Question Number	Scheme	Marks
8 (i)	$4\tan^2(2\theta-30)°+1=49$	
	$\tan(2\theta-30)°=(\pm)\sqrt{12}$	M1
	$(2\theta-30)=$ any of awrt 74, 106, 254, 286	A1
	Correct method to find θ E.g. $\theta=$ awrt $\frac{74+30}{2}$	dM1
	Two of $\theta=$ awrt 51.9, 68.1, 141.9, 158.1	A1
	All four of $\theta=$ awrt 51.9, 68.1, 141.9, 158.1	A1
		(5)
(ii)	Uses $\tan x=\frac{\sin x}{\cos x}\Rightarrow 2\times\frac{\sin x}{\cos x}\sin x+3=0$	M1
	$2\sin^2 x+3\cos x=0\Rightarrow 2\left(1-\cos^2 x\right)+3\cos x=0$	dM1
	$\Rightarrow 2\cos^2 x-3\cos x-2=0$	A1
	$\Rightarrow(2\cos x+1)(\cos x-2)=0\Rightarrow\cos x=-\frac{1}{2}$	ddM1
	$\Rightarrow x=\frac{2}{3}\pi,\frac{4}{3}\pi$	A1
		(5) **(10 marks)**

(i)

M1: **Either:** Attempts to make $\tan(2\theta-30)°$ the subject. Allow $\tan\alpha°=3.46$

An attempt is defined as a numerical slip in finding '12'

Allow the use of a substitution here e.g., let $2\theta-30=x\Rightarrow\tan x°=(\pm)\sqrt{12}$

OR: Uses the sin/cos and Pythagorean identities as follows:

$$\tan^2\alpha=12\Rightarrow\frac{\sin^2\alpha}{\cos^2\alpha}=12\Rightarrow 1-\cos^2\alpha=12\cos^2\alpha$$

$$\cos^2\alpha=\frac{1}{13}\Rightarrow\cos\alpha=(\pm)\sqrt{\frac{1}{13}}\quad\text{o.e.}$$

OR $\sin\alpha=(\pm)\sqrt{\frac{12}{13}}$ o.e.

Award this mark for obtaining a value for either sin or cos allowing for numerical slips only.

A1: Achieves $(2\theta-30)=$ any of one of awrt 74, 106, 254, 286

Allow a substitution, so achieves any one of $x=$ awrt 74, 106……..

dM1: Dependent upon the previous M mark. It is for attempting to find θ. Score for $\frac{\arctan k \pm 30}{2}$

A1: For two of $\theta =$ awrt $51.9,\ 68.1, 141.9, 158.1$

A1: All four of $\theta =$ awrt $51.9,\ 68.1, 141.9, 158.1$ and no other values in the range

Ignore values outside of range.

(ii)

M1: Uses $\tan x = \frac{\sin x}{\cos x} \Rightarrow 2 \times \frac{\sin x}{\cos x} \sin x + 3 = 0$

dM1: Uses $\sin^2 x = 1 - \cos^2 x$ and multiplies by $\cos x$ and attempts to form a 3TQ in $\cos x$

A1: Correct simplified 3 term quadratic $2\cos^2 x - 3\cos x - 2 = 0$ in any form.

ddM1: Solves a 3TQ using any valid method [including calculators] in $\cos x$ leading to at least one value for $\cos x$

A1: $x = \frac{2}{3}\pi, \frac{4}{3}\pi$ and no other values in the range Ignore values outside of range

Question Number	Scheme	Marks
9.(a)	Attempts to use $7\,500 = 12\,400 + 14d$ to find 'd'	M1
	Finds $d = (-350)$ and uses this in $12\,400 + 4d$	M1
	Lithium mined in Year 5 is 11 000	A1
		(3)
(b)	Attempts $\frac{15}{2}(12400 + 7500)$ or $\frac{15}{2}\{2\times12400 + 14\times-350\} = 149\,250$	M1, A1
		(2)
(c)	Attempts to use $7\,500 = 12\,400r^{14}$ to find 'r'	M1
	Finds $r = (0.9647)$ and uses this in $12\,400 \times r^{9}$	M1
	Lithium mined in Year 10 $8580 \leqslant \mathbb{L} \leqslant 9000$	A1
		(3)
(d)	Limit = $\frac{12400}{1-'0.9647'} = 351\,300$ Accept $310\,000 \leqslant S_{\infty} \leqslant 351\,600$	M1, A1
		(2)
		(10 marks)

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(a)

M1: Attempts to use the AP formula in an attempt to find 'd'

Accept an attempt at $7\,500 = 12\,400 + 14d$ resulting in a value for d.

Accept the calculation $\frac{7500 - 12400}{14}$ condoning slips on the 7500 and 12400

M1: A correct attempt, using $12\,400 + 4d$, to find the mass of lithium mined in year 5.

You may award this following an "incorrect" AP formula with $15d$ being used instead of $14d$

Eg $7\,500 = 12\,400 + 15d$ or more likely $\frac{7500 - 12400}{15}$ usually leading to an answer of awrt 11093

A1: Lithium mined in Year 5 is 11 000

(b)

M1: Any correct method to find the sum of the AP .

Look for $\frac{15}{2}\{2\times12400 + 14\times-350\} = ...$ following through on their 'd'

OR $\frac{15}{2}(12400 + 7500) = ...$ using first + last formula

A1: 149 250