



eClassroom

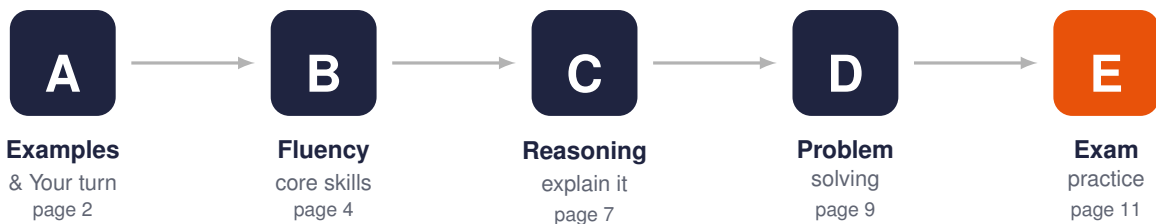
GCSE MATHEMATICS • ALGEBRA

Sequences

Worksheet

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • Calculator allowed

Free Sequences worksheet for GCSE and iGCSE Maths, with full worked solutions



Tap a section to jump straight to it

By the end of this worksheet you can: continue sequences and use term-to-term rules • find and use the n th term of a linear sequence • decide whether a number is in a sequence • work with geometric and Fibonacci-type sequences and patterns • *Higher:* quadratic n th terms and geometric sequences with surds.

Which questions are for me?

FOUNDATION Everyone starts here. These skills appear on both tiers.

HIGHER Higher only: quadratic n th terms and geometric sequences with surds, plus harder reasoning with sequences. Grades 6 to 9.

Every section has both, clearly labelled. Questions get harder as you go, and every skill in Sections A to D is needed in Section E.

Track your progress

Section	B	C	D	E
Foundation marks	23	10	13	16
Higher marks	16	14	17	15
My score				

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A**Worked examples & Your turn**

Read each example carefully. Cover it up, then answer the question beside it using the same method.

FOUNDATION*Everyone starts here***Worked example A1**

Find the n th term of 7, 10, 13, 16, ...

The terms go up by 3, so start with $3n$. $3n$ gives 3, 6, 9, ...: add 4

$$3n + 4$$

Your turn A1

Find the n th term of 11, 9, 7, 5, ...

Worked example A2

Is 100 a term of the sequence with n th term $6n - 2$?

Solve $6n - 2 = 100$. A term must have a whole-number position.

$$6n = 102, \text{ so } n = 17$$

yes, the 17th term

Your turn A2

Is 60 a term of the sequence with n th term $7n + 5$?

Worked example A3

3, 6, 12, 24, ... Find the next two terms and the 10th term.

Multiply by 2 each time. The 10th term is 3×2^9

48, 96; 1536

Your turn A3

80, 40, 20, 10, ... Find the next two terms and the 8th term.



HIGHER*Higher only: quadratic sequences and surds***Worked example A4: a quadratic n th term**Find the n th term of 3, 9, 19, 33, 51, ...*First differences 6, 10, 14, 18. Second difference 4, so start with $2n^2$* Sequence $-2n^2$: 1, 1, 1, ...

$$2n^2 + 1$$

Your turn A4Find the n th term of 2, 7, 14, 23, 34, ...**Worked example A5: geometric with surds**3, $3\sqrt{3}$, 9, $9\sqrt{3}$, ... Find the 7th term.*Multiply by $\sqrt{3}$ each time. The 7th term is $3 \times (\sqrt{3})^6$*

$$(\sqrt{3})^6 = 27$$

$$81$$

Your turn A55, $5\sqrt{2}$, 10, $10\sqrt{2}$, ... Find the 9th term.**Worked example A6: Fibonacci-type with algebra**Each term is the sum of the two before. The first two terms are a and b . The 3rd term is 7 and the 5th term is 19. Find a and b .*Terms: $a, b, a+b, a+2b, 2a+3b$*

$$a + b = 7 \text{ and } 2a + 3b = 19$$

$$a = 2, b = 5$$

Your turn A6Each term is the sum of the two before. The first two terms are a and b . The 4th term is 11 and the 6th term is 29. Find a and b .**Worked example A7: the first term past a value**Find the first term of $5n+2$ that is greater than 100

$$5n+2 > 100 \text{ gives } n > 19.6, \text{ so } n = 20$$

$$5 \times 20 + 2$$

$$102$$

Your turn A7Find the first negative term of the sequence with n th term $80 - 3n$ 

B**Fluency**

Each question is a designed sequence. From one part to the next, ask yourself: what changed, and what did it do to the answer?

