Question Number	Scheme	Marks
5. (a)	$u_2 = 1-\frac{1}{4}=\frac{3}{4}, \quad u_3 = 1-\frac{4}{3}=-\frac{1}{3},$	M1 A1
	$u_4 = 1-\left(-\frac{3}{1}\right)=4$ with statement saying the sequence repeats every 3 terms o.e	A1*
		(3)
(b)	$\sum_{n=1}^{180}(5n+3)=\frac{180}{2}(8+903)=(81990)$	M1
	$\sum_{n=1}^{180}(u_n)=60\times\left(4+\frac{3}{4}+-\frac{1}{3}\right)=(265)$	M1
	$\sum_{n=1}^{180}(5n+3+u_n)=81990+265=82255$	A1, A1
		(4)
		(7 marks)

(a)

M1: Attempts to use the iterative sequence correctly at least once.

Most often this is for $u_2 = 1-\frac{1}{4}$ or $u_2 = \frac{3}{4}$ o.e.

Condone omission of the lhs as long as it is obvious. E.g. 4, 0.75

A1: Achieves a correct value for both u_2 and u_3. Condone $u_3 = -0.\dot{3}$

Do not allow $u_3 = -0.33$ unless you see the exact value beforehand.

Allow $(4), \frac{3}{4}, -\frac{1}{3}$ if it is obviously values for both u_2 and u_3.

A1*: This is a show that question and requires

- correct values for u_2 and u_3
- a correct calculation and value seen for u_4 E.g. $u_4 = 1-\left(-\frac{3}{1}\right)=4$
- a minimal reason/statement 'the sequence repeats every 3 terms' o.e such as 'as $u_4 = u_1$,
- a minimal conclusion such as sequence is periodic of order 3' or 'hence true'

(b) **All stages of working must be shown so don't accept just answers as evidence of method**

M1: Establishes a viable method to find $\sum_{n=1}^{180}(5n+3)$ using the fact that it is an AP.

Look for use of $\frac{n}{2}\{a+l\}$ or $\frac{n}{2}\{2a+(n-1)d\}$ o.e. with $n=180, a=3,5 \text{ or } 8$ and $d=5$

Alternatively attempts $\sum_{n=1}^{180}(5n+3)=\sum_{n=1}^{180}5n+\sum_{n=1}^{180}3=5\times\frac{180}{2}\{180+1\}+180\times3$ o.e.

Do not just accept $\sum_{n=1}^{180}(5n+3)=81990$ without sight of an intermediate calculation

This may be awarded from terms within a more complicated expression to complete $\sum_{n=1}^{180}(5n+3+u_n)$

M1: Establishes a viable method to find $\sum_{n=1}^{180}(u_n)$.

For example, as it repeats every 3 terms look for $60\times(4+u_2+u_3)$ o.e such as

$60\times4+60\times u_2+60\times u_3$

Do not accept $\sum_{n=1}^{180}(u_n)=265$ without sight of an intermediate calculation

This may be awarded from terms within a more complicated expression to complete $\sum_{n=1}^{180}(5n+3+u_n)$

A1: Scored for either $\sum_{n=1}^{180}(5n+3)=81990$ or $\sum_{n=1}^{180}(u_n)=265$ following the award of the equivalent M mark

It can be implied, so for instance 82255 following the award of both M's but it is the value, not the calculation that must be seen or implied.

A less obvious award would be for $\sum_{n=1}^{180}(u_n+3)=60\times\left(4+\frac{3}{4}+-\frac{1}{3}+9\right)=805$ which implies the 265

A1: 82255 which must follow the award of M1, M1 and A1

Question Number	Scheme	Marks
6 (i) (a)	Uses $\sin^2\theta+\cos^2\theta=1$ with $\cos\theta=\frac{1}{\sqrt{5}}\Rightarrow\sin^2\theta=\frac{4}{5}$	M1
	$\Rightarrow\sin\theta=-\frac{2}{\sqrt{5}}$	A1
(b)	Uses $\tan\theta=\frac{\sin\theta}{\cos\theta}$ with $\cos\theta=\frac{1}{\sqrt{5}}$ and their $\sin\theta=-\frac{2}{\sqrt{5}}$	M1
	$\Rightarrow\tan\theta=-2$	A1 **(4)**
(ii) (a)	1 (m)	B1 **(1)**
(b)	$30t-40=180\Rightarrow t=7.33$ Hence 7:20 **am**	M1, A1, A1 **(3)**
(c)	$4+3\cos(30T-40)°=3.5\Rightarrow\cos(30T-40)°=-\frac{1}{6}$	M1
	$\Rightarrow 30T-40=99.6, 260.4, \underline{\underline{459.6}}$	A1
	$\Rightarrow T=\frac{"459.6"+40}{30}=16.65$	dM1, A1 **(4)** **(12 marks)**

(i)

Clear use of trigonometric identities must be shown. Answers without method don't score marks

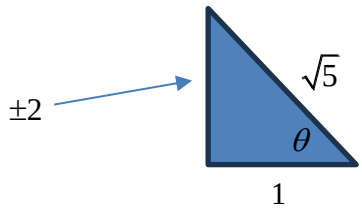
Look for work within the body of the script which may be common

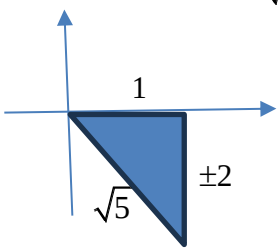
(a)

M1: Uses $\sin^2\theta+\cos^2\theta=1$ with $\cos\theta=\frac{1}{\sqrt{5}}\Rightarrow\sin^2\theta+\frac{1}{5}=1$ o.e.

Alternatively shows a 'triangle' method and uses Pythagoras' theorem to reach $\sin\theta=\pm\frac{2}{\sqrt{5}}$

E.g.





A1: $\sin\theta=-\frac{2}{\sqrt{5}}$ or simplified equivalent such as $-\frac{2\sqrt{5}}{5}$ following the award of the M1. ISW after a correct answer. Note that $\sin\theta=-\sqrt{\frac{4}{5}}$ is A0 as it is not simplified