Question Number	Scheme	Marks
4(a)	Gradient $= \dfrac{3.85-3.08}{5-0}$ (=0.154 or $\dfrac{77}{500}$) $\log_{10} N = 3.08 + 0.154t$ oe	M1 A1
		(2)
(b)	$a = 10^{3.08} =$ awrt 1200 $\log_{10} b = "0.154"$ or $b = 10^{"0.154"}$ $b =$ awrt 1.43	B1 M1 A1
		(3)
(c)	$\log_{10} 500\,000 = 3.08 + 0.154T \Rightarrow T = ...$ or $T = \log_{"1.43"}\left(\dfrac{500\,000}{"1200"}\right) = ...$ $(T =)$ awrt 17	M1 A1
		(2)
		(7 marks)

Mark (a) and (b) together
(a)

M1 A correct attempt to find the gradient between the given coordinates. This may be implied by $10^{0.154}$ or awrt 1.43 or $\dfrac{77}{500}$. The values embedded in the expression $\dfrac{3.85-3.08}{5-0}$ or $\dfrac{3.08-3.85}{-5}$ is sufficient. Check Figure 1 and may be seen in (b)

A1 $\log_{10} N = 3.08 + 0.154t$ Must be in terms of $\log_{10} N$ and t (may be seen in (b))
Condone log N or lg N for $\log_{10} N$ but do not accept ln N
Accept equivalent equations such as $\log_{10} N = \dfrac{77}{25} + \dfrac{77}{500}t$ or $500\log_{10} N = 1540 + 77t$ or $t = \dfrac{500}{77}\log_{10} N - \dfrac{1540}{77}$
Do not accept $N = 1200 \times 1.43^t$

(b)

B1 awrt 1200

M1 A correct equation to find *b* using their gradient in (a). Can be awarded for $\log_{10} b = "0.154"$ or $b = 10^{"0.154"}$ (may be implied by awrt 1.43). Allow log or lg but not ln.

A1 awrt 1.43

(c)

M1 Substitutes in *N* = 500 000 into their $N = ab^t$ using their values for *a* and *b* and uses a valid method to find a value or expression for *T* (can be left as a logarithm)
This can be either by:

- using correct inverse laws
- using a calculator and proceeding directly to a value for *t*

Typically, $"1200" \times "1.43"^T = 500\,000 \Rightarrow "1.43"^T = \dfrac{500\,000}{"1200"} \Rightarrow T = \dfrac{\log_{10} "\frac{1250}{3}"}{\log_{10} "1.43"} = ...$

$$\Rightarrow "1.43"^T = \frac{500\,000}{"1200"} \Rightarrow T = \log_{"1.43"}\left(\frac{500\,000}{"1200"}\right) = ...$$

Alternatively uses their $\log_{10} N = "3.08" + "0.154" t$ and rearranges to find a value for *T* allowing sign slips only:

$$\log_{10} 500\,000 = "3.08" + "0.154" T \Rightarrow T = \frac{\log_{10} 500\,000 - "3.08"}{"0.154"} = ...$$

May be implied by a correct answer.

A1 $(T =)$ awrt 17 isw after a correct answer is seen (cannot be left as a logarithm)

This mark can only be scored provided EITHER their equation in (a) is correct OR their values for *a* and *b* are correct in (b).

Question Number	Scheme	Marks
5(a) **(i)**	7	B1
(ii)	$\frac{9}{k}$	B1
		(2)
(b)	$kx-9-2=0$ and $-kx+9-2=0 \Rightarrow \frac{\ldots}{k}, \frac{\ldots}{k}$	M1
	CVs $\frac{7}{k}, \frac{11}{k}$	A1
	$\frac{7}{k} < x < \frac{11}{k}$	A1
		(3)
(c)	$"-2" = -2 \times "\frac{9}{k}" + 3 \Rightarrow k = \ldots$	M1
	$(k =)\ 3.6$	A1
	$k > 3.6$	A1
		(3)
		(8 marks)
Alt(b)	$-2 < kx - 9 < 2$	
	$\frac{\ldots}{k} < x < \frac{\ldots}{k}$	M1
	$\frac{7}{k} < x < \frac{11}{k}$	A1A1

(a) Check Figure 2 and by the questions

(i)

B1 7 Condone $(0, 7)$ but not $(7, 0)$