Name	Date started	Target end date

WJEC GCSE Mathematics and Numeracy (Double Award) — Question Pack

Recognising quadratic sequences from their constant second difference and finding the nth term in the form $an^2 + bn + c$. Includes generating term

REVISE
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3.06 — Quadratic sequences & nth term

Spec 2.3.5 — Unit 2 (no calculator)

Recognising quadratic sequences from their constant second difference and finding the nth term in the form $an^2 + bn + c$. Includes generating terms from a given quadratic nth term and using the formula to find arbitrary terms. Sourced from legacy WJEC GCSE Mathematics Higher calculator-allowed papers, organised for revision under the 2025 spec.

2025 SPECIFICATION

Estimated time for entire question pack: ~22 minutes

*Derived from the GCSE Higher pace of **~1.5 min/mark** (15 marks across 7 questions).*

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **focused single-topic practice pack**, not a single mock paper. Questions are organised against the 2025 specification. Questions are ordered chronologically by sitting, with custom-written and SAM questions at the end.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working — method marks are awarded for clear setup.

*A calculator is **not** permitted on any question in this pack (Unit 2 is the non-calculator paper).*

Quadratic sequences & nth term — what the new spec asks

WJEC GCSE Mathematics (first teaching 2025) · Unit 2: non-calculator.

Identifying quadratic sequences 2.3.5

- Compute first then second differences.
- Constant second difference ⇒ quadratic, with leading coeff $a = \frac{\text{2nd diff}}{2}$.
- Otherwise the sequence is not quadratic in n.

Finding $an^2 + bn + c$ 2.3.5

- Set $a = \frac{\text{2nd diff}}{2}$.
- Subtract an^2 from each term to leave a linear sequence.
- Find b from the common difference of the residual, then c from $n = 1$.

Generating terms 2.3.5

- Substitute $n = 1, 2, 3, \ldots$ into the given nth term.
- Mind signs when the formula involves $-c$ or $-n$.
- Check at least one term against the printed sequence.

Diagram & pattern problems 2.3.5

- Translate a diagram pattern to its count sequence first.
- Use the standard a, b, c method on the counts.
- Recognise classics: triangular ($\frac{n(n+1)}{2}$), square (n^2).

Crib sheet »

Quadratic sequences & nth term in one page

Quick-reference notes — revisit before each question. Don't use during the questions.

Spotting a quadratic sequence

First differences *change*; second differences are *constant*.

If the second difference is non-zero and constant, the sequence is quadratic — nth term has the form $an^2 + bn + c$.

Finding a

$\text{second difference} = 2a$, so $a = \frac{\text{2nd diff}}{2}$.

Example: 2nd diff $= 4 \Rightarrow a = 2$, so nth term starts with $2n^2$.

Finding b and c

Subtract an^2 from each term of the original sequence.

You're left with a linear sequence whose nth term is $bn + c$.

Use the linear method (common diff $= b$, then back-solve for c).

Worked example

Sequence $3, 9, 19, 33, 51, \ldots$

1st diffs: $6, 10, 14, 18$. 2nd diffs: $4, 4, 4 \Rightarrow a = 2$.

Subtract $2n^2$: $3 - 2, 9 - 8, 19 - 18, 33 - 32, \ldots = 1, 1, 1, 1, \ldots$

So $bn + c = 1$, i.e. $b = 0, c = 1$. nth term $= 2n^2 + 1$.

Generating terms from nth term

If nth term $= n^2 + 7$, substitute $n = 1, 2, 3, \ldots$ to list terms.

$n = 1 : 8$; $n = 2 : 11$; $n = 3 : 16$; $n = 4 : 23$.

Calculator-allowed — just be careful with signs for terms like $n^2 - 5$.

Finding specific terms

For nth term $= 2n^2 + 1$, the 100th term is $2(100)^2 + 1 = 20001$.

Substitute the required n directly — no need to list every prior term.

Diagrammatic / pattern questions

Some questions give a sequence of diagrams (dots, tiles, triangles) and ask for the count in the nth.

Tabulate the counts, take differences, and apply the same method.

Triangular numbers $1, 3, 6, 10, \ldots$: nth term $= \frac{n(n+1)}{2}$.

Common traps

- Halving the 2nd difference incorrectly (it's divided by 2, not just 'the 2nd difference').
- Subtracting an^2 from the wrong term position.
- Confusing first & second differences when the first happen to be constant (that's linear, not quadratic).
- Skipping the $bn + c$ step when $b = 0$ — still state c.

Examiner only

2. The nth term of a sequence is given by $n^2 + 7$.

Write down the first three terms of this sequence. [2]

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.....

1st term = ... 2nd term = ... 3rd term = ...

3. Circle the correct answer for each of the following.

(a) $x^3 \times x^6 =$ [1]

x^{36} $x^{0.5}$ x^2 x^9 x^{18}

.....

(b) $(7x - 5y) - (3x + 2y) =$ [1]

$4x - 3y$ $4x - 7y$ $4x + 3y$ $-4x + 7y$ $-4x - 7y$

.....

.....

(c) A car travels x miles in 30 minutes.
Its average speed in miles per hour is [1]

$\frac{x}{2}$ $\frac{x}{30}$ $2x$ $\frac{2}{x}$ $30x$

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Examiner only

6. *(a)* Rearrange the following formula to make x the subject.
Give your answer in its simplest form. [3]

$$2(x + y) = 7y - 3$$

(b) Write down the nth term of the following sequence. [2]

3, 6, 11, 18, 27, …

Examiner only

3. *(a)* Write down the first three terms of the sequence whose nth term is given by $n^2 - 6$. [2]

1st term = ... 2nd term = ... 3rd term = ...

(b) Write down an expression for the nth term of the following sequence. [2]

5, 11, 17, 23, …

Examiner only

1. *(a)* Write an expression for the nth term of the following sequence. [2]

2 7 12 17 .....

.....

.....

nth term = ...

(b) The first four diagrams in a sequence are shown below.

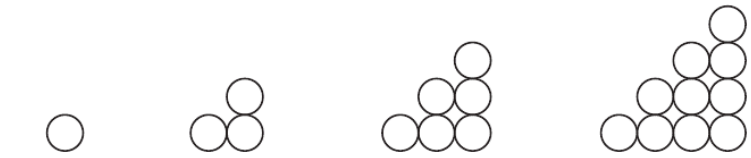

Diagram 1 Diagram 2 Diagram 3 Diagram 4

Complete the following subtraction. [1]

Number of circles in Diagram 17	–	Number of circles in Diagram 16	=	

(c) The first three diagrams in another sequence are shown below.

Diagram 1 Diagram 2 Diagram 3

Give an expression, in terms of n, for the number of dots (●) in Diagram n.
You must simplify your expression. [2]

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Examiner only

15. The first four terms of a sequence are

3, 9, 19, 33, ...

Find the 100th term of the sequence. [3]

Examiner only

3. (a) Write down an expression for the nth term of the following sequence. [2]

11, 15, 19, 23, ...

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(b) The nth term of a different sequence is given by $n^2 - 5$.
Write down the first three terms of this sequence. [2]

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First three terms are ....., ..., ...

Examiner only

16. The first four terms of a sequence are

2, 11, 26, 47, ...

Find the nth term of the sequence.
Hence, find the 250th term. [3]

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nth term = ...

250th term = ...