Question Number	Scheme	Mark
4(a)	$p=10^{1.3}$ **or** $q=10^{\frac{3.4-1.3}{10}}$ $p=$ awrt 20.0 **or** $q=$ awrt 1.62 $p=10^{1.3}$ **and** $q=10^{\frac{3.4-1.3}{10}}$ $p=$ awrt 19.95 **and** $q=$ awrt 1.622	M1 A1 dM1 A1
		(4)
(b)	e.g. $"19.95"\times"1.622"^{T}=700$ $\Rightarrow "1.622"^{T}=\dfrac{700}{"19.95"}$ $\Rightarrow T=\log_{"1.622"}\left(\dfrac{700}{"19.95"}\right)=$ awrt 7.36	M1A1
		(2)
		(6 marks)

(a)

M1: A correct expression for p **or** q. May be implied by a correct value so $p=$ awrt 20.0 **or** $q=$ awrt 1.62 Condone p truncating to 19.9 but not just p = awrt 20

May be seen as e.g. $\{N=\}\ 10^{1.3}\times...$ to imply the expression for p or $\{N=\}\ ...\times\left(10^{0.21}\right)^{t}$ to imply the expression for q (but not just $\{N=\}\ ...\times10^{0.21t}$).

Note that they may use simultaneous equations i.e. $pq^{0}=10^{1.3}$ and $pq^{10}=10^{3.4}$ which may lead to $q^{10}=\dfrac{2511...}{19.95...}=125.8...$ so $q=\sqrt[10]{125.8...}$ which scores the M1.

A1: $p=$ awrt 20.0 **or** $q=$ awrt 1.62 Condone p truncating to 19.9.

dM1: A correct expression for p **and** a correct expression for q.
May be implied by correct values so $p=$ awrt 20.0 **and** $q=$ awrt 1.62 Condone p truncating to 19.9 but not just p = awrt 20. May also be implied if embedded in their equation.
It is dependent on the previous method mark.

A1: $p=$ awrt 19.95 **and** $q=$ awrt 1.622 There is no need to see the complete model.
If p and q are not stated explicitly then allow them to be implied by e.g. $\{N=\}\ 19.95\times1.622^{t}$

SC: Incorrect index work seen e.g. $10^{1.3}+10^{0.21t}$ followed by correct values for p and q scores maximum SC 1100.

(b)

M1: Uses their values for p and q in $pq^T = 700$ or uses $\log 700 = 1.3 + "0.21"T$ and proceeds to a value for $T > 0$ (or t) using the correct order of operations and correct log work.

They cannot proceed directly from $"19.95" \times ("1.622")^T = 700$ to a value for T without at least $("1.622")^T = \frac{700}{"19.95"}$ **or** $T = \log_{"1.622"} \frac{700}{"19.95"}$ o.e. e.g. $T \ln("1.622") = \ln \frac{700}{"19.95"}$

You may need to check their log work on a calculator, in which case 2 sf is sufficient.
Condone slips such as multiplying instead of dividing or miscopying their p or q e.g. 1.62 in place of 1.622.
Note that $\log 700 = pq^T$ is incorrect and scores M0.

A1: awrt 7.36 following award of the M1.

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 $\dfrac{\ln x - 7}{5}+2$