Question	Scheme	Marks
6(a)	$u_n = ar^{n-1} \Rightarrow ar + ar^2 = 6$ and $ar^3 = 8$	**M1**
	$\Rightarrow \dfrac{ar + ar^2}{ar^3} = \dfrac{6}{8} \Rightarrow 1 + r = \dfrac{3}{4}r^2$	**M1**
	$\Rightarrow 3r^2 - 4r - 4 = 0$*	**A1***
		(3)
(a) Way 2	$u_4 = 8 \Rightarrow u_3 = \dfrac{8}{r},\ u_2 = \dfrac{8}{r^2}$	**M1**
	$\dfrac{8}{r} + \dfrac{8}{r^2} = 6$	**M1**
	$\Rightarrow 3r^2 - 4r - 4 = 0$*	**A1***
		(3)
(b)	$r = -\dfrac{2}{3}$	**B1**
	$ar^3 = 8 \Rightarrow a = \dfrac{8}{\left(-\dfrac{2}{3}\right)^3} = \ldots$	**M1**
	$u_1 = -27$	**A1ft**
		(3)
(c)	$S_\infty = \dfrac{-27}{1 - \left(-\dfrac{2}{3}\right)} = \ldots$	**M1**
	$= -\dfrac{81}{5}$	**A1**
		(2)
		(8 marks)

Notes:

(a) **<u>Ignore labelling and mark (a), (b) and (c) together</u>**

M1: Uses the correct *n*-th term formula for a GP to set up two equations in *a* and *r*

May also be in terms of u_1 and *r* or u_2 and *r* or u_3 and *r* e.g.

$u_1 r + u_1 r^2 = 6,\ u_1 r^3 = 8$ or $u_2 + u_2 r = 6,\ u_2 r^2 = 8$ or $\dfrac{u_3}{r} + u_3 = 6,\ ru_3 = 8$

Must be using the correct term formula so e.g. $ar^2 + ar^3 = 6$ and $ar^4 = 8$ is M0

Alternatively may use the correct sum formula for the first equation, $a\dfrac{1-r^3}{1-r} - a = 6$ oe.

M1: Attempts to solve their two equations to get an equation in *r*. Look for an attempt to divide the two equations, or an attempt to find *a* in terms of *r* from one and substitute into the other.

Allow slips but the algebra should essentially be correct so do not allow use of e.g. $ar^3 = (ar)^3$

Alternatively, attempts to eliminate r from the equation, $r = \frac{2}{\sqrt[3]{a}} \Rightarrow \frac{2a}{\sqrt[3]{a}} + \frac{4a}{\sqrt[3]{a^2}} = 6$

$\Rightarrow 2a^{\frac{2}{3}} + 4a^{\frac{1}{3}} = 6$. Award when they reach a quadratic in $a^{\frac{1}{3}}$ in this case.

A1*: CSO Note that as we are marking (a), (b) and (c) together, allow the printed answer to appear anywhere as long as it follows correct work but the "=0" must be seen not implied.

Way 2:

M1: Uses $u_4 = 8$ to write u_2 and u_3 in terms of r

M1: Uses $u_2 + u_3 = 6$ to get an equation in r

A1*: CSO

(b)

B1: Correct value of r seen or used in their working even if subsequently rejected and ignore any other value offered e.g. $r = 2$

M1: Uses a value for r from solving the equation given in (a) where $|r|<1$ in one of their equations from (a) to find a value for u_1 or a. Allow slips but the algebra should essentially be correct

A1ft: Correct value and no other values. Follow through on $\frac{8}{(\text{their } r)^3}$ for a value of r with $|r|<1$

(c)

M1: Uses the correct sum formula with their a (u_1) obtained from $|r|<1$ and r where $|r|<1$, to find the sum to infinity.

A1: Correct answer and no other values. Allow equivalents e.g. –16.2

Question	Scheme	Marks
7	$(x+2)$ a factor $\Rightarrow f(-2)=0 \Rightarrow -8A+24+8+B=0$	**M1A1**
	$\int f(x)dx = \frac{A}{4}x^4 + 2x^3 - 2x^2 + Bx$	**M1 A1**
	$\int_3^5 f(x)dx = 176 \Rightarrow \left[\frac{A}{4}x^4 + 2x^3 - 2x^2 + Bx\right]_3^5 = 176$ $\Rightarrow \left(\frac{A}{4}5^4 + 2(5^3) - 2(5^2) + 5B\right) - \left(\frac{A}{4}3^4 + 2(3^3) - 2(3^2) + 3B\right) = 176$	**dM1**
	$\left.\begin{array}{l} 8A - B = 32 \\ 136A + 2B = 12 \end{array}\right\} \Rightarrow A = ..., B = ...$	**dM1**
	$A = \frac{1}{2},\ B = -28$	**A1**
		(7)
		(7 marks)

Notes:

M1: Uses the factor theorem or long division (see below) to find one linear **equation** relating *A* and *B*. The "= 0" must be seen or implied by later work.

A1: Correct equation. Award once a correct equation is seen unsimplified or simplified.

So allow e.g. $A(-2)^3 + 6(-2)^2 - 4(-2) + B = 0$ but not e.g. $A\times -2^3 + 6\times -2^2 - 4\times -2 + B = 0$

unless the indices are processed correctly subsequently to e.g. $-8A + 24 + 8 + B = 0$

The "= 0" must be seen or implied by later work.

M1: Attempts to integrate the given expression, look for at least one power increased by 1.

This can also be evidenced by $B \rightarrow Bx$

A1: Correct integration. Allow unsimplified e.g. $\frac{6x^{2+1}}{2+1}$ for $2x^3$

Condone poor notation e.g. $\int f(x)dx = \int \frac{A}{4}x^4 + 2x^3 - 2x^2 + Bx$ and ignore any "+ *c*"

dM1: Applies limits 5 and 3 either way round and subtracts and equates to 176 to obtain an equation in *A* and *B*. **Depends on <u>previous</u> M.**

Condone poor use of brackets when subtracting e.g. allow

$$\frac{A}{4}5^4 + 2(5^3) - 2(5^2) + 5B - \frac{A}{4}3^4 + 2(3^3) - 2(3^2) + 3B = 176$$

dM1: Solves their two equations in *A* and *B* to find values for both constants.

Depends on <u>all previous</u> M marks <u>but allow this mark if the only error was to attempt f (2) = 0 at the beginning</u>.

A1: Correct values.

Note that some candidates eliminate *A* or *B* by rearranging the first equation and substituting into the integral. This essentially follows the main scheme: