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Comparative Study of Arithmetic Progression By Using Modern and Vedic Mathematics

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Abstract

Finding the nth term and the sum of n terms in Arithmetic Progression is very easy if the number of terms is small but it is bulky if the number of terms is larger and takes larger time and also takes our large efforts and difficulties. On the other hand, the Vedic Mathematics works opposite as the modern mathematics so if we use the third sutra of Vedic Mathematics known as Urdhvatiryagbhyam, seventh sutra known as Sankalan-Vyavkalanabhyam and Upa-sutra(Sub-formula)Antyyoravto of 9th sutra 'Calana - Kalanabhyam' finding the nth term and the sum of n term's in Arithmetic Progression it takes our large effect's reduced around 60-65% and also takes small-time comparatively modern mathematics. The arithmetic pattern is one of the easiest series to study. It contains adding or subtracting from a common difference (d), for generating a string of the interrelated numbers. Thus In this document, we present the comparison to find the nth term and the sum of n terms in Arithmetic Progression by using modern mathematics and Vedic mathematics.

1. INTRODUCTION OF ARITHMETIC PROGRESSION

A Sequence or Progressions is a list of numbers in a special order. It is a string of numbers following a particular pattern, and all the elements of a sequence are called its terms. There are various types of sequences which are universally accepted, but the one which we are going to study right now is the Arithmetic Progression. Arithmetic Progression is a sequence in which the difference between any two consecutive terms is the same (constant) and this is called the common difference of the Arithmetic Progression which is denoted by 'd'. In other words we can say that the next number in the series is calculated by adding a fixed number to the previous number in the series.

2. BACKGROUND OF ARITHMETIC PROGRESSION

John Carl Friedrich is the father of Arithmetic Progression, when he was in school ,his teacher asked to find the sum of integers from 1 to 100 without using a counting manner.

It was unheard but Gauss was took up the challenges. He listed the first 50 integers and wrote the sub sequent 50 in reverse order below the first set. The sum of the number next to each other 101 i.e. 100+1, 99+2, 51 + 50 etc.; we found there were 50 such pair and ended up multiplying 101 with 50 to give an output 5050.

3. FINITE ARITHMETIC SEQUENCE

The number of terms in this sequence is countable or finite then it has a limit. So if the number of terms in an AP has a limit, they are called Finite Sequences. A finite sequence has a finite number of terms and the AP is called Finite AP.
Example: 3, 6, 9, 12 (It's Finite AP because sequence has 4 numbers)

4. INFINITE ARITHMETIC SEQUENCE

The number of terms in this sequence is uncountable or infinite then it has a no limit. So if the number of terms in an AP has no limit, they are called Infinite Sequences. Such a sequence which contains the infinite number of terms is known as an Infinite Sequence the AP is called Infinite AP.
Example: 3, 6, 9, 12, …

(It's Infinite AP because sequence does not have limited number of terms.)

5. N^TH TERM OF ARITHMETIC PROGRESSION :

We assume that the terms a, $(a+d)$, $(a+2d)$, ..., $(a+nd)$ are in AP. If the first term is 'a' and its common difference is 'd'. Then the terms can also be explained as following:

2nd term $a_2 = a_1 + d = a + d = a + (2-1)d$
3rd term $a_3 = a_2 + d = (a + d) + d = a + 2d = a + (3-1)d$
as well as n^{th} term $a_n = a + (n-1)d$

Therefore

We can get the n^{th} term of an AP by using this formula, $a_n = \{a + (n-1)d\}$, a_n is called the general n^{th} term of an Arithmetic Progression (AP).

6. SUM OF N TERM OF ARITHMETIC PROGRESSION

Assume that the terms a, $(a+d)$, $(a+2d)$, ..., $(a+nd)$ are in AP. If the first term is 'a' and its common difference is 'd'. Then the Arithmetic Progression (AP) defined as:

$a, a+d, a+2d, a+3d, \ldots \{a+(n-1)d\}$
Sum of two terms $= a+(a+d) = 2a+d = 2/2\ \{2a+(2-1)d\}$
sum of three terms $= a+(a+d)+(a+2d) = 3a+3d = 3/2\ \{2a+(3-1)d\}$
as well as the sum of n terms $s_n = n/2\ \{2a+(n-1)d\}$

Therefore,

We can get the sum of n terms of an Arithmetic Progression (AP) by using this formula, $s_n = n/2\ \{2a+(n-1)d\}$, is called the general sum of n terms of an Arithmetic Progression (AP).

7. ARITHMETIC MEAN

If we have a set of positive numbers $a_1, a_2, a_3, \ldots, a_n$ then the arithmetic mean (AM) is

$$AM = \frac{a_1 + a_2 + a_3 + \cdots + a_n}{n}$$

So we can say that AM for two positive integers a and b is As well as we can find AM for the finite terms of AP.

