SOUENCE AND SERIES

WHAT IS A PROGRESSION?

A progression is a list of things (usually numbers) that are in order.



TYPE OF PROGRESSION

Arithmetic **Progression**

Geometric progression

Harmonic Progression **Arithmetico** Geometric progression

Miscellaneous **Progression**

Arithmetic Progression

Definition 🚭

A pattern of numbers that increases or decreases by a constant number. E.g. 4, 7, 10, 13.....

General Progression

General form of an arithmetic progression is given as a, a+d, a+2d..., a+(n-1)d

Where: a - First term : d - Common difference

nth term

General term of an arithmetic progression is given as

$$T_n = a + (n-1)d$$

Sum of 'n' terms 💩

If 'n' terms a,a+d,a+2d...,a+(n-1)d are in arithmetic progression Then the sum of 'n' terms:

$$S_n = \frac{n}{2} \left[2a + (n-1)d \right]$$

Airthmetic Mean 🥌

If a₁, a₂,...,a_n are in arithmetic progression then the Arithmetic Mean (AM) is:

$$A_m = \frac{a_1 + a_2 + \dots + a_n}{n}$$
 or $= \frac{S_n}{n}$

If A1, A2....An are 'n' arithmetic means between two numbers 'a' and 'b' then a, A1, A2....An, b are in AP.

$$d = \frac{b - a}{n + 1}$$

Where common diffrence
$$d = \frac{b-a}{n+1}$$
 and arithmetic means are $A_i = a+i\frac{b-a}{n+1}$

Geometric Progression



Definition 6

The progression, where the ratio of successive terms of a progression is constant E.g. 4, 8, 16, 32, 64, here the common ratio is 2.

General Progression

General form of a geometric progression is given as a, ar, ar²,.... arⁿ⁻¹

Where: a - First term r - Common ratio

nth term 👑

General term of a geometric progression is given as



$$T_n = a \cdot r^{(n-1)}$$

Sum of 'n' terms 🚭

If 'n' terms a, ar, ar²,.... arⁿ⁻¹ are in geometric progression then the sum of 'n' terms:

$$S_n = \frac{a(r^n-1)}{r-1}; r \neq 1$$

Geometric Mean

If a1, a2, ..., an are in geometric progression then the geometric mean (GM) is:

$$G_m = (a_1 \cdot a_2 \cdot a_3 \dots a_n)^{1/n}$$

If G₁, G₂....G_n are 'n' geometric means between two numbers 'a' and 'b' then a, G1, G2.....Gn, b are in G.P.

Where common ratio
$$r = \left(\frac{b}{a}\right)^{\frac{1}{n+1}}$$
 and geometric means are

$$G_i = a \left(\frac{b}{a}\right)^{\frac{i}{n+1}}$$

Arithmetico Geometric Progression

Definition de

The result of the multiplication of a geometric progression with the corresponding terms of an arithmetic progression

General Progression

a, (a+d)r, (a+2d)r2, (a+3d)r3... Where:

a - First term r - Common ratio of GP d - Common difference of AP

nth Term 🛑

General term of a arithmetico geometric progression is

$$T_n = [a+(n-1)d]r^{(n-1)}$$

Sum of 'n' Terms

a, (a+d)r, $(a+2d)r^2$,..... are in AGP then sum of the terms is:

If |r| < 1 and 'n' tends to infinity then sum of infinite terms is:

$$S_n = \frac{a}{1-r} + \frac{rd(1-r^{n-1})}{(1-r)^2} - \frac{[a+(n-1)d]r^n}{1-r}$$

$$\lim_{n \to \infty} S_n = \frac{a}{(1 - r)} + \frac{rd}{(1 - r)^2}$$

HARMONIC PROGRESSION & MISC.

WHAT IS A PROGRESSION?

A Progression is a list of things (usually numbers) that are in order.

Example:

2 4 8...... Dots Denote
Infinite Progression
term

TYPE OF PROGRESSION

Arithmetic Progression Geometric progression

Harmonic Progression Arithmetico Geometric progression

Miscellaneous Progression

HARMONIC PROGRESSION

- It is a sequence in which the reciprocal of the terms are in Arithmetic Progression.
- If a, a + d, a + 2d, in Arithmetic Progression.

then $\frac{1}{a}$, $\frac{1}{a+d}$, $\frac{1}{a+2d}$, in Harmonic Progression.

- \rightarrow nth term of the Harmonic term is $T_n = \frac{1}{a + (n-1)d}$
- Sum of 'n' terms ⇒ No direct way but can be found with the help of A.P.
- → If a₁ , a₂ , a_n in Arithmatic Progression the Harmonic mean H_m is

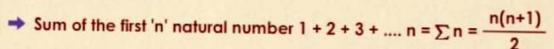
$$\frac{n}{H_m} = \frac{1}{q_1} + \frac{1}{q_2} + \dots + \frac{1}{q_n}$$

- R.M.S ≥ AM ≥ GM ≥ HM
- → GM² = AM x HM → AM, GM, and HM are in Geometric Progression.

MISCELLANEONS PROGRESSION

Sequences which sometimes follow a particular pattern and sometimes not.

POWER SERIESES



- Sum of Squares of the first 'n' natural numbers $1^2 + 2^2 + 3^2 + \dots + n^2 = \sum_{n=1}^{\infty} n^2 = \frac{n(n+1)(2n+1)}{6}$
- ⇒ Sum of cubes of the first 'n' natural numbers $1^3 + 2^3 + ... + n^3 = \sum n^3 = \frac{[n (n+1)]^2}{4} = (1 + 2 + n)^2$