

Quadratic Sequences

GCSE Maths · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

Find the n th term of 3, 8, 15, 24, ...

Step 1 · Differences

5, 7, 9 → second differences 2, 2

Step 2 · $a = 2 \div 2 = 1$

Start with n^2 : 1, 4, 9, 16

Step 3 · Sequence – n^2

2, 4, 6, 8 → $2n$

Answer: $n^2 + 2n$

Check: $n = 4$: $16 + 8 = 24$ ✓

2. Now try one with the steps

Find the n th term of 2, 9, 20, 35, 54, ...

Step 1 · Differences

Step 2 · $a = 4 \div 2 = 2$

Step 3 · Sequence – $2n^2$

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. Write down the next two terms of 2, 5, 10, 17, ... [1]

2. Find the second difference of 1, 6, 15, 28, 45, ... [1]

3. Find the n th term of 2, 5, 10, 17, 26, ... [2]

4. Find the n th term of 0, 3, 8, 15, 24, ... [2]

5. Find the n th term of 4, 7, 12, 19, 28, ... [2]

6. Find the n th term of 2, 6, 12, 20, 30, ... [3]

7. Find the n th term of 5, 12, 21, 32, 45, ... [3]

8. Find the n th term of 3, 10, 21, 36, 55, ... [3]

9. Find the n th term of 1, 7, 17, 31, 49, ... [3]

10. Find the n th term of 0, 2, 6, 12, 20, ... [3]

11. Find the n th term of 10, 14, 20, 28, 38, ... [3]

12. Find the n th term of 20, 17, 12, 5, -4 , ... [3]

13. Find the 10th term of the sequence with n th term $n^2 + 3n - 2$. [1]

14. The n th term of a sequence is $n^2 + 4n$. Which term is equal to 140? [3]

15. Explain why 200 is not a term of the sequence with n th term $n^2 + 1$. [2]

4. Before you hand it in

Second difference 4 $\rightarrow$ n th term starts $4n^2$

The second difference of an^2 is $2a$, so $a = \text{second difference} \div 2$. Second difference 4 $\rightarrow 2n^2$.

Subtracting n^2 from the first differences

Subtract an^2 from the TERMS of the sequence, position by position (1st term $- a$, 2nd $- 4a$, 3rd $- 9a$...).

Treating 3, 8, 15, 24 with n th term $5n - 2$

The differences are 5, 7, 9 — not constant. Check the second differences before choosing a method.

$$n^2 + 4n = 140 \rightarrow n = 140 \div 5 = 28$$

Rearrange to $n^2 + 4n - 140 = 0$ and factorise: $n = 10$.