Case Study 1: Arithmetic Progression in Daily Life

Rohit is fond of reading novels and sets a personal target for himself. On the first day, he reads 12 pages, on the second day 17 pages, on the third day 22 pages, and continues this pattern of reading. His aim is to complete a novel of 600 pages. The number of pages he reads each day forms an arithmetic progression (AP). Using the concepts of Arithmetic Progressions, let us analyze his reading pattern and answer the following questions.

The general form of an Arithmetic Progression is:

$$a, a + d, a + 2d, a + 3d, \dots$$

where a is the first term and d is the common difference.

The nth term is given by:

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

The sum of the first n terms is given by:

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

MCQ Questions

1. What is the common difference d of the AP formed by Rohit's reading pattern? (a) 4 (b) 5 (c) 6 (d) 7

   Answer: (b) 5

   Solution: The first three terms are 12, 17, 22. $d = 17 - 12 = 5$.

2. What will be the number of pages Rohit reads on the 10th day? (a) 52 (b) 57 (c) 60 (d) 62

   Answer: (b) 57

   Solution: $a = 12$, $d = 5$, $n = 10$. $a_{10} = a + (n - 1)d = 12 + 9(5) = 57$.

3. How many pages will Rohit read in the first 20 days? (a) 1200 (b) 1300 (c) 1400 (d) 1500

   Answer: (b) 1300

   Solution: $a = 12$, $d = 5$, $n = 20$. $S_{20} = \frac{20}{2}[2(12) + (20 - 1)(5)] = 10(24 + 95) = 10(119) = 1190$.

   Correction: None of the given options match 1190. Correct answer should be 1190.

4. On which day will Rohit read exactly 87 pages? (a) 14th day (b) 15th day (c) 16th day (d) 17th day

   Answer: (c) 16th day

   Solution: $a_n = 12 + (n - 1)(5) = 87$ $(n - 1)(5) = 75 \implies n - 1 = 15 \implies n = 16$.

5. After how many days will Rohit complete reading the 600 pages novel? (a) 20 days (b) 22 days (c) 23 days (d) 24 days

   Answer: (c) 23 days

   Solution: We need $S_n = 600$. $S_n = \frac{n}{2}[2(12) + (n - 1)(5)] = 600 \implies n(24 + 5n - 5)/2 = 600 \implies n(5n + 19) = 1200 \implies 5n^2 + 19n - 1200 = 0$ Solving, $n = 23$.