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ARITHMETIC PROGRESSOINS
PPT-4

SUBJECT : MATHEMATICS
CHAPTER NUMBER: 05
CHAPTER NAME : ARITHMETIC PROGRESSIONS

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PREVIOUS KNOWLEDGE TEST

- An **arithmetic progression** is a list of numbers in which each term is obtained by adding afixed number to the preceding term except the first term.
- The general form of an arithmetic progression is given by
  $a, a + d, a + 2d, a + 3d, \ldots$ where a is the first term and d the common difference.

  nth term a_n = a + (n – 1) d.
  So, the nth term an of the AP with first term a and common difference d is given by
  - a_n is also called the general term of the AP.
  - nth term of an AP from the end = l – (n – 1) d

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LEARNING OUTCOME

1. Students will be able to know the sum of first n terms of an AP.

2.Students will be able to solve problems based on finding the number of terms, when sum of terms and AP are given.

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Sum of first n-terms of an AP
https://youtu.be/cRyeMph7tKU(12.52)

1.Find the sum of the following AP:

2, 7, 12, . . ., to 10 terms.

2, 7, 12, ..., to 10 terms

Here, $a = 2, d = 7 - 2 = 5, n = 10, S_{10} = ?$

$\because \quad S_n = \frac{n}{2}[2a + (n - 1)\, d]$

$\therefore \quad S_{10} = \frac{10}{2}[2 \times 2 + (10 - 1)\, 5]$

$= 5\,[4 + 45] = 5 \times 49 = 245$

2.Find the sum $34 + 32 + 30 + \ldots + 10$

$34 + 32 + 30 + \ldots\ldots + 10$

Here, $a = 34,\ d = 32 - 34 = -2$

$a_n = 10$

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

$\Rightarrow \quad 10 = 34 + (n-1)(-2)$

$\Rightarrow \quad 10 - 34 = (n-1)(-2)$

$\Rightarrow \quad \frac{-24}{-2} = n - 1 \quad \Rightarrow \quad n - 1 = 12$

$\Rightarrow \quad n = 12 + 1 = 13$

$\therefore \quad S_{13} = \frac{13}{2}[34 + 10]$

$= \frac{13}{2} \times 44 = 13 \times 22 = 286$

3.In an AP: given a = 5, d = 3, a_n = 50, find n .

$$a = 5,\ d = 3,\ a_n = 50$$

$$a_n = 50$$

$$\Rightarrow a + (n-1)\,d = 50$$

$$\Rightarrow 5 + (n-1)\,3 = 50$$

$$\Rightarrow (n-1)\,3 = 50 - 5$$

$$\Rightarrow (n-1)\,3 = 45$$

$$\Rightarrow n - 1 = \frac{45}{3} = 15 \quad \Rightarrow \quad n = 16$$

4. given $a_3 = 15$, $S_{10} = 125$, find d and a_{10}.

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Given, $a_3 = 15$, $S_{10} = 125$

$a_3 = 15$

$\Rightarrow \quad a + 2d = 15$

$\Rightarrow \quad a = 15 - 2d$

We have, $S_n = \frac{n}{2}[2a + (n-1)\,d]$

$S_{10} = \frac{10}{2}[2a + (n-1)\,d]$

$= 5\,[2\,(15 - 2d) + (10 - 1) \times d]$

$= 5\,[30 - 4d + 9d]$

$\Rightarrow \quad 125 = 5\,(30 + 5d)$

$\Rightarrow \quad \frac{125}{5} = 30 + 5d$

$\Rightarrow \quad 25 - 30 = 5d$

$\Rightarrow \quad -5 = 5d$

$\Rightarrow \quad \frac{-5}{5} = d$

$\Rightarrow \quad d = -1$

$a_{10} = a + 9d = 15 - 2d + 9d$

$= 15 + 7d = 15 + 7 \times (-1)$

$= 15 - 7 = 8$

5. given $a_n = 4$, $d = 2$, $Sn = -14$, find n and a.

