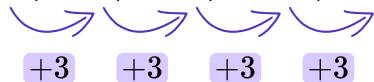


Sequences

A **sequence** is a set of numbers or algebraic terms that follow a particular pattern or rule to get from one term to the next.

Examples

2, 5, 8, 11, 14, ...

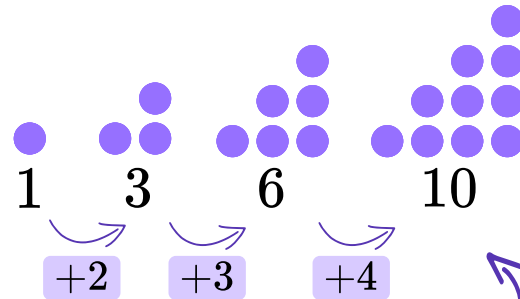


This is an **arithmetic** sequence - to get from one term to the next, you add

3, 6, 12, 24, 48, ...



This is a **geometric** sequence - to get from one term to the next, you multiply



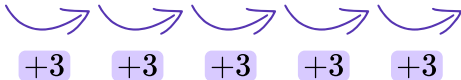
This is a special sequence called the **triangular numbers**.

Arithmetic Sequences

Arithmetic sequences are ordered sets of numbers that have a **common difference** between each consecutive term.

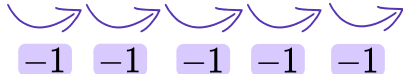
If we **add** or **subtract** the same number each time to make the sequence, it is an **arithmetic sequence**.

 Example

$$4, 7, 10, 13, 16, \dots$$


$+3 \quad +3 \quad +3 \quad +3 \quad +3$

 Example

$$5, 4, 3, 2, 1, \dots$$


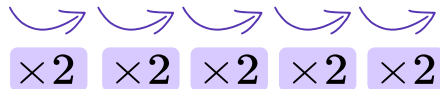
$-1 \quad -1 \quad -1 \quad -1 \quad -1$

Geometric Sequences

Geometric sequences (geometric progressions) are ordered sets of numbers that progress by **multiplying or dividing** each term by the same amount each time - this amount is called a **common ratio**.

 Example

1, 2, 4, 8, 16, ...



 Example

20, 10, 5, 2.5, 1.25, ...



Nth Term of a Sequence

The ***nth* term** of a sequence enables us to find any term in a sequence. We can calculate it by using the common difference to create a sequence, and then adding or subtracting to make the original sequence.

 **Example** Find the *nth* term of 5, 9, 13, 17, 21, ...

$$\begin{array}{ccccccccc} 5, & 9, & 13, & 17, & 21, & \dots \\ \uparrow & \uparrow & \uparrow & \uparrow & \uparrow & \\ +4 & +4 & +4 & +4 & +4 & \end{array}$$

$4n$	4, 8, 12, 16, 20
$4n + 1$	5, 9, 13, 17, 21

The *nth* term of this sequence is $4n + 1$.

Quadratic Sequences

Quadratic sequences are ordered sets of numbers that follow a rule based on the sequence $n^2 = 1, 4, 9, 16, 25, \dots$ (the **square numbers**).

 **Example**

4, 7, 12, 19, 28

+3 +5 +7 +9

+2 +2 +2

The first differences are not equal.
The **second differences** for this sequence are **equal** - we are adding 2 each time.

second difference $\div 2$

This sequence is the square numbers with 3 added to each term, so its n th term rule is $n^2 + 3$

$$1n^2 = 1, 4, 9, 16, 25, \dots$$

$\downarrow +3$

$$n^2 + 3 = 4, 7, 12, 19, 28, \dots$$