



4.7H Sequences (Nth Term): Higher Tier Practice

EDEXCEL Edexcel 1MA1 · Calculator allowed · about 75 minutes

Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** Work out the 6th term of the arithmetic sequence with nth term $7n - 4$.

(Total for Question 1 is 2 marks)

- 2** The first three terms of a sequence are 3, 8, 15.

(a) Work out the 4th term.

(b) Suggest an nth term formula for this sequence.

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(1)

(b) Suggest an nth term formula for this sequence.

(2)

(Total for Question 2 is 3 marks)

3 The n th term of a sequence is $4n^2 - 2n$.

(a) Work out the 1st and 2nd terms.

(b) Show that the difference between consecutive terms is $8n + 2$ when going from term n to term $n+1$. Give a short explanation.

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(2)

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(2)

(Total for Question 3 is 4 marks)

4 A sequence has n th term given by $T_n = 5n - 3$ for n odd, and $T_n = 5n + 1$ for n even.

(a) Work out T_5 and T_6 .

(b) Explain briefly whether this sequence is arithmetic overall.

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(2)

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(2)

(Total for Question 4 is 4 marks)

5 Find the n th term of the sequence: 11, 18, 25, 32, ...

Give your answer in the form $an + b$.

(Total for Question 5 is 5 marks)

6 A sequence is defined recursively by $U_1 = 6$ and $U_{n+1} = 2U_n + 1$ for $n \geq 1$.

(a) Work out U_2 and U_3 .

(b) Show that $U_n = 7 \cdot 2^{n-1} - 1$ for all $n \geq 1$. You may use proof by induction or an argument that checks the base case and shows the recurrence preserves the form.

(a) Work out U_2 and U_3 . (2)

(b) Show that $U_n = 7 \cdot 2^{n-1} - 1$ for all $n \geq 1$. You may use proof by induction or an argument that checks the base case and shows the recurrence preserves the form. (4)

(Total for Question 6 is 6 marks)

Mark scheme · 4.7H Sequences (Nth Term): Higher Tier Practice

Question 1

- **M1** substitute $n = 6$ into $7n - 4$ or show $7 \times 6 - 4$
- **A1** 38 cao
- **Answer: 38**

Question 2

- (a) **B1** 24 cao
- (a) **Answer: 24**
- (b) **M1** recognise quadratic form with second difference 2 and write $an^2 + bn + c$ with $a = 1$
- (b) **A1** $n^2 + 2n$ cao
- (b) **Answer: $n^2 + 2n$**

Question 3

- (a) **M1** substitute $n = 1$ and $n = 2$ into $4n^2 - 2n$
- (a) **A1** 2 and 12 cao
- (a) **Answer: 1st term = 2, 2nd term = 12**
- (b) **M1** compute $T(n+1) - T(n) = [4(n+1)^2 - 2(n+1)] - [4n^2 - 2n]$
- (b) **A1** $8n + 2$ cao with brief simplification shown
- (b) **Answer: $8n + 2$**

Question 4

- (a) **M1** substitute $n = 5$ and $n = 6$ into correct formula depending on parity
- (a) **A1** 22 and 31 cao
- (a) **Answer: $T_5 = 22, T_6 = 31$**
- (b) **M1** compare differences between consecutive terms and note they are not constant
- (b) **A1** statement: not arithmetic because differences are not constant (example given)
- (b) **Answer: Not arithmetic, because consecutive differences are not constant (they alternate).**

Question 5

- **M1** identify common difference 7 and write general linear form $an + b$
- **M1** state $a = 7$ and substitute $n = 1$ into $a + b = 11$ to find b
- **M1** compute $b = 11 - 7 = 4$
- **A1** $7n + 4$ cao
- **B1** final answer stated clearly
- **Answer: $7n + 4$**

Question 6

- (a) **M1** substitute $U_1 = 6$ into recurrence to get U_2 , then substitute U_2 to get U_3
- (a) **A1** 13 and 27 cao
- (a) **Answer: $U_2 = 13, U_3 = 27$**
- (b) **M1** base case: verify $n=1$ gives $U_1 = 7 \cdot 2^{\{0\}} - 1 = 7 - 1 = 6$
- (b) **M1** assume for some k that $U_k = 7 \cdot 2^{\{k-1\}} - 1$ (induction hypothesis)
- (b) **M1** use recurrence: $U_{\{k+1\}} = 2U_k + 1$ and substitute hypothesis to get $2(7 \cdot 2^{\{k-1\}} - 1) + 1 = 7 \cdot 2^{\{k\}} - 1$
- (b) **A1** conclude $U_{\{k+1\}}$ has the required form so formula holds for all $n \geq 1$
- (b) **Answer: $7 \cdot 2^{\{n-1\}} - 1$**