

Topic 2: Patterns/Sequences

1) Arithmetic Sequences/Series:

a) Linear Sequences:

- A list of numbers where the **difference** between **each term** is the **same** every time.
E.g. 3, 8, 13, 18,
- The **general term of a sequence** (T_n) is a formula that can be used to find the value of any term of the sequence.

$$T_n = (\text{Common Difference})n + (\text{Term } 0)$$

Example: Find the general term for the sequence 4, 9, 14, 19.....

Common Difference = +5



Term 0 will be 5 below the first term \Rightarrow Term 0 is -1
 \Rightarrow General Term: $T_n = 5n - 1$

- Once we have the General Term, we can find ANY term in the sequence.

E.g. What is 50th term?

$$T_{50} = 5(50) - 2$$

$$= 248$$

- The general term also allows us to work back and find what term number a value would be.

E.g. What term would 458 be?

$$T_n = 458$$

$$5n - 2 = 458$$

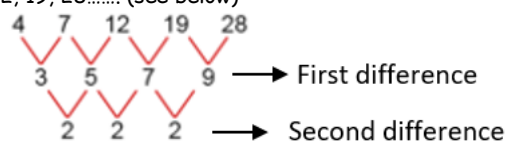
$$5n = 458 + 2$$

$$5n = 460$$

$$n = 92 \quad \Rightarrow \text{92nd term}$$

b) Quadratic Sequences:

- A sequence where the **second difference** is the **same** every time.
E.g. 4, 7, 12, 19, 28..... (see below)



Steps to find General Term:

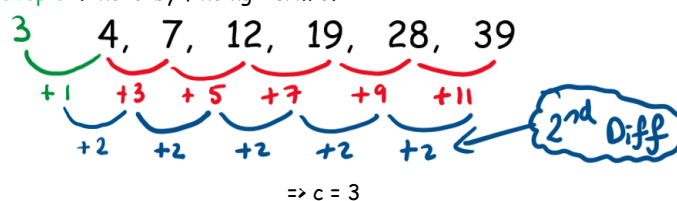
- Let the General Term $T_n = an^2 + bn + c$.
- The second difference represents $2a$, so halving the second difference gave us a value for ain the sequence above, the second difference is $+2$, so $'a'$ would be 1.
- Find $'c'$ by finding Term 0.
- Use any of the terms to find $'b'$.

Example: Find the General Term of the sequence 4, 7, 12, 19, 28

Step 1: Let the General Term $T_n = an^2 + bn + c$.

Step 2: The second difference represents $2a$, so halving the second difference gives us a value for $'a'$in the sequence above, the second difference is $+2$, so $'a'$ would be 1.

Step 3: Find $'c'$ by finding Term 0.



Step 4: Use any of the terms to find $'b'$.

$$T_n = n^2 + bn + 3 \text{ and } T_1 = 4$$

$$\Rightarrow T_1 = (1)^2 + b(1) + 3 = 4$$

$$\Rightarrow b = 0$$

$$\Rightarrow T_n = n^2 + 0n + 3$$

$$\Rightarrow T_n = n^2 + 3$$

c) Exponential Sequences:

- A sequence where each term is found by **multiplying** the previous term by the same number every time.
E.g. 2, 6, 18, 54, 162.....

