Arithmetic Progressions

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Comprehensive study notes for

Arithmetic Progressions

by

Ajay Yadav

(Math King of Katargam). Master every concept with clear explanations, solved examples, and practice problems.

Key Concepts

Definition

An

Arithmetic Progression (AP)

is a sequence where the difference between consecutive terms is constant. This constant is called the

common difference

(d). Example: 2, 5, 8, 11, ... has d = 3.

General Term (nth term)

The nth term of an AP:

a5 = a + (n-1)d

, where a is the first term and d is the common difference. The term a5 is also called the

general term

.

Sum of n Terms

The sum of the first n terms of an AP:

S5 = n/2 [2a + (n-1)d]

or

S5 = n/2 (a + l)

where l = a5 is the last term.

Arithmetic Mean

If three numbers are in AP, the middle one is the arithmetic mean of the other two. If a, b, c are in AP, then

2b = a + c

or

b = (a+c)/2

.

Finding Number of Terms

Given a, d, and an AP term value, use a5 = a + (n-1)d to find n. If the term exists, n will be a positive integer.

Applications

APs appear in many contexts: monthly savings, depreciation, patterns, triangular numbers (1, 3, 6, 10, ...), and more.

Important Formulas

nth term

$a5 = a + (n-1)d$

Sum of n terms

$S5 = n/2 [2a + (n-1)d]$

Sum using last term

$S5 = n/2 (a + l)$ where $l = a5$

Arithmetic Mean

If a, b, c are in AP, $2b = a + c$

Common Difference

$d = a5(2 - a5(2)2 = a2 - a1$

Solved Examples

Example 1:

Find the 10th term of AP: 2, 7, 12, 17, ...

Solution:

$a = 2, d = 5, n = 10. a10 = 2 + 9(5) = 2 + 45 =$

47

.

Example 2:

Find the sum of first 20 terms of AP: 1, 4, 7, 10, ...

Solution:

$a = 1, d = 3, n = 20. S20 = 20/2 [2(1) + (19)(3)] = 10(2 + 57) =$

590

.

Example 3:

How many terms of AP: 3, 7, 11, ... sum to 210?

Solution:

$S5 = n/2 [2(3) + (n-1)(4)] = n/2 [6 + 4n - 4] = n(2n+1) = 210. 2n2 + n - 210 = 0.$ Solving: $n = 10$ or $n = -21/2.$ So

$n = 10$

.

Practice Questions

Find the 15th term of AP: -5, -1, 3, 7, ...

Find the sum of first 25 terms of AP: 6, 10, 14, ...

If the 8th term of an AP is 23 and the 15th term is 44, find the AP.

Find the sum of all multiples of 7 between 100 and 1000.

Which term of AP: 20, 17, 14, ... is -40?

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