratic shape cusps correct position	B1 B1 B1 B1
	(ii)	complete method 2	M1 A1 [6]

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4)

7	(i)	Graph of modulus function	B1 B1 B1 [3]	B1 for shape B1 for 5 marked on y axis B1 for $\frac{5}{3}$ marked on x axis
	(ii)	Straight line graph	B1 [1]	B1 for straight line with greater gradient
	(iii)	$8x = \pm(3x - 5)$ leading to $x = \frac{5}{11}$ or 0.455 **only**	M1 M1, A1 [3]	M1 for attempt to deal with modulus M1 for solution

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5)

1	-1.5 Solve $2x + 10 = -7$ or $(2x + 10)^2 = 49$ -8.5	B1 M1 A1 [3]

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6)

12E [10]	**(i)** $-\infty < (f) < \infty$ (i.e. all real values) **(ii)** $(f^{-1}) > 0$ (i.e. all positive values)	B1	B1
	(iii) Graph of $f(x) = \ln x$ Graph of $f^{-1}(x)$ (as e^x or reflection in $y = x$)	B1	B1
	(iv) $fg(x) = \ln(3x + 2) = 3 \Rightarrow x = (e^3 - 2)/3$ [≈ 6.0(3)]	M1	A1
	(v) $g^{-1}(x) = (x - 2)/3$ $f^{-1}(x) = e^x$ [can be earned anywhere]	B1	B1
	$e^{(x-2)/3} = 7 \Rightarrow x = 3\ln 7 + 2$ oe [≈ 7.84 condone 7.8]	M1	A1
	Or $g^{-1}(x) = (x - 2)/3$ $f^{-1}g^{-1}(x) = 7 \Rightarrow g^{-1}(x) = f(7)$	B1	B1
	$(x - 2)/3 = \ln 7 \Rightarrow x = 3\ln 7 + 2$ oe [≈ 7.84 condone 7.8]	M1	A1
	Or $f^{-1}g^{-1}(x) = 7 \Rightarrow g^{-1}(x) = f(7)$ $\Rightarrow x = g\,f(7)$	B1	B1
	$x = g(\ln 7) = 3\ln 7 + 2$ oe [≈ 7.84 condone 7.8]	M1	A1

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7)

10 (a) (i) $fg(x) = f\left(\frac{x}{x+2}\right)$ $= 3 - \frac{x}{x+2}$	M1 A1 [2]	M1 for order
(ii) $3 - \frac{x}{x+2} = 10$ leading to $x = -1.75$	DM1 A1 [2]	DM1 for dealing with fractions sensibly
(b) (i) $h(x) > 4$	B1 [1]	
(ii) $h^{-1}(x) = e^{x-4}$ $h^{-1}(9) = e^5$ (≈ 148) or $4 + \ln x = 9$, leading to $x = e^5$	M1 A1 [2]	M1 for attempting to obtain inverse function
(iii) correct graphs	B1 B1 B1 [3]	B1 for each curve B1 for idea of symmetry

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