Question	Scheme	Marks
2(a)	$\int kx^{-3} + 4x^{\frac{3}{2}}\,\mathrm{d}x = k\dfrac{x^{-2}}{-2} + 4\dfrac{x^{\frac{5}{2}}}{5/2} \quad (+c)$	**M1 A1**
	$\displaystyle\int_1^4 kx^{-3} + 4x^{\frac{3}{2}}\,\mathrm{d}x = \left[-\frac{k}{2x^2} + \frac{8x^{\frac{5}{2}}}{5}\right]_1^4 = \left(-\frac{k}{2\times 16} + \frac{8(4)^{\frac{5}{2}}}{5}\right) - \left(-\frac{k}{2} + \frac{8}{5}\right)$	**M1**
	$= \dfrac{15k}{32} + \dfrac{248}{5}$	**A1**
		(4)
(b)	$\dfrac{15k}{32} + \dfrac{248}{5} = 50 \Rightarrow k = \ldots$	**M1**
	$k = \dfrac{64}{75}$ o.e.	**A1**
		(2)
		(6 marks)

Notes:

(a)

M1: Raises the power by 1 in **both** terms. Need not be simplified

Accept for example, $\alpha x^{-3+1} + \beta x^{\frac{3}{2}+1}$ for this mark.

A1: Correct integral with or without +*c*. Need not be simplified although indices must be simplified for this mark. Look for $k\dfrac{x^{-2}}{-2} + 4\dfrac{x^{\frac{5}{2}}}{5/2}$ as a minimum.

M1: Substitutes and subtracts either way around into an expression with changed indices.

A1: Correct simplified answer. Accept e.g., $\dfrac{75k + 7936}{160}$

condone e.g., $0.46875k + 49.6$ with no rounded decimals.

(b)

M1: Sets the result of their changed expression from (a) [provided it is a linear expression of least **2 terms** in terms of *k*] equal to 50, and solves to find *k*

A1: Correct answer from a correct equation. Accept equivalent fractions and also accept $0.85\dot{3}$

Question	Scheme	Marks
3(a)	$u_2 = \frac{3}{2}(5) - \frac{1}{2}(5)^2 + 4 = ...(= -1)$	M1
	$u_3 = \frac{3}{2}("-1") - \frac{1}{2}("-1")^2 + 4 = (2),\ u_4 = \frac{3}{2}("2") - \frac{1}{2}("2")^2 + 4 = (5)\ [= u_1]$	M1
	e.g., $(u_4 = u_1)$ (so sequence is periodic) with period 3.	A1
		(3)
(b)	$u_{200} = -1$	B1
		(1)
(c)	$\sum_{r=1}^{200} u_r = (u_1 + u_2 + u_3) + ... + (u_{196} + u_{197} + u_{198}) + [+u_{199} + u_{200}]$	M1
	$= 66 \times (5 - 1 + 2) + 5 - 1$ OR $= 67 \times (5 - 1 + 2) - 2$	M1
	$= 400$	A1
		(3)
		(7 marks)

Notes:

(a)

M1: Substitutes 5 into the equation to find u_2

M1: Continue by using their u_2 to find the next term(s) until a repeat is found.

A1: All terms correct, (concludes periodic) **and** states period is 3

Accept either $u_1 = u_4$ or $(u_1 = 5$ and$)$ $u_4 = 5$ seen in the working with a conclusion

(b)

B1: Correct value coming from a correct sequence.

(c)

M1: Attempts to group the sum into multiples of the **three** term sum. Look for any attempt at using a multiple of the sum of their terms from part (a) e.g $\alpha(5 - 1 + 2)$ where α is an integer.

M1: Splitting the sum correctly to get 66 sets of 3 and the extra terms, or 67 sets of 3 minus one term

A1: For 400