Continue Linear Sequences

7, 11, 15, 19…

How do I know this is a linear sequence?
It increases by adding 4 to each term

How many terms do I need to make this conclusion?
At least 4 terms – two terms only shows one difference not if this difference is constant (a common difference)

How do I continue the sequence?
You continue to repeat the same difference through the next positions in the sequence

Predict and check terms

3 5 7

+2 +2

CHECK – draw the next terms

9 11 13

Predictions:
Look at your pattern and consider how it will increase.

eg How many lines in pattern 6?

Prediction - 13

If it is increasing by 2 each time - in 3 more patterns there will be 6 more lines

Sequences from algebraic rules

This is substitution!

$3n + 7$

This will be linear - note the single power of n. The values increase at a constant rate

$3n^2 + 7$

This is not linear as there is a power for n

$2n - 5$ →

Substitute the number of the term you are looking for in place of 'n'

eg
1^{st} term = 2 (1) – 5 = -3
2^{nd} term = 2 (2) – 5 = -1
100^{th} term = 2 (100) – 5 = 195

Checking for a term in a sequence

Form an equation

Is 201 in the sequence 3n – 4?

Algebraic rule

$3n - 4 = 201$

Term to check

Solving this will find the position of the term in the sequence.
ONLY an integer solution can be in the sequence.

Complex algebraic rules

Misconceptions and comparisons

$2n^2$

2 times whatever n squared is

eg
1^{st} term = $2 \times 1^2 = 2$
2^{st} term = $2 \times 2^2 = 8$
100^{th} term = $2 \times 100^2 = 2000$

$(2n)^2$

2 times n then square the answer

eg
1^{st} term = $(2 \times 1)^2 = 4$
2^{st} term = $(2 \times 2)^2 = 16$
100^{th} term = $(2 \times 100)^2 = 40000$

$n(n + 5)$ ←

eg
1^{st} term = $1(1 + 5) = 6$
2^{st} term = $2(2 + 5) = 14$
100^{th} term = $100(100 + 5) = 10500$

You don't need to expand the expression

Explain term-to-term rule

How you get from term to term

Try to explain this in full sentences not just with mathematical notation
Use key maths language – doubles, halves, multiply by two, add four to the previous term etc.

To explain a whole sequence you need to include a term to begin at…

The next term is found by tripling the previous term. The sequence begins at 4.

4, 12, 36, 108…

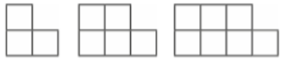
x3 x3 x3

First term

Sequence in a table and graphically

Position: the place in the sequence

1 2 3



3 5 7

Term: the number or variable
(the number of squares in each image)

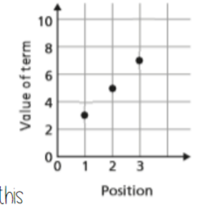
"The term in position 3 has 7 squares"

In a table

Position	1	2	3
Term	3	5	7

+2 +2

Graphically



Because the terms increase by the same addition each time this is **linear** – as seen in the graph

Describe and continue a sequence diagrammatically

Count the number of circles or lines in each image

1 3 5

+2 +2

What will the next number be? Can you draw this?

Finding the algebraic rule

This is the 4 times table → 4, 8, 12, 16, 20…

4n

7, 11, 15, 19, 22 ← This has the same constant difference – but is 3 more than the original sequence

$4n + 3$

$4n + 3$

This is the constant difference between the terms in the sequence

This is the comparison (difference) between the original and new sequence

Quadratic Nth term

Find the nth term of the following quadratic sequence:

2, 11, 26, 47, 74, …

9 15 21 27

6 6 6

	2	11	26	47	74
$3n^2$	3	12	27	48	75
	-1	-1	-1	-1	-1

Answer: $3n^2 - 1$

Steps for success

1. Find the first difference
2. Find the second difference
3. Half the second difference and put it in front of n^2
4. Find the sequence of this
5. Subtract the new sequence from the original sequence
6. Find the nth term of the new sequence
7. Put all the components together

Find the nth term of the following quadratic sequence:

5, 12, 25, 44, …

7 13 19

6 6

	5	12	25
$3n^2$	3	12	27
	2	0	-2

nth term $-2n+4$

Answer: $3n^2 - 2n + 4$