Question Number	Scheme	Marks
1	$2\left(2\cos^2 x-1\right)=7\cos x$ $4\cos^2 x-7\cos x-2=0 \Rightarrow \cos x=-\frac{1}{4}$ $\Rightarrow x=\arccos\left(-\frac{1}{4}\right)=104.5°, 255.5°$	M1 M1 A1 dM1 A1 **(5)** **(5 marks)**

M1 Attempts to use $\cos 2x=\pm 2\cos^2 x\pm 1$ to form a quadratic equation in $\cos x$

If the other two forms are attempted there must be some attempt to use $\sin^2 x+\cos^2 x=1$ to form a quadratic equation in $\cos x$

$2\times 2\cos^2 x-1=7\cos x$ is M0 unless the correct identity has been previously stated or recovery occurs.

M1 Attempts to solve a 3TQ in $\cos x$ using an allowable method (the quadratic need not be correct and may have come from incorrect work)

A1 Reaches $\cos x=-\frac{1}{4}$ or $-\frac{2}{8}$ or −0.25. (May be implied by a correct value for x) Ignore any reference to $\cos x=2$ Those who use $y=\cos x$ and stop at a $y=-\frac{1}{4}$ score A0.

dM1 Depend on the second method mark. Takes arccos of at least one solution (α) of their quadratic where $|\alpha|<1$ to find at least one solution in range. If substitution not seen then you will need to check.

NB a radian answer of awrt 1.8 or correct 1d.p. answer for their α can imply the method.

A1 awrt $104.5°, 255.5°$ with no other values in the range. Ignore values outside the range.

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Question Number	Scheme	Marks
2.(a)	Sight of $10^{1.478}$ or $10^{0.0646}$ or $10^{0.0646t+1.478}$	M1
	$(a=)$awrt 30 or $(b=)$awrt 1.16	A1
	$\log_{10} N = 0.0646t + 1.478 \rightarrow N = 10^{0.0646t+1.478} = 10^{0.0646t}10^{1.478}$	dM1
	$= "30" \times "1.16"^t$	
	$N = 30 \times 1.16^t$	A1
		(4)
(b)	Attempts $N = 30 \times 1.16^{30} =$ awrt 2600	M1 A1
		(2)
		(6 marks)

(a) **NB This shows as MMAA on ePEN but is being marked as MAMA.**

M1 Sight of $10^{1.478}$ or $10^{0.0646}$ or $10^{0.0646t+1.478}$ (allowing slips copying the values) anywhere in their solution. This mark is implied by seeing awrt 30 or awrt 1.16

A1 Sight of either awrt 30 or awrt 1.16

dM1 Applies correct index laws and proceeds to find values for *a* and *b*. $N = \left(10^{0.0646}\right)^t \times 10^{1.478} = "1.16"^t \times "30"$

For this mark there must be evidence of correct index work so expect to see at least $10^{0.0464t+1.478}$ before a final answer and no incorrect index work.

A1 $a = awrt\ 30$ and $b = awrt\ 1.16$ as long as there is no contrary work, or states that $N = 30 \times 1.16^t$ (awrt values)

(b)

M1 Attempts $N = 30 \times 1.16^{30}$ with their values of *a* and *b*.

Alternatively $\log_{10} N = 0.0646 \times 30 + 1.478 \Rightarrow N = 10^{3.416}$

A1 awrt 2600, isw after a correct answer.

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Alt (a) using $N = ab^t$ as a starting point.

M1 As main scheme.

A1 $a =$ awrt 30 or $b =$ awrt 1.16 (must be correctly assigned)

dM1 Takes $\log_{10}$ of both sides and proceeds to at least $\log_{10} N = \log_{10} a + t \log_{10} b$ and attempts to find a value for both of the constants with no incorrect log work.

A1 $a = awrt\ 30$ and $b = awrt\ 1.16$ as long as there is no contrary work, or states that $N = 30 \times 1.16^t$ (awrt values)