Question			Answer	Marks	AO	Guidance	
11	**(a)**		$\text{fg}(x) = (6x - 2a)^2 + 8a(6x - 2a) + 4a^2$ $= 36x^2 + 24ax - 8a^2$	**B1**	**1.1**	Accept unsimplified form	**OR** **M1** Complete a square on $\text{f}(x)$
			$(\text{fg})'(x) = 72x + 24a = 0$	**M1**	**1.1**	Differentiate their $\text{fg}(x) = 0$ or use square completion: $4(9x^2 + 6ax - 2a^2) = 4(3x + a)^2 - 4a^2$ $-8a^2$	**A1** Obtain $(x + 4a)^2 - 12a^2$
			$x = -\dfrac{a}{3}$, giving $\text{fg}\left(-\dfrac{a}{3}\right) = (-4a)^2 + 8a(-4a) + 4a^2 = -12a^2$	**M1**	**2.1**	Solve for x and substitute their value for x in $\text{fg}(x)$	**M1** Substitute $\text{g}(x)$ and simplify
			Stationary point of fg is a minimum so range of $\text{fg}(x) \geq -12a^2$ or $\left[-12a^2\right]$	**E1**	**2.2a**	Must mention minimum Do not accept $x \geq -12a^2$	**E1** Obtain $(6x + 2a)^2 - 12a^2$ or equivalent form and state $\text{fg}(x) \geq -12a^2$
				[4]			
11	**(b)**		$144 + 48a - 8a^2 = 144$	**M1**	**3.1a**	Substitute $x = 2$ in their $\text{fg}(x)$ and equate to 144	
				M1	**1.1**	Attempt to solve their equation	
			$a = 6$	**A1**	**1.1**	Do not give this mark if $a = 0$ also given as an answer	
				[3]			
11	**(c)**		Each y value in the range $(y > -12a^2)$ corresponds to two x values, e.g. corresponds to $x = 1.46$ or -5.46 Therefore fg has no inverse	**M1** **E1**	**2.4** **2.2a**	An example or graph must be given, or a clear explanation that quadratic functions on the real numbers are one-to-many.	
				[2]			