CLASS – X
MATHEMATICS
CHAPTER – 6
ARITHMETIC PROGRESSION (AP)

NOTES

- **Sequence**

  A succession of numbers formed according to a specific rule is called a sequence.

- **Arithmetic Progression**

  A sequence $a_1, a_2, a_3, a_4,$ ...., a_n, ... is called an Arithmetic Progression(AP) if $a_{n+1} - a_n$=constant for all $n \in N$.

  Or

  An arithmetic progression is a sequence in which each term other than the first is obtained by adding a fixed number to the preceding term.

- **Common Difference**

  In an AP, $\boldsymbol{a_1, a_2, a_3, \ldots \ldots, a_n \ldots \ldots}$ the value of $\boldsymbol{a_{n+1} - a_n}$ is called common difference of the AP.

- **The n^th term (or the general term) of an AP**

  Let a be the first term and d be the common difference of an AP.

  Then the AP is $a, a+d, a+2d, a+3d, \ldots\ldots\ldots\ldots$

  Here, $a_1 = a = a + (1-1)d$

  $a_2 = a + d = a + (2-1)d$

  $a_3 = a + 2d = a + (3-1)d$

  $a_4 = a + 3d = a + (4-1)d$

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  Looking the above pattern, we can write

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

  Thus, for an AP whose first term is a and the common difference is d,

  the nth term (or the general term) $a_n = a + (n-1)d$

Sum of the first n terms of an AP

Let a and d be the first term and the common difference of an AP.

Then the AP is

$$a, a+d, a+2d, \dots \dots . a+(n-2)d, a+(n-a)d, \dots$$

Let S_n denotes the sum of the first n terms of the AP.

Then $S_n = a + (a+d) + (a+2d) + \dots + \{a+(n-2)d\}, \{a+(n-1)d\}$

And $S_n = \{a+(n-1)d\} + \{a+(n-2)d\} + \dots . + (a+2d) + (a+d) + a$

Adding the above relations, we have

$$2.S_n = \{2a+(n-1)d\} + \{2a+(n-1)d\} + \dots . + \text{ to } n \text{ terms}$$

$$\Rightarrow 2.S_n = n\{2a+(n-1)d\}$$

$$\Rightarrow S_n = \frac{n}{2}\{2a+(n-1)d\} \text{ -------- (i)}$$

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

$$\therefore S_n = \frac{n}{2}(a+a_n)$$

$$= \frac{n}{2}(a+l) \text{ ---------- (ii)}$$

Thus, for an AP whose first term is a and the common difference is d,

the sum of the first n terms, $S_n = \frac{n}{2}(a+a_n)$

$$= \frac{n}{2}(a+l)$$

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