CHAPTER 2

ARITHMETIC PROGRESSION

KEY POINTS

1. **Sequence :** A set of numbers arranged in some definite order and formed according to some rules is called a sequence.

2. **Progression :** The sequence that follows a certain pattern is called progression.

3. **Arithmetic Progression :** A sequence in which the difference obtained by substracting any term from its proceeding term is constant throughout, is called an arithmetic sequence or arithmetic progression (A.P.).

   The general form of an A.P. is *a, a + d, a + 2d*, ... (a : first term *d* : common difference).

4. **General Term :** If '*a*' is the first term and '*d*' is common difference in an A.P., then n^{th} term (general term) is given by $a_n = a + (n - 1)\, d$.

5. **Sum of *n* Terms of An A.P. :** If '*a*' is the first term and '*d*' is the common difference of an A.P., then sum of first *n* terms is given by

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

   If '*l*' is the last term of a finite A.P., then the sum is given by

$$S_n = \frac{n}{2}\left\{a + l\right\}.$$

6.   (i)   If a_n is given, then common difference $d = a_n - a_{n-1}$.

   (ii)   If s_n is given, then n^{th} term is given by $a_n = s_n - s_{n-1}$.

   (iii)   If *a, b, c* are in A.P., then $2b = a + c$.

   (iv)   If a sequence has *n* terms, its rth term from the end = $(n - r + 1)^{th}$ term from the beginning.

MULTIPLE CHOICE QUESTIONS

1. Three numbers in A.P. have sum 24. The middle term is—

   (a) 6   (b) 8

   (c) 3   (d) 2

2. If n^{th} term of on A.P. is $2n + 7$, then 7th term of the A.P. is

   (a) 15   (b) 21

   (c) 28   (d) 25

3. If the sum of n terms of an A.P. is $\dfrac{5}{2} n^2 + \dfrac{3n}{2}$, then sum of its 10 terms is

   (a) 250   (b) 230

   (c) 225   (d) 265

4. If n^{th} term of the A.P. 4, 7, 10, _____ is 82, then the value of n is

   (a) 29   (b) 27

   (c) 30   (d) 26

5. If a, b and c are in A.P. then

   (a) $a = \dfrac{b + c}{2}$ (b) $b = \dfrac{a + c}{2}$

   (c) $c = \dfrac{a + b}{2}$ (d) $b = a + c$

6. 12th term of the A.P. $x - 7$, $x - 2$, $x + 3$ is

   (a) $x + 62$ (b) $x - 48$

   (c) $x + 48$ (d) $x - 62$

7. Common difference of A.P. $8\dfrac{1}{8}$, $8\dfrac{2}{8}$, $8\dfrac{3}{8}$, _____ is

   (a) $\dfrac{1}{8}$ (b) $1\dfrac{1}{8}$

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(c) $8\dfrac{1}{8}$ (d) 1

8. n^{th} term of the A.P. –5, –2, 1, _____ is

   (a) $3n + 5$ (b) $8 - 3n$

   (c) $8n - 5$ (d) $3n - 8$

9. If n^{th} term of an A.P. is $5 - 3n$, then common difference of the A.P. is

   (a) 2 (b) –3

   (c) –2 (d) 3

10. If 5, $2k - 3$, 9 are in A.P., then the value of 'k' is

    (a) 4 (b) 5

    (c) 6 (d) –5

11. Sum of first 10 natural numbers is

    (a) 50 (b) 55

    (c) 60 (d) 65

12. 9th term from the end of the A.P. 7, 11, 15, _____ 147 is

    (a) 135 (b) 125

    (c) 115 (d) 110

13. If the sum of n terms of an A.P. is n^2, then its nth term is

    (a) $2n - 1$ (b) $2n + 1$

    (c) $n^2 - 1$ (d) $2n - 3$

14. The sum of 3 numbers in A.P. is 30. If the greatest number is 13, then its common difference is

    (a) 4 (b) 3

    (c) 2 (d) 5

15. The sum of 6th and 7th terms of an A.P. is 39 and common difference is 3, then the first term of the A.P. is

   (a) 2   (b) −3

   (c) 4   (d) 3

LONG ANSWER TYPE QUESTIONS

16. Is $\sqrt{2}$, $\sqrt{8}$, $\sqrt{18}$, $\sqrt{32}$, _____ an A.P.? If yes, then find its next two terms.

17. Find an A.P. whose 2nd term is 10 and the 6th term exceeds the 4th term by 12.

18. Which term of the A.P. 41, 38, 35 _____ is the first negative term? Find the term also.

19. Nidhi saves Rs. 2 on day 1, Rs. 4 on day 2, Rs. 6 on day 3 and so on. How much money she save in month of Feb. 2011?

20. Find the number of terms in an A.P. whose first term and 6th term are 12 and 8 respectively and sum of all terms is 120.

21. How many two digits numbers between 6 and 102 are divisible by 6.

22. If s_n the sum of first n terms of an A.P. is given by $s_n = 3n^2 - 4n$, then find its nth term and common difference.

