

Arithmetic Progression (AP) is a sequence of numbers in order that the difference of any two successive numbers is a constant value. For example, the series of natural numbers: 1,2,3,4,5,6,... is an AP, which has a common difference between two successive terms (say 1 and 2) equal to 1 (2 -1). Even in the case of odd numbers and even numbers we can see the common difference between two successive terms will be equal to 2.

In mathematics, there are three different types of progressions. They are:

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

A progression is a special type of sequence for which it is possible to obtain a formula for the nth term. The Arithmetic Progression is the most commonly used sequence in maths with easy to understand formulas. Let us see its three different types of definition.

Notation in AP

In AP, we will come across, three main terms, which are denoted as:

- Common difference (d)
- Nth Term (a_n)
- Sum of nth term (S_n)

All three terms represent the property of Arithmetic Progression. We will learn more about these three properties in the next section.

Common Difference in Arithmetic Progression

In this progression, for a given series, the terms used are the first term, the common difference between the two terms and nth term. Suppose, $a_1, a_2, a_3, \dots, a_n$ is an AP, then; the **common difference “ d ”** can be obtained as;

$$d = a_2 - a_1 = a_3 - a_2 = \dots = a_n - a_{n-1}$$

Where “d” is a common difference. It can be positive, negative or zero.

First Term of AP

The AP can also be written in terms of common difference, as follows;

a, a + d, a + 2d, a + 3d, a + 4d, ,a +
(n - 1) d

where “a” is the **first term** of the progression.

Formulas

There are two major formulas we come across when we learn about Arithmetic Progression, which is related to:

- Nth term of AP
- Sum of nth term

nth Term of an AP

The formula for finding the n-th term of an AP is:

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

Where, a = First term

d = Common difference

n = number of terms

a_n = nth term

Sum of N Terms of AP

For any progression, the sum of n terms can be easily calculated. For an AP, the sum of the first n terms can be calculated if the first term and the total terms are known. The formula for the arithmetic progression sum is explained below:

Consider an AP consisting “n” terms.

$$S = n/2[2a + (n - 1) \times d]$$

This is the AP sum formula to find the sum of n series.