FOUNDATION*Everyone starts here*

B1 Write down the next term of each sequence.

(a) 4, 9, 14, ...

(b) 30, 26, 22, ...

(c) 1, 3, 9, ...

(d) 1, 1, 2, 3, 5, ...

[4 marks]

B2 A sequence has n th term $3n + 2$

(a) Find the first term.

(b) Find the 10th term.

(c) Find the 100th term.

(d) Which term is 62?

[4 marks]

B3 Find the n th term of each sequence.

(a) 5, 8, 11, ...

(b) 5, 10, 15, ...

(c) $-3, 1, 5, \dots$

(d) 20, 17, 14, ...

[4 marks]

B4 A sequence has n th term $4n - 1$. Is each number a term? If it is, which term is it?

(a) 39

(b) 50

(c) 99

(d) 200

[4 marks]



FOUNDATION*continued: geometric sequences and patterns*

B5 2, 10, 50, ... is a geometric sequence.

- (a) Find the next term. (b) Find the common ratio. (c) Find the 6th term.

[3 marks]

B6 Here are the first three patterns in a sequence made of matchsticks.



- (a) How many matchsticks are in Pattern 4?
(b) Find an expression for the number of matchsticks in Pattern n .
(c) How many matchsticks are in Pattern 20?
(d) Could a pattern use exactly 150 matchsticks? Explain.

[4 marks]

HIGHER*Higher tier only*

B7 Find the n th term of each sequence.

- (a) 2, 5, 10, 17, ... (b) 3, 12, 27, 48, ...
(c) 0, 3, 8, 15, ... (d) 4, 10, 18, 28, ...

[4 marks]

B8 Find the n th term of each sequence.

- (a) 6, 15, 28, 45, ... (b) 10, 16, 20, 22, ...
(c) 7, 13, 23, 37, ... (d) 3, 5, 9, 15, ...

[4 marks]



HIGHER*continued: geometric sequences and inequalities***B9** Find the stated term of each geometric sequence.**(a)** $1, \sqrt{2}, 2, 2\sqrt{2}, \dots$ 8th term**(b)** $27, 9, 3, 1, \dots$ 6th term**(c)** $2, -6, 18, \dots$ 5th term**(d)** $\sqrt{3}, 3, 3\sqrt{3}, \dots$ 6th term**[4 marks]****B10 (a)** Find the first term of $4n + 3$ that is greater than 50**(b)** Find the first negative term of $100 - 7n$ **(c)** Find the first term of $2n^2 + 1$ that is greater than 100**(d)** Find the first term of 3×2^n that is greater than 1000**[4 marks]**

C**Reasoning**

Show your working and explain your thinking. A correct answer without a reason does not score full marks.

FOUNDATION

Everyone starts here

- C1** Tom says, "The n th term of 5, 8, 11, ... is $n + 3$ "
Explain Tom's mistake, and write the correct n th term. [2 marks]
- C2** Is the sequence 1, 4, 9, 16, ... an arithmetic sequence? Explain your answer. [2 marks]
- C3** Kim says, "Every term of $4n + 2$ is even, and every term of $4n + 3$ is odd."
Explain why Kim is right. [3 marks]
- C4** A sequence has n th term $3n - 5$
(a) Show that the 20th term is 55 (b) Explain why no term of this sequence is a multiple of 3 [3 marks]



HIGHER*Higher tier only*

- C5** Jo says, "The second difference of 2, 6, 12, 20, ... is 2, so the n th term is $2n^2$ "
Explain Jo's mistake, and find the correct n th term. [3 marks]
- C6** A sequence starts 5, 10, 20, 40, ...
Is 1000 a term of this sequence? Explain your answer. [3 marks]
- C7** A sequence has n th term $n^2 + n$
Show that the difference between any two consecutive terms is always even. [3 marks]
- C8** Sequence A has n th term $3n + 2$. Sequence B has n th term $5n - 1$
(a) Find the three smallest numbers that are in both sequences.
(b) Find an expression for the k th number that is in both sequences.
(c) How many numbers less than 100 are in both sequences? [5 marks]



D**Problem solving**

You decide the method. Read the whole question first, and show every step.