5. given $a_n = 4$, d = 2, Sn = –14, find n and a.

$$a_n = 4,\ d = 2,\ S_n = -14$$

$$S_n = \frac{n}{2}[a + a_n]$$

$$\Rightarrow \quad -14 = \frac{n}{2}[a + 4]$$

$$\Rightarrow \quad -28 = na + 4n$$

$$\Rightarrow \quad \frac{-28 - 4n}{n} = a$$

$$a_n = 4$$

$$\Rightarrow \quad a + (n-1)d = 4$$

$$\Rightarrow \quad \frac{-4n - 28}{n} + (n-1)2 = 4$$

$$\Rightarrow -4n - 28 + 2n^2 - 2n = 4n$$

$$\Rightarrow 2n^2 - 10n - 28 = 0 \text{ or } n^2 - 5n - 14 = 0$$

$$\text{or} \quad n^2 - 7n + 2n - 14 = 0$$

$$\Rightarrow n(n-7) + 2(n-7) = 0$$

$$\Rightarrow (n+2)(n-7) = 0$$

$$\Rightarrow \text{Either } n + 2 = 0 \text{ or } n - 7 = 0$$

$$\Rightarrow n = -2 \text{ or } n = 7,\ n = -2 \text{ is rejected}$$

$$\therefore \quad a = \frac{-28 - 4n}{n} = \frac{-28 - 4 \times 7}{7}$$

$$= \frac{-28 - 28}{7} = \frac{-56}{7} = -8$$

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6.Find the sum of first 22 terms of an AP in which d = 7 and 22nd term is 149.

Find the sum of first 22 terms of an AP in which $d = 7$ and 22nd term is 149.

Sol. Given, $d = 7$, $a_{22} = 149$

$$a_{22} = a + 21d = 149$$

$$\Rightarrow \quad a + 21 \times 7 = 149$$

$$\Rightarrow \quad a + 147 = 149$$

$$\Rightarrow \quad a = 149 - 147 = 2$$

$$\therefore \quad S_{22} = \frac{22}{2}[a + a_{22}]$$

$$= 11\ [2 + 149]$$

$$= 11 \times 151 = 1661$$

7.How many terms of the AP : 9, 17, 25, . . . must be taken to give a sum of 636?.

How many terms of AP: 9, 17, 25, ... must be taken to give a sum of 636?

Sol. Given, $a = 9$, $d = 17 - 9 = 8$,

$$S_n = 636$$

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

$$\Rightarrow \quad 636 = \frac{n}{2}[2 \times 9 + (n-1)\,8]$$

$$\Rightarrow \quad 636 \times 2 = n\,[18 + 8n - 8]$$

$$\Rightarrow \quad 636 \times 2 = n\,(10 + 8n)$$

$$\Rightarrow \quad 636 \times 2 = 2n(5 + 4n)$$

$$\Rightarrow \quad \frac{636 \times 2}{2} = 5n + 4n^2$$

$$\Rightarrow \quad 4n^2 + 5n - 636 = 0$$

$$\Rightarrow \quad 4n^2 + 53n - 48n - 636 = 0$$

$$\Rightarrow \quad 4n\,(n + 53) - 48\,(n + 53) = 0$$

$$\Rightarrow \quad (4n - 48)\,(n + 53) = 0$$

$$\Rightarrow \quad \text{Either } 4n = 48 \text{ or } n + 53 = 0$$

$$\Rightarrow \quad n = \frac{48}{4} \text{ or } n = -53 \text{ (rejected)}$$

$$\Rightarrow \quad n = 12$$

Hence $n = 12$

HOME ASSIGNMENT Ex. 5.3 Q. No 1 to Q10

AHA

1. How many terms of the AP : 24, 21, 18, . . . must be taken so that their sum is 78?

2. The houses of a row are numbered consecutively from 1 to 49. Show that there is a value of x such that the sum of the numbers of the houses preceding the house numbered x is equal to the sum of the numbers of the houses following it. Find this value of x.

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