CLASS X : CHAPTER - 5
ARITHMETIC PROGRESSION (AP)

NCERT NICHOOD

SEQUENCE

An arrangement of numbers in a definite order according to some rule is called a sequence. In other words, a pattern of numbers in which succeeding terms are obtained from the preceding term by adding/subtracting a fixed number or by multiplying with/dividing by a fixed number, is called sequence or list of numbers.
e.g. 1,2,3,4,5

A sequence is said to be finite or infinite accordingly it has finite or infinite number of terms. The various numbers occurring in a sequence are called its terms.

ARITHMETIC PROGRESSION (AP).

An **arithmetic progression** is a list of numbers in which each term is obtained by adding a fixed number to the preceding term except the first term.
This fixed number is called the common difference of the AP. It can be positive, negative or zero.
Let us denote the first term of an AP by a_1, second term by a_2, . . ., nth term by a_n and the common difference by d. Then the AP becomes $a_1, a_2, a_3, \ldots, a_n$.
So, $a_2 - a_1 = a_3 - a_2 = \ldots = a_n - a_{n-1} = d$.
The general form of an arithmetic progression is given by

$$a, a + d, a + 2d, a + 3d, \ldots$$

where a is the first term and d the common difference.

nth Term of an AP

Let $a_1, a_2, a_3, \ldots$ be an AP whose first term a_1 is a and the common difference is d.
Then,
the **second term** $a_2 = a + d = a + (2 - 1)\, d$
the **third** term $a_3 = a_2 + d = (a + d) + d = a + 2d = a + (3 - 1)\, d$
the **fourth** term $a_4 = a_3 + d = (a + 2d) + d = a + 3d = a + (4 - 1)\, d$
. . . . . .
. . . . . .
Looking at the pattern, we can say that the **nth** term $a_n = a + (n - 1)\, d$.
So, **the nth term a_n of the AP with first term a and common difference d is given by**

$$a_n = a + (n - 1)\, d.$$

a_n is also called the **general term of the AP**. If there are m terms in the AP, then a_m represents the **last term which is sometimes also denoted by l.**

nth Term from the end of an AP

Let the last term of an AP be 'l' and the common difference of an AP is 'd' then the nth term from the end of an AP is given by

$$l_n = l - (n - 1)\, d.$$

Sum of First *n* Terms of an AP

The sum of the first n terms of an AP is given by

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

where a = first term, d = common difference and n = number of terms.

Also, it can be written as

$$S_n = \frac{n}{2}[a + a_n]$$

where a_n = nth terms
or

$$S_n = \frac{n}{2}[a + l]$$

where l = last term
This form of the result is useful when the first and the last terms of an AP are given and the common difference is not given..

Sum of first *n* positive integers is given by $S_n = \frac{n(n+1)}{2}$

Problems based on finding a_n if S_n is given.

Find the nth term of the AP, follow the steps:

- Consider the given sum of first n terms as S_n.
- Find the value of S_1 and S_2 by substituting the value of n as 1 and 2.
- The value of S_1 is a_1 i.e. a = first term and $S_2 - S_1 = a_2$
- Find the value of $a_2 - a_1$ = d, common difference.
- By using the value of a and d, Write AP.

Problems based on finding S_n if a_n is given.

Find the sum of n term of an AP, follow the steps:

- Consider the nth term of an AP as a_n.
- Find the value of a_1 and a_2 by substituting the value of n as 1 and 2.
- The value of a_1 is a = first term.
- Find the value of $a_2 - a_1$ = d, common difference.
- By using the value of a and d, Write AP.
- By using Sn formula, simplify the expression after substituting the value of a and d.

Arithmetic Mean

If a, b and c are in AP, then 'b' is known as arithmetic mean between 'a' and 'c'

$b = \frac{a+c}{2}$ i.e. AM between 'a' and 'c' is $\frac{a+c}{2}$.