FOUNDATION

Everyone starts here

- D1** Ali saves £20 in week 1. Each week he saves £5 more than the week before.

In which week does he first save more than £100 in a single week?

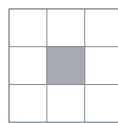
[3 marks]

- D2** Sequence P has n th term $6n + 1$. Sequence Q has n th term $50 - n$

For which value of n are the n th terms of the two sequences equal? What is that term?

[4 marks]

- D3** Here are the first three patterns made of grey and white tiles.



Pattern 1



Pattern 2



Pattern 3

Which pattern has exactly 50 white tiles?

[3 marks]

- D4** The first two terms of a Fibonacci-type sequence are 2 and x . The fifth term is 25

Find x .

[3 marks]



HIGHER*Higher tier only*

- D5** Patterns of dots contain 3, 8, 15, 24, ... dots.
(a) Find the number of dots in Pattern 10 (b) Which pattern has 399 dots? [4 marks]
- D6** A ball is dropped from 2 m. After each bounce it rises to $\frac{3}{4}$ of its previous height.
After which bounce does it first rise to less than 0.5 m? [4 marks]
- D7** The 5th term of an arithmetic sequence is 23 and the 12th term is 51
Find the n th term. [4 marks]
- D8** The n th term of a quadratic sequence is $n^2 + bn + c$. The 2nd term is 10 and the 5th term is 40
(a) Find b and c . (b) Show that every term of the sequence is even. [5 marks]



**Exam practice**

Exam-style questions. Write your answers in the spaces. Aim for about one minute per mark.

FOUNDATION*Foundation and Higher crossover*

E1 Here are the first four terms of a sequence. 5 9 13 17

(a) Write down the next term.

.....
(1)

(b) Find an expression for the n th term.

.....
(2)

(Total for Question E1 is 3 marks)

E2 Is 150 a term of the sequence with n th term $4n + 1$? You must explain your answer.

(Total for Question E2 is 2 marks)



E3 Here are the first three patterns in a sequence made of matchsticks.



Pattern 1



Pattern 2



Pattern 3

(a) How many matchsticks are in Pattern 10?

.....

(1)

(b) Find an expression for the number of matchsticks in Pattern n .

.....

(1)

(c) Which pattern uses 100 matchsticks?

.....

(1)

(Total for Question E3 is 3 marks)

E4 In a Fibonacci-type sequence, each term is the sum of the two terms before it.

(a) Write down the next two terms of 3, 4, 7, 11, ...

.....

(1)

(b) The first two terms of another sequence are a and b . Find the 5th term in terms of a and b .

.....

(1)

(Total for Question E4 is 2 marks)



E5 Here is a geometric sequence. 2 6 18 54

(a) Write down the next term.

.....
(1)

(b) Write down the rule for continuing the sequence.

.....
(1)

(c) Find the 8th term.

.....
(1)

(Total for Question E5 is 3 marks)

E6 A sequence has n th term $20 - 3n$

(a) Write down the first three terms.

.....
(1)

(b) Find the first negative term of the sequence.

.....
(2)

(Total for Question E6 is 3 marks)

HIGHER

Higher tier only

E7 Here are the first five terms of a quadratic sequence. 4 9 18 31 48

Find an expression for the n th term.

.....
(Total for Question E7 is 4 marks)



- E8** Here is a geometric sequence. $\sqrt{2}$ 2 $2\sqrt{2}$ 4
Find the 10th term of the sequence.

.....
(Total for Question E8 is 3 marks)

- E9** A sequence has n th term $\frac{n+1}{2n+1}$
Find the first term of the sequence that is less than 0.52

.....
(Total for Question E9 is 3 marks)

- E10** The first three terms of a quadratic sequence are 5, 11, 21
(a) Find an expression for the n th term.

.....
(3)

- (b) Explain why every term of the sequence is odd.

(1)

- (c) Which term of the sequence is 101?

.....
(1)

(Total for Question E10 is 5 marks)

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