8. INTRODUCTION OF VEDIC UPA-SUTRA [9]ANTYAYOREVA

Antyayoreva means- Only the end terms.

Antyayoreva is a upa-sutra(sub-formula) of 'Calana - Kalanabhyam' which is 9th sutra of Vedic mathematics which means that 'Sequential motion'

Sequential Progression steps of up-sutra 09

1	2	3	4	5	6	7	8	9	10	11
अ	न्	त्	य्	अ	य्	ओ	र्	ए	व्	अ
A	n	t	y	a	y	o	r	e	v	a

The 'Antyayoreva' is a technical term whose composition as

अन्त्य + अय + ओर + एव (Anty + ay + or + eva)

which means that (अन्त्य) end on its reverse (अय) orientation (रओ) leads too (एव).

Feature of this sutra "end point" Of sequential set is that there happens reverse orientation for continuation of further leads (sequential progression).

In this feature of chase which become the basic feature of organization format of this phase and stage of Ganita Upa-sutra 9.

9. METHODOLOGY

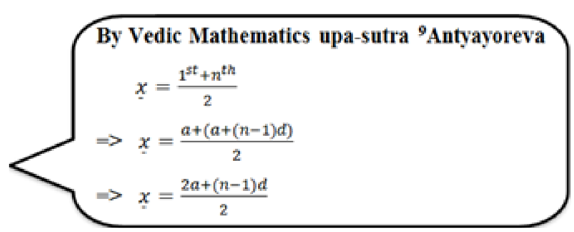
If terms a, $(a+d)$, $(a+2d)$, ..., $(a+nd)$ are in AP. If the first term is 'a' and its common difference is 'd'. Then,

9.1 Arithmetic Mean

$$AM = \frac{a + (a+d) + (a+2d) + \cdots + \{a + (n-1)d\}}{n}$$

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

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



By Vedic Mathematics upa-sutra [9]Antyayoreva

$$x = \frac{1^{st} + n^{th}}{2}$$

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

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

9.2 n^{th} term

To find the nth term, we use the 7th Formula of Vedic mathematics known as Sankalan-Vyavkalanabhyan which means that 'by addition and by subtraction'.

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

By Vedic Mathematics Sutra
[7]Sankalan-Vyavkalanabyam
$a_n = 2x - 1^{st}(term) = 2x - a$

9.3 Sum of n term

Here we use the 3rd formula of Vedic mathematics known as Urdhva – tiryagbhyam. Urdhva – tiryagbhyam is the general formula applicable to all cases of multiplication.

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

By Vedic Mathematics Sutra 'Urdhvatiryagbhyam'
$a_n = x$ x $n^{th}(term) = x$ x n

10. LET US TAKE A GENERAL CASE FOR ARITHMETIC PROGRESSION.

If terms *a, a+d, a+*2*d, a+*3*d, a+*4*d, ...* are in AP. Then find 16th term of the series and the sum of first 16 terms of the series. For better understating ,here we take first 16 terms of this AP . Here we can choose any number of terms as required.

The first term is '*a*' and its common difference is '*d*' and n = 16. Then,

10.1 Arithmetic Mean

$$AM = \frac{a + (a+d) + (a+2d) + \cdots + (a + (16-1)d)}{16}$$

$$\Rightarrow x = \frac{\frac{16}{8}[2a + (16-1)d]}{16}$$

$$\Rightarrow x = \frac{2a + 15d}{2}$$

By Vedic Mathematics upa-sutra [9]Antyayoreva
$x = \frac{1^{st} + n^{th}}{2} = \frac{a + (a + (16-1)d)}{2}$
$\Rightarrow x = \frac{2a+15d}{2}$

10.2 16th terms

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

$$\Rightarrow a_{16} = a + (16-1)d$$

$$\Rightarrow a_{16} = a + 15d$$

By Vedic Mathematics Sutra 'Urdhvatiryagbhyam'
$a_n = x$ x $n^{th}(term) = x$ x n
$\Rightarrow s_{16} = \frac{2a+15d}{2}$ x 16

10.3 Sum of 16 terms

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

$$\Rightarrow S_{16} = \frac{16}{2}[2a + (16-1)d]$$

$$\Rightarrow S_{16} = 8[2a + 15d]$$

By Vedic Mathematics Sutra 'Urdhvatiryagbhyam'
$a_n = x$ x $n^{th}(term) = x$ x n
$\Rightarrow s_{16} = \frac{2a+15d}{2}$ x 16

11. CONCLUSION

An Arithmetic progression is a series which has consecutive terms having a common difference between the terms as a constant value. it is used to generalized a set of patterns, that we observe in our daily life routine. In this paper we conclude that when we calculate the sum of nth terms of series by both method Vedic and modern, we consume more time to solving problems by modern method despite of Vedic formulas. With the help of Vedic methods it is possible we can far away mathematics phobia in the students.

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