Question Number	Scheme	Mark
5(a)	$\mathrm{f}(x) > 5$	M1A1
		(2)
(b)	$\left\{\mathrm{g}^{-1}(x) =\right\} \quad \ln\left(\dfrac{x-7}{5}\right)+2$ $x > 7$	M1A1 B1
		(3)
(c)	$\mathrm{fg}(a) = 8 \Rightarrow \dfrac{35+25\mathrm{e}^{a-2}+2}{7+5\mathrm{e}^{a-2}-3} = 8$ **or** $\mathrm{g}(a) = \mathrm{f}^{-1}(8) \Rightarrow 7+5\mathrm{e}^{a-2} = \dfrac{26}{3}$ $37+25\mathrm{e}^{a-2} = 40\mathrm{e}^{a-2}+32 \Rightarrow 15\mathrm{e}^{a-2} = 5 \Rightarrow a = 2-\ln 3$	M1 dM1A1
		(3)
		(8 marks)

(a)

M1: $\mathrm{f}(x) \ldots 5$ where … is any inequality or equality.
Ignore another bound e.g. $0 < \mathrm{f}(x)$ for this mark.
Condone use of y for $\mathrm{f}(x)$ or just f … 5 but not x … 5
May be implied by use of interval notation with or without $\mathrm{f}(x) \in$

A1: $\mathrm{f}(x) > 5$ or $\mathrm{f} > 5$ or $y > 5$ but not e.g. $x > 5$.
$5 < \mathrm{f}(x) < \infty$ scores A1 but $5 < \mathrm{f}(x) \leqslant \infty$ is A0.
Using interval notation, $(5, \infty)$ scores M1A1 but $(5, \infty]$ or $[5, \infty]$ or $[5, \infty)$ score M1A0 with or without $\mathrm{f}(x) \in$.

(b) **Use of log in place of ln or $\log_e$ is ambiguous and is condoned only for the M marks.**

M1: Complete attempt to find $\mathrm{g}^{-1}(x)$. Score for $\{y =\} \ln\left(\dfrac{\pm x \pm 7}{5}\right) \pm 2$ or $\{x =\} \ln\left(\dfrac{\pm y \pm 7}{5}\right) \pm 2$

Do not penalise invisible brackets unless they are clearly incorrect e.g. $\dfrac{\ln x - 7}{5}$

A1: $\left\{\mathrm{g}^{-1}(x) =\right\} \ln\left(\dfrac{x-7}{5}\right)+2$ o.e. $\left\{\mathrm{g}^{-1}(x) =\right\} \ln\left|\dfrac{x-7}{5}\right|+2$ is acceptable.

So accept e.g. $\left\{\mathrm{g}^{-1} =\right\} \ln\left(\dfrac{x-7}{5}\right)+2\ln \mathrm{e}$ or $\ln(x-7)-\ln 5+2$ or $\ln\left(\dfrac{(x-7)\mathrm{e}^2}{5}\right)$

ISW after a correct answer is seen.

There is no need to see a LHS but score A0 if they have e.g. $x = \ln\left(\dfrac{x-7}{5}\right)+2$

Condone spurious $y =$ e.g. $\mathrm{g}^{-1}(x) = y = \ln\left(\dfrac{x-7}{5}\right)+2$

Condone invisible brackets if they are unambiguous e.g. $\ln\dfrac{x-7}{5}+2$ but not clearly incorrect $\dfrac{\ln x - 7}{5}+2$

B1: $x > 7$ must be x and not y or g

Using interval notation, $(7, \infty)$ scores B1 but $(7, \infty]$ or $[7, \infty]$ or $[7, \infty)$ score B0.

If using $x \in (7, \infty)$ then it must be x and not y or g

(c) **May work in x instead of a which is acceptable for all marks.**
Use of log in place of ln or $\log_e$ is ambiguous and is condoned only for the M marks.

M1: Attempts to form the equation $\dfrac{5\left(7+5\mathrm{e}^{a-2}\right)+2}{7+5\mathrm{e}^{a-2}-3}=8$ **or** attempts to form an equation from $\dfrac{5x+2}{x-3}=8 \Rightarrow x=...\left\{\dfrac{26}{3}\right\}$ **and** $\mathrm{g}(a)=\mathrm{f}^{-1}(8) \Rightarrow 7+5\mathrm{e}^{a-2}=\text{"}\dfrac{26}{3}\text{"}$

You may see $\dfrac{5x+2}{x-3}=8 \Rightarrow x=...\left\{\dfrac{26}{3}\right\} \Rightarrow \{a=\} \ln\left(\dfrac{\text{"}\frac{26}{3}\text{"}-7}{5}\right)+2$ which scores M1dM1

dM1: Attempts to rearrange the equation to the form $A\mathrm{e}^{a-2}=B$ o.e. with $A \times B > 0$

It is dependent on the previous method mark.

Proceeding directly to $\ln\left(\dfrac{\text{"}\frac{26}{3}\text{"}-7}{5}\right)+2$ scores M1dM1

A1: $\{a=\}\ 2-\ln 3$ or simplified equivalent. Condone $\{a=\}\ 2+\ln\left(\dfrac{1}{3}\right)$ and allow $x =$

Condone $\ln\left(\dfrac{\mathrm{e}^2}{3}\right)$ and ISW after a correct simplified equivalent is seen.

Condone also $\{a=\}\ 2+\ln\left|\dfrac{1}{3}\right|$

Question Number	Scheme	Mark
6(a)	$R = 5$ $\tan\alpha = \left(\frac{4}{3}\right) \Rightarrow \alpha = ...$ $5\sin(x + 0.927)$	B1 M1 A1
		(3)
(b)(i) **(ii)**	Max = 529 $2x + "0.927" = \frac{7\pi}{2} \Rightarrow x = ...$ awrt 5.03	B1ft M1 A1
		(3)
		(6 marks)

(a)

B1: For $R = 5$. Not scored for just $R = -5$ but condone $R = \pm 5$ for this mark. Condone 5.00 (3sf)

M1: Attempts to find α.
Look for $\tan\alpha = \pm\frac{4}{3}$ or $\tan\alpha = \pm\frac{3}{4}$ leading to $\alpha = \ldots$ (you do not need to check their value of α) and α may come from $\sin\alpha = \pm\frac{4}{5}$ or $\cos\alpha = \pm\frac{3}{5}$
May be implied by $\alpha =$ awrt 0.927 or if working in degrees by awrt 53.1

A1: $5\sin(x + 0.927)$ Requires the expression not just correct values for R and α
May be scored if seen at the start of part (b) only if correct i.e. $5\sin(x + 0.927)$ seen not $5\sin(2x + 0.927)$
Condone 5.00 for R but not ± 5 for R and do not allow invisible brackets.

(b)(i)

B1ft: 529 following $R = 5$ or ft their (a). Look for $\left(4 \times (-R) - 3\right)^2$

(b)(ii)

M1: Sets $2x + "0.927" = \frac{7\pi}{2}$ and proceeds using a correct order of operations to a value for x
You may need to check their value if their α is incorrect.
May be seen as e.g. $x = \frac{7\pi}{4} - \frac{"0.927"}{2}$ or $x = k\pi + \frac{3\pi}{4} - \frac{"0.927"}{2}$ where $k = 1$
This mark may be withheld if it comes from clearly incorrect work, e.g., $\sin(2x + 0.927) = 1$ so $2x + "0.927" = \frac{\pi}{2}, \frac{7\pi}{2}$

A1: awrt 5.03 only following a correct equation. Answer only with no method scores no marks.
If they have more than one answer, then awrt 5.03 must be selected or the others rejected.