Class 10 Arithmetic Progression Notes PDF

The concept of progression series is introduced in class 10 Maths Arithmetic Progression (AP) chapter. Being one of the most essential chapters of the class 10 maths syllabus, it is important to be well-versed with the intricacies of this one to excel in the board examination. Once, you are through with the concept of AP, you can easily solve the complex questions that are a part of competitive exams as well. In this blog, we will discover more about arithmetic progression, its formula, solved examples, etc. We shall also understand how to find the nth term and the sum of the consecutive terms. So, let's begin!

Sequences, Series and Progressions

- A **sequence** is a finite or infinite set of integers that follow a pattern. For example, the series is infinite: 1, 2, 3, 4, 5... Natural number sequence.
- The total of the components in the matching sequence is referred to as a **series**. For example, 1+2+3+4+5.... is a natural number sequence. Each number in a sequence or series is referred to as a term.
- A **progression** is a sequence in which the general term can be can be expressed using a mathematical formula.

Arithmetic Progression

Let us begin by understanding what arithmetic progressions are, Arithmetic Progression can be simply defined as a series of numbers wherein the difference between any of the 2 consecutive numbers is always the same. For Example, In a given series of natural numbers, i.e., 6, 7,8,9,10, …n, we can say that the series is an arithmetic progression as the difference between 2 consecutive terms (7 and 8 or 6 and 7) is equal to 1 (7-6).

If we consider a series of odd numbers and one of even numbers, then it will be an AP as the common difference between any two consecutive terms of the respective series is equal to 2.

According to the class 10 arithmetic progression chapter, In an arithmetic progression, the series refers to the sum of elements of the successive numbers. The difference between one term and its next term is always constant in AP.

We can say, if we just add similar value or numbers to the previous numbers every time, the result will be constant. This property can be understood from the below-mentioned formula:

$a_1 + a_n = a_2 + a_{n-1} = \ldots = a_k + a_{n-k+1}$ and $a_n = \frac{1}{2}(a_{n-1} + a_{n+1})$

Now that we are through the theoretical understanding of class 10 arithmetic progression, let us move forward and understand the concept through solved examples.

Example 1: Find the AP given by x + b, x + 3b, x + 5b,…

Solution 1: Here a = x + b ,
d = x + 3b − (x + b)
d = x + 3b − x − b
∴ d = 2b

The general term of an AP is given by the formula

$a_n = a + (n − 1) d$

$a_n = x + b + (n − 1)2b$

∴ *$a_n = x + (2n − 1)b$*

Arithmetic Progression and the Sequence of Numbers

In our class 10 arithmetic progression notes, the next topic is the sequence of numbers in AP. When the difference between two successive numbers is always constant, then it can be termed as a sequence. For Example:

- 1, 2, 3, 4, 5… is a sequence, which is arithmetic progression and has a common difference of 1
- 3, 5, 7, 9, 11… is another common sequence that is an arithmetic progression and has a common difference of 2
- In a given sequence, 10, 20, 30, 40, 50… that is arithmetic progression has a common difference of 10

The arithmetic sequence can also be written as:

{ a, a + b, a + 2b, a + 3b, a + 4b, ….}

Where,

a is the first term, and

b is the difference between the terms

Example 2: Which term of the A.P. 3,8,13 …is 78?

Solution: Here $a_n = a + (n - 1) d = 78$

a= 3, d = 8- 3 = 5

Therefore,

3 + (n -1) (5) = 78

(n-1) * 5 = 78 – 3 = 75

n – 1 = 75/5 = 15

n = 15 + 1 = 1

Hence, 78 is the 16th term.

Example 3: Which term of the A.P. 3, 15, 27, 39 … will be 132 more than its 54th term?

Solution: Given series is 3, 15, 27, 39…

Here, a =3, d= 15-3 = 12

Since $a_n = a_k = (n-k) d$

$a_n – a_{54} = (n-54) 12$

132 = 12n – 54 * 12   …..(since $a_n – a_{54} = 132$ given)

12 n = 132 + 54 * 12 = 12 (11+ 54)

n= 11 + 54 = 65

Progression and Its Types

As we move further with the class 10 arithmetic progression, we will now learn the various types of progression. Progression is a kind of special sequence of numbers. This makes it possible to determine or obtain the formula of the n_{th} term. Majorly, progressions can be bifurcated into three categories such as:

- Harmonic Progression (HP)
- Geometric Progression (GP)
- Arithmetic Progressions (AP)

The arithmetic progressions (AP) is the simplest progression sequence used. It is a difference noticed between any 2 successive terms that are always constant in AP.

Notation in Arithmetic Progressions

Through our class 10 arithmetic progression notes, you are familiar with the definition of AP and when a fixed number can be added to any of its terms which are also known as the common difference in AP. Three major terms denoted in arithmetic progressions are:

- Common difference
- nth term
- Sum of the nth term

All of them represent the properties of an arithmetic progression.

Uses of Arithmetic Progressions

Arithmetic progressions are used to set or generalize a pattern in observable studies.

To calculate the sum of an AP, it is vital to have the first term, common differences between the terms and the number of all the terms. The general formula to find the nth term is:

an = a + (n - 1) × d

Alternative formula is, *S = n/2 [2a + (n-1) × d]*

The nth Term of the Arithmetic Progression

The formula for obtaining the nth term of an AP is a = a + (n+1) d.

In this formula, a is the initial term in the arithmetic sequence while d is the common difference between the terms.

Both of these values can either be negative or a positive integer. It is because the actual value of the arithmetic sequence can be negative, and the difference between any two sequences can be a negative integer.

n is also a number in terms of an arithmetic sequence. As negative integers are not used to count anything, the value of the *n*th term in the formula will not be a negative integer.

Sum of the First 'n' Terms of an AP

In the formula of AP the sum of the progression term with 'n' term, 'a' as the first term, and 'd' as the common difference are given as:

S = n/2 [2a + (n-1) x d]

If l is the nth term of a finite A.P., then The sum of all terms of the AP is given by:

S = n(a + l) / 2

It is worth noting that the sum of the first n positive integers is given by:

S = [n(n + 1)] / 2

If a, b, c are in AP. Then b is called the arithmetic mean of a and c and is given by

b = (a + c) / 2

Example 4: Find the 15th term of the arithmetic progression 3, 9, 15, 21,….?

Solution: In the given AP, a = 3, d = (9 – 3) = 6, n =15
T15 = a + (n – 1)d
= 3 + (15 -1)6
= 3 + 84 = 87