Question	Scheme	Marks	AOs
10 (a)	$y=\dfrac{3x-5}{x+1}\Rightarrow y(x+1)=3x-5\Rightarrow xy+y=3x-5\Rightarrow y+5=3x-xy$	M1	1.1b
	$\Rightarrow y+5=x(3-y)\Rightarrow \dfrac{y+5}{3-y}=x$	M1	2.1
	Hence $f^{-1}(x)=\dfrac{x+5}{3-x},\quad x\in\mathbb{R},\ x\neq 3$	A1	2.5
		(3)	
(b)	$ff(x)=\dfrac{3\left(\dfrac{3x-5}{x+1}\right)-5}{\left(\dfrac{3x-5}{x+1}\right)+1}$	M1	1.1a
	$=\dfrac{\dfrac{3(3x-5)-5(x+1)}{x+1}}{\dfrac{(3x-5)+(x+1)}{x+1}}$	M1 A1	1.1b 1.1b
	$=\dfrac{9x-15-5x-5}{3x-5+x+1}=\dfrac{4x-20}{4x-4}=\dfrac{x-5}{x-1}$ (note that $a=-5$)	A1	2.1
		(4)	
(c)	$fg(2)=f(4-6)=f(-2)=\dfrac{3(-2)-5}{-2+1};=11$	M1 A1	1.1b 1.1b
		(2)	
(d)	$g(x)=x^2-3x=(x-1.5)^2-2.25$. Hence $g_{min}=-2.25$	M1	2.1
	Either $g_{min}=-2.25$ or $g(x)\geqslant -2.25$ or $g(5)=25-15=10$	B1	1.1b
	$-2.25\leqslant g(x)\leqslant 10$ or $-2.25\leqslant y\leqslant 10$	A1	1.1b
		(3)	
(e)	E.g. • the function g is many-one • the function g is not one-one • the inverse is one-many • $g(0)=g(3)=0$	B1	2.4
		(1)	
			(13 marks)

Question 10 Notes:	
(a)	
M1:	Attempts to find the inverse by cross-multiplying and an attempt to collect all the *x*-terms (or swapped *y*-terms) onto one side
M1:	A fully correct method to find the inverse
A1:	A correct $\mathrm{f}^{-1}(x) = \dfrac{x+5}{3-x}$, $x \in \mathbb{R},\ x \neq 3$, expressed fully in function notation (including the domain)
(b)	
M1:	Attempts to substitute $\mathrm{f}(x) = \dfrac{3x-5}{x+1}$ into $\dfrac{3\mathrm{f}(x)-5}{\mathrm{f}(x)+1}$
M1:	Applies a method of "rationalising the denominator" for both their numerator and their denominator.
A1:	$\dfrac{\dfrac{3(3x-5)-5(x+1)}{x+1}}{\dfrac{(3x-5)+(x+1)}{x+1}}$ which can be simplified or un-simplified
A1:	Shows $\mathrm{ff}(x) = \dfrac{x+a}{x-1}$ where $a = -5$ or $\mathrm{ff}(x) = \dfrac{x-5}{x-1}$, with no errors seen.
(c)	
M1:	Attempts to substitute the result of $\mathrm{g}(2)$ into f
A1:	Correctly obtains $\mathrm{fg}(2) = 11$
(d)	
M1:	Full method to establish the minimum of g. E.g. • $(x \pm \alpha)^2 + \beta$ leading to $g_{\min} = \beta$ • Finds the value of *x* for which $\mathrm{g}'(x) = 0$ and inserts this value of *x* back into $\mathrm{g}(x)$ in order to find to $g_{\min}$
B1:	For either • finding the correct minimum value of g (Can be implied by $\mathrm{g}(x) \geqslant -2.25$ or $\mathrm{g}(x) > -2.25$) • stating $\mathrm{g}(5) = 25 - 15 = 10$
A1:	States the correct range for g. E.g. $-2.25 \leqslant \mathrm{g}(x) \leqslant 10$ or $-2.25 \leqslant y \leqslant 10$
(e)	
B1:	See scheme