**Progressions**

**Basic concepts:**

* A ***sequence*** is an arrangement of numbers in a definite order according to some rule.

Ex: 1) 2, 5, 10, 17, …...

Rule is an = n² + 1

2) 2, -4, 8, -16, 32, …….

Rule is an = (-1) n – 1 .2n

* The various numbers in a sequence are called **‘*terms’***
* Generally, the terms are represented by t1, t2, t3, …… or a1, a2, a3, ……..
* The number occurring in the ‘nth’ place is called its nth term which is denoted by ‘tn’ .
* If a1, a2, a3, …… is a sequence, then a1 + a2 + a3 + …… or a1 – a2 – a3 - …… is called a ‘**Series**’.

**Progression:**

* If the terms of a sequence follow a certain pattern, then the sequence is called ‘***Progression’***.
* We have three types of progressions. They are

1. Arithmetic progression
2. Geometric progression
3. Harmonic progression

* In this chapter, we will study about Arithmetic progression and Geometric progression.

**Arithmetic progression:**

* In a progression, except the first term, if each term is formed by adding a constant to its previous term, then the progression is called ‘***Arithmetic progression***’ .

Ex: a) 2, 5, 8, 11, 14, ………

b) 1, 3/2, 2, 5/2, 3, 7/2 ………

c) multiples of any constant in sequence

7, 14, 21, 28, ……….

* The constant term is called ‘Common difference’. It is denoted by ‘d’.

d = an – an-1

d = a2 – a1

* In an arithmetic progression, the difference between any two consecutive terms is constant. It is called common difference.

i.e. d = a2 – a1 = a3 – a2 = a4 – a3

* In the arithmetic progression, each term is formed by adding the common difference to its previous term except first term.

a2= a1 + d

a3 = a2 + d

an = an-1 + d

* If first term is ‘a’ and common difference is ‘d’ then the arithmetic progression is

A.P: a, a+d, a+2d, a+3d, ……….

Here a1 = a

a2 = a + d

a3 = a + 2d

a4 = a + 3d

…………….

an = a + (n – 1) d.

* In the A.P, the nth term an = a + (n – 1) d
* If a, b, c are in A.P, then ‘b’ is called ‘Arithmetic mean’ of a and c. and

b – a = c - b

2b = a + c

b =

* The arithmetic mean of ‘a’ and ‘b’ is
* The sum of first ‘n’ terms of an A.P is represented by Sn and defined as

Sn =

Sn =

* The sum of first ‘n’ natural numbers =
* The sum of first ‘n’ even natural numbers = n (n + 1)
* The sum of first ‘n’ odd natural numbers = n2
* In an A.P, if we add (or subtract) a constant to each term, then resulting progression is also an Arithmetic progression.

If a1, a2, a3, a4 , …….are in A.P and ‘k’ is a constant then (a1 + k), (a2 + k), (a3 + k),…… are in A.P

* If each term of the A.P is multiplied or divided by a non-zero constant then the resulting sequence is also in A.P

If a1, a2, a3, a4 , …….are in A.P and ‘k’ is a constant then ka1, ka2, ka3, ka4, ……..are in A.P.

* an – ap = (n – p)d.

Ex: a12 – a7 = 5d.

* In a sequence, an = sn – sn-1

**Geometric progression:**

* The progression in which except the first, each term is formed by multiplying the preceding term by a constant, then the progression is called ‘Geometric progression’.

Ex: 1) 2, 4, 8, 16, 32, ………

2) 0.1, 0.01, 0.001, 0.0001, ……..

* The constant is called ‘common ratio’. It is denoted by ‘r’.
* In geometric progression, the ratio of two consecutive terms is constant. It is called ‘Common ratio’.



* In geometric progression, each term is formed by multiplying the preceding term by the common ratio.

a2 = a1 × r

a3 = a2 × r

a4 = a3 × r

……………

an = an-1 × r

* If the first term of the G.P is ‘a’ and common ratio is ‘r’ then the progression is

G.P. : a, ar, ar2 ,ar3, ar4, ……….

here a1 = a

a2 = ar

a3 = ar2

a4 = ar3

…………….

an = a × rn-1

* In G. P, the nth term an = a.rn-1
* If a, b, c are in G.P, then ‘b’ is called ‘Geometrical mean’ of a and c. and

b2 = a.c

b =

* The geometrical mean of ‘a’ and ‘b’ is .

**Some additional concepts**

* In an A.P, if an = m and am = n then ap = m + n – p.
* In an A.P, if m times to mth term is equal to n times to nth term then (m+n)th term is zero.
* If we need three terms in A.P, then generally, we will take them as (a – d), a, (a + d).
* In a sequence, an = sn – sn-1
* In G.P, sum of ‘n’ terms

