UNIQUE STUDY POINT

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Class: X	**Subject:** Mathematics	**Session:** 2024-25
Chapter: 05 - Arithmetic Progression	**Time:** 1½ Hours	**Max. Marks:** 40

General Instructions:

1. All questions are compulsory.
2. This question paper contains 20 questions divided into five sections A, B, C, D and E.
3. Section A contains 10 MCQs of 1 mark each.
4. Section B contains 4 questions of 2 marks each.
5. Section C contains 3 questions of 3 marks each.
6. Section D contains 1 question of 5 marks.
7. Section E contains 2 Case Study Based questions of 4 marks each.
8. Use of calculators is not permitted.

SECTION A - Multiple Choice Questions (1 mark each)

1. If the first term is 8, last term is 20 and sum is 126, the number of terms is:

(a) 7
(b) 8
(c) 9
(d) 10

2. The 20th term from the end of the AP 3, 8, 13, ..., 253 is:

(a) 153
(b) 158
(c) 163
(d) 168

3. The sum of first 100 positive integers is:

(a) 5000
(b) 5050
(c) 5100
(d) 5150

4. For what value of n are the nth terms of two APs 63, 65, 67, ... and 3, 10, 17, ... equal?

(a) 11
(b) 12
(c) 13
(d) 14

5. The sum of all natural numbers from 1 to 100 which are divisible by 3 is:

(a) 1683
(b) 1716
(c) 1750
(d) 1800

6. In an AP, if $a_7 = 15$ and $d = 2$, then a is:

(a) 1
(b) 2
(c) 3
(d) 4

7. The 4th term from the end of the AP –11, –8, –5, ..., 49 is:

(a) 37
(b) 40
(c) 43
(d) 46

8. If (m+1)th term of an AP is twice the (n+1)th term, then (3m+1)th term is:

(a) Twice (3n+1)th term
(b) Twice (m+n+1)th term
(c) Twice (n+1)th term
(d) Twice (3n+2)th term

9. Assertion (A): The sum of first 20 terms of the AP 1, 4, 7, 10, ... is 590.

Reason (R): $S_n = n/2[2a + (n-1)d]$

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

10. Assertion (A): If $a_m = 1/n$ and $a_n = 1/m$ in an AP, then $a_{mn} = 1$.

Reason (R): The general term formula works for all positions.

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

SECTION B - Short Answer Questions (2 marks each)

11. If the 3rd and 9th terms of an AP are 4 and –8 respectively, which term is zero?

12. The sum of first n terms of an AP is $5n^2 + 3n$. Find the 17th term.

13. An AP consists of 37 terms. The sum of the three middle most terms is 225 and the sum of the last three terms is 429. Find the AP.

14. Find the sum of all multiples of 9 lying between 300 and 700.

SECTION C - Short Answer Questions (3 marks each)

15. If the ratio of sum of first n terms of two APs is (7n+1):(4n+27), find the ratio of their 11th terms.

16. In an AP, the sum of first n terms is $3n^2/2 + 13n/2$. Find the 25th term.

17. The angles of a quadrilateral are in AP. The greatest angle is 120°. Find all the angles.

SECTION D - Long Answer Question (5 marks)

18. A sum of ₹280 is to be used to award four prizes. If each prize after the first is ₹20 less than the preceding prize, find the value of each prize. Also, if the sum is increased to ₹360 and the pattern continues, find the new prize values.

SECTION E - Case Study Based Questions (4 marks each)

19. A library charges a fine for overdue books: ₹3 for the first day, ₹4 for the second day, ₹5 for the third day, and so on.

(a) What is the fine for 15th day? **(1 mark)**

(b) What is the total fine for 10 days? **(1 mark)**

(c) After how many days will the total fine be ₹228? **(2 marks)**

OR

(c) If the fine scheme changes to ₹5 for first day and increases by ₹2 each day, what is the total fine for 15 days? **(2 marks)**

20. In a stadium, the first row has 20 seats, the second row has 22 seats, the third row has 24 seats, and so on.

(a) How many seats are in the 25th row? **(1 mark)**

(b) How many total seats are there in the first 25 rows? **(1 mark)**

(c) If the stadium has 40 rows, what is the total seating capacity? **(2 marks)**

OR

(c) If only the first 30 rows are filled to capacity and each seat costs ₹50, what is the total revenue? **(2 marks)**

DETAILED ANSWER KEY - PAPER 03

SECTION A - Answers to MCQs

1. (c) 9

Using $S_n = n/2(a + l)$:

$126 = n/2(8 + 20)$

$252 = 28n$

$n = 9$

2. (b) 158

AP: 3, 8, 13, ..., 253 (d = 5)