23. The sum of 4th and 8th terms of an A.P. is 24 and sum of 6th and 10th terms is 44. Find A.P.

24. Find the sum of odd positive integers between 1 and 199.

25. How many terms of the A.P. 22, 20, 18, _____ should be taken so that their sum is zero?

26. $4k + 8$, $2k^2 + 3k + 6$, $3k^2 + 4k + 4$ are the angles of a triangle. These form an A.P. Find value of k.

27. If 11 times of 11th term is equal to 17 times of 17th term of an A.P. find its 28th term.

28. Find an A.P. of 8 terms, whose first term is $\dfrac{1}{2}$ and last term is $\dfrac{17}{6}$.

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29. The fourth term of an A.P. is equal to 3 times the first term and the seventh term exceeds twice the third term by 1. Find the first term and common difference of the A.P.

30. Find the middle term of the A.P. 20, 16, 12, ..., −176.

31. If 2nd, 31st and last terms of on A.P. are $\dfrac{31}{4}$, $\dfrac{1}{2}$ and $-\dfrac{13}{2}$ respectively. Find the number of terms in the A.P.

32. Find the number of terms of the A.P. 57, 54, 51, _____ so that their sum is 570. Explain the double answer.

33. The sum of three numbers in A.P. is 24 and their product is 440. Find the numbers.

34. Find the sum of the first 40 terms of an A.P. whose n^{th} term is $3 - 2n$.

35. In an A.P., the first term is 2, the last term is 29 and the sum of the terms is 155. Find common difference 'd'.

36. If n^{th} term of an A.P. is 4, common difference is 2 and sum of n terms is −14, then find first term and the number of terms.

37. Find the sum of all the three digits numbers each of which leaves the remainder 3 when divided by 5.

38. The sum of first six terms of an A.P. is 42. The ratio of the 10th term to the 30th term is 1 : 3. Find first term and 11th term of the A.P.

39. The sum of n terms of two A.P.'s are in the ratio $3n + 8 : 7n + 15$. Find the ratio of their 12th terms.

40. The eight term of on A.P. is half the second term and the eleventh term exceeds one-third of its fourth term by 1. Find a_{15}.

41. The sum of first 8 terms of an A.P. is 140 and sum of first 24 terms is 996. Find the A.P.

42. The digits of a three digits positive number are in A.P. and the sum of digits is 15. On subtracting 594 from the number the digits are interchanged. Find the number.

43. A picnic group for Shimla consists of students whose ages are in A.P., the common difference being 3 months. If the youngest student Neeraj

is just 12 years old and the sum of ages of all students is 375 years. Find the number of students in the group.

44. The sum of first 20 terms of an A.P. is one third of the sum of next 20 terms. If first term is 1, then find the sum of first 30 terms.

45. The sum of first 16 terms of an A.P. is 528 and sum of next 16 terms is 1552. Find the first term and common difference of the A.P.

46. Kriti, starts a game and scores 200 points in the first attempt and she increases the points by 40 in each attempt. How many points will she score in the 30th attempt?

47. In an A.P. the sum of first ten terms is –150 and the sum of its next ten terms is –550. Find the A.P.

48. The first and the last term of an A.P. are 4 and 81 respectively. If common difference is 7. Find the number of terms and their sum.

49. The sum of 5th and 9th terms of an A.P. is 8 and their product is 15. Find the sum of first 28 terms of the A.P.

50. Pure and Ashu live in two different villages 165 km apart. They want to meet each other but there is no fast means of transport. Puru travels 15km the first day, 14 km the second day, 13 km the third day and so on. Ashu travels 10 km the first day, 12 km the second dry, 14 km the third day and so on. After how many days will they meet.

ANSWERS

1.	b	2.	b
3.	d	4.	b
5.	b	6.	c
7.	a	8.	d
9.	b	10.	b
11.	b	12.	c
13.	a	14.	b
15.	d	16.	Yes, $\sqrt{50}$, $\sqrt{72}$

17. 4, 10, 16, ...

18. 15th term, –1

19. Rs. 812

20. 12

21. 15

22. $6n - 7$, Common difference = 6

23. –13, –8, –3, 2 ....

24. 9800

25. 23

26. 0, 2

27. 0

28. $\dfrac{1}{2}, \dfrac{5}{6}, \dfrac{7}{6}$, ...

29. First term = 3, common difference = 2

30. –76, –80

31. 59

32. 19 or 20, {20th term is zero}

33. 5, 8, 11

34. –1520

35. 3

36. First term = – 8, Number of terms

37. 99090

38. First term = 2, 11th term = 22

39. 7 : 16

40. 3

41. 7, 10, 13, 16, ...

42. 852

43. 25 students

44. 450

45. First term = 3, Common difference = 4

46. 1360

47. 3, –1, –5 ....

48. 12, 510

49. 217, $7 \left\{ d = \pm \dfrac{1}{2} \right\}$

50. 6 days