| Question Number | Scheme | Marks |
|---|---|---|
| **1 (a)** | $54=\frac{9}{2}(2a+8d)$<br>$\Rightarrow a+4d=6$ * | M1<br>A1*<br>**(2)** |
| **(b)** | Correct equation $a+7d=\frac{1}{2}(a+6d)$ | B1 (M1 on EPEN) |
| | Substitutes or eliminate terms $\Rightarrow 6-4d+7d=\frac{1}{2}(6-4d+6d)$<br>$\Rightarrow d=...$ (or $a=...$) | M1 |
| | $d=-1.5$ (o.e.) , $a=12$ | A1, A1<br>**(4)** |
| | | **(6 marks)** |

(a)

M1: Attempts to use e.g. $S_9=\frac{9}{2}(2a+8d)$ or $S_9=\frac{9}{2}(2a+(9-1)d)$ with $S_9=54$

Alternatively uses $S_9=\frac{9}{2}(a+l)$ with $S_9=54$ and $l=a+8d$

or lists terms $a+a+d+...+a+8d=54\Rightarrow 9a+36d=54$ scored when a correct equation is achieved (i.e. without …).

There is no need to see the notation $S_9$

A1*: Proceeds to the given answer via a correct equation as in the main scheme.

There is no need to see any rearranging between this and the given answer.

Just $9a+36d=54\Rightarrow a+4d=6$ scores M0A0*: a valid formula or listing of terms in a sum must be seen.

(b)

B1: Correct equation e.g., $a+7d=\frac{1}{2}(a+6d)$ or $2(a+(8-1)d)=a+(7-1)d$

There is no need to see any notation e.g. $u_8$

Note that the simplified equation is $a+8d=0$

M1: Uses both equations, condoning a slip such as misplacing the $\frac{1}{2}$, e.g., $\frac{1}{2}(a+7d)=a+6d$,

**and** solves simultaneously to find a value for $a$ **or** $d$.

This mark depends on the use of acceptable expressions for $u_7$ and $u_8$.

Don't be concerned with the process of solving their simultaneous equations provided they have two acceptable equations and arrive at a solution for $a$ **or** $d$.

A1: Either $d = -1.5$ o.e. **or** $a = 12$

A1: Both $d = -1.5$ o.e. **and** $a = 12$

Note that solving $u_8 = 2u_7$ (should) lead to $d = -6$ and $a = 30$ and scores B0M1A0A0.

| Question Number | Scheme | Marks |
|---|---|---|
| **2 (a)** | $u_2 = 2-\frac{4}{3}=\frac{2}{3}, \quad u_3 = 2-\frac{4}{"\frac{2}{3}"}=-4, \quad u_4 = 2-\frac{4}{"-4"}=3$ | M1 A1 A1 **(3)** |
| **(b)** | $\{u_{61} =\}\ 3$ | B1 **(1)** |
| **(c)** | $\left\{\sum_{i=1}^{99} u_i =\right\}\ \frac{99}{3}\times\left(3+"\frac{2}{3}"+"-4"\right)$ $=-11$ | M1 A1 **(2)** |
| | | **(6 marks)** |

(a)

M1: Attempts to use the formula correctly using **values** at least once which may be implied by $u_2 = \frac{2}{3}$

or

e.g. by $u_2 = 5, u_3 = \frac{6}{5}$ where their $u_3$ follows from their $u_2$ Not scored for e.g. just $u_2 = 2-\frac{4}{u_1}$

A1: 2 correct answers. Do not allow e.g. 0.66 or 0.66… for $\frac{2}{3}$ but allow $0.\dot{6}$

A1: All 3 correct. If the terms are not labelled, then the order must be clear to score this mark.

(b)

B1: cao. Must be clearly identified as their answer to part (b) or labelled as $u_{61}$

They do not need to show that they have used a period of 3 in their answer, but if they have **clearly** used a period of e.g. 4 in part (b), withhold the mark.

(c)

M1: Uses a valid method. Note that $3+\frac{2}{3}-4=-\frac{1}{3}$ and you might see $99+22-132=-11$

A1: cao. Answer only scores both marks.