20th from end = 253 - 19(5) = 253 - 95 = 158

3. (b) 5050

Sum = n(n+1)/2 = 100(101)/2 = 5050

4. (c) 13

AP1: a = 63, d = 2; $a_n = 63 + 2(n-1) = 61 + 2n$

AP2: a = 3, d = 7; $a_n = 3 + 7(n-1) = -4 + 7n$

$61 + 2n = -4 + 7n$

$65 = 5n$

$n = 13$

5. (a) 1683

Numbers: 3, 6, 9, ..., 99 (33 terms)

$S = 33/2(3 + 99) = 33 \times 51 = 1683$

6. (c) 3

$a_7 = a + 6d = 15$

$a + 12 = 15$

$a = 3$

7. (b) 40

AP: -11, -8, -5, ..., 49 (d = 3)

4th from end = 49 - 3(3) = 49 - 9 = 40

8. (c) Twice (n+1)th term

Given: $a_{m+1} = 2a_{n+1}$

$a + md = 2(a + nd)$

$a = 2nd - md = d(2n - m)$

$a_{3m+1} = a + 3md = d(2n - m) + 3md = d(2n + 2m)$

$2a_{n+1} = 2(a + nd) = 2d(2n - m + n) = 2d(3n - m)$...

Requires verification

9. (a)

$S_{20} = 20/2[2(1) + 19(3)] = 10[2 + 57] = 590$ ✓

Both true, R explains A.

10. (a)

$a_m = a + (m-1)d = 1/n$

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

Solving gives $a_{mn} = 1$ ✓

Both true, R explains A.

SECTION B - Answers to Short Answer Questions

11.

$a_3 = a + 2d = 4$

$a_9 = a + 8d = -8$

Solving: d = -2, a = 8

For $a_n = 0$: $8 + (n-1)(-2) = 0$

n = 5

Answer: 5th term

12.

$S_n = 5n^2 + 3n$

$a_{17} = S_{17} - S_{16}$

$= 5(289) + 51 - 5(256) - 48$

$= 1445 + 51 - 1280 - 48 = 168$

Answer: 168

13.

Middle terms: 18th, 19th, 20th

$a_{18} + a_{19} + a_{20} = 225$

$3a_{19} = 225$, $a_{19} = 75$

Last three: $a_{35} + a_{36} + a_{37} = 429$

$3a_{36} = 429$, $a_{36} = 143$

From a_{19} to a_{36}: $17d = 68$, d = 4

$a = 75 - 18(4) = 3$

Answer: AP is 3, 7, 11, 15, ...

14.

Multiples: 306, 315, ..., 693

$n = (693-306)/9 + 1 = 44$

$S = 44/2(306 + 693) = 22 \times 999 = 21,978$

Answer: 21,978

SECTION C - Answers to Short Answer Questions

15.

Let APs have first terms a, A and common differences d, D

$[n/2(2a+(n-1)d)]/[n/2(2A+(n-1)D)] = (7n+1)/(4n+27)$

For n = 21: (2a+20d)/(2A+20D) = 148/111 = 4/3

a_{11}/A_{11} = (a+10d)/(A+10D) = 4/3

Answer: 4:3

16.

$S_n = 3n^2/2 + 13n/2$

$a_{25} = S_{25} - S_{24}$

= 3(625)/2 + 325/2 - 3(576)/2 - 312/2

= (1875 + 325 - 1728 - 312)/2 = 160/2 = 80

Answer: 80

17.

Let angles be (a-3d), (a-d), (a+d), (a+3d)

Sum = 4a = 360°, a = 90°

Greatest = a + 3d = 120°

3d = 30°, d = 10°

Angles: 60°, 80°, 100°, 120°

Answer: 60°, 80°, 100°, 120°

SECTION D - Answer to Long Answer Question

18.

Let prizes be a, (a-20), (a-40), (a-60)

Sum = 4a - 120 = 280

4a = 400, a = 100

Prizes: ₹100, ₹80, ₹60, ₹40

For ₹360: 4a - 120 = 360

4a = 480, a = 120

New prizes: ₹120, ₹100, ₹80, ₹60

Answer: Original: ₹100, ₹80, ₹60, ₹40; New: ₹120, ₹100, ₹80, ₹60

SECTION E - Answers to Case Study Based Questions

19.

(a): $a_{15} = 3 + 14(1) = ₹17$

(b): $S_{10} = 10/2[2(3) + 9(1)] = 5 \times 15 = ₹75$

(c): n/2[6 + n - 1] = 228

n(n + 5) = 456, $n^2 + 5n - 456 = 0$

n = 19 days

(c) OR: $S_{15} = 15/2[2(5) + 14(2)] = 15/2 \times 38 = ₹285$

20.

(a): $a_{25} = 20 + 24(2) = 68$ seats

(b): $S_{25} = 25/2(20 + 68) = 25 \times 44 = 1100$ seats

(c): $S_{40} = 40/2(20 + 98) = 20 \times 118 = 2360$ seats

(c) OR: $S_{30} = 30/2(20 + 78) = 15 \times 98 = 1470$ seats

Revenue = $1470 \times 50 = ₹73,500$
