Question	Scheme	Marks	AOs
7(a)	$\text{f}(x) > 3$	B1	1.1b
		(1)	
(b)	$y = 3+\sqrt{x-2} \Rightarrow x = ...$	M1	1.1b
	$\text{f}^{-1}(x) = (x-3)^2+2$	A1	1.1b
	$x > 3$	B1ft	2.2a
		(3)	
(c)	$\text{f}(6) = 3+\sqrt{6-2} = 5 \Rightarrow \text{g}(\text{"}5\text{"}) = \dfrac{15}{\text{"}5\text{"}-3} = ...$	M1	1.1b
	$= \dfrac{15}{2}$	A1	1.1b
		(2)	
(d)	$3+\sqrt{a^2+2-2} = \dfrac{15}{a-3} \Rightarrow \text{"}a^2-9 = 15\text{"}$	M1	1.1b
	$a = 2\sqrt{6}$	A1	2.2a
		(2)	
			(8 marks)

Notes

(a)

B1: $\text{f}(x) > 3$ o.e.

e.g. $y > 3$, range > 3, $\text{f}(x) \in (3, \infty)$, $\{\text{f}(x) : \text{f}(x) > 3\}$, $\text{f} > 3$ **but not e.g.** $x > 3$, $\text{f}(x) \ldots 3$, $[3, \infty)$

(b)

M1: Sets $y = 3+\sqrt{x-2}$ and attempts to make x the subject (or vice versa). Look for the correct order of operations so score for an expression of the form $(x =)\ (y \pm 3)^2 \pm 2$ or $(y =)\ (x \pm 3)^2 \pm 2$

A1: $\text{f}^{-1}(x) = (x-3)^2+2$ Also accept $\text{f}^{-1} : x \rightarrow (x-3)^2+2$. Condone $\text{f}^{-1} = (x-3)^2+2$ (or $\text{f}^{-1} = y = (x-3)^2+2$) but do not allow just $y = ...$ or $\text{f}^{-1} : y =$

Also accept other equivalent expressions such as $\text{f}^{-1}(x) = x^2-6x+11$ (simplified or unsimplified)

B1ft: $x > 3$ or follow through on their part (a). The omission of $x \in \mathbb{R}$ is condoned.

Allow equivalent answers such as $x \in (\text{"}3\text{"}, \infty)$ or $\{x : x > \text{"}3\text{"}\}$

Note: It is also acceptable to define f^{-1} in any variable e.g. as $\text{f}^{-1}(t) = (t-3)^2+2$ $\quad t > 3$ as long as the variable is used consistently to score M1A1B1. If another variable is used other than x it must be fully defined e.g. $\text{f}^{-1}(t) = ...$ not just $\text{f}^{-1} = ...$

(c)

M1: Substitutes $x = 6$ into f and substitutes the result into g to find a value for $\text{gf}(6)$.

Allow an attempt to substitute $x = 6$ into $\text{gf}(x) = \dfrac{15}{\sqrt{x-2}}$ condoning slips. They must proceed to find a value. Condone arithmetical slips and bracket errors/omissions. Condone for M1 attempts where when dealing with $\sqrt{x-2}$ leads to two different answers e.g. $\dfrac{15}{\sqrt{6-2}} \rightarrow \pm\dfrac{15}{2}$

A1: $\dfrac{15}{2}$ only oe isw once a correct answer is seen

(d)

M1: Attempts to form the equation $3+\sqrt{a^2+2-2}=\dfrac{15}{a-3}$, and proceeds to a quadratic in *a* (usually $a^2=k$ or $a^2-k=15$ but condone arithmetical, miscopying and sign slips. Condone equations which would lead to complex roots.
May be implied by a correct exact answer.

Alternatively, they attempt to form the equation $a^2+2=\mathrm{f}^{-1}\mathrm{g}(a)\Rightarrow a^2+2=\left(\dfrac{15}{a-3}-3\right)^2+2$

$\Rightarrow(a+3)(a-3)=15\Rightarrow a^2-9=15$ (condone slips)

They should be square rooting both sides so that $\sqrt{a^2+2-2}\to a$, before multiplying both sides by $a-3$ and rearranging so that the a^2 term comes from their "$(a+3)(a-3)$"

May be implied by a correct exact answer for their quadratic in *a* but a correct decimal answer does not imply this mark.

A1: $(a=)\ 2\sqrt{6}$ or accept $\sqrt{24}$ (they must reject the negative solution if found as $\mathrm{f}\left(a^2+2\right)\neq\mathrm{g}(a)$ when $a=-2\sqrt{6}$) $\sqrt{6}\times\sqrt{4}$ is A0
isw $\sqrt{24}$ followed by $4\sqrt{6}$ (incorrect manipulation of the surd) but not followed by $\pm\sqrt{24}$ o.e.
A decimal answer on its own or multiple answers e.g. $\pm\sqrt{24}$ score A0.