CHAPTER 5

Arithmetic Progression

1. OBJECTIVE QUESTIONS

1. If the sum of the series $2+5+8+11$ .... is 60100, then the number of terms are

(a) 100 (b) 200
(c) 150 (d) 250

Ans : (b) 200

Let, $S_n = 60100$

$$\frac{n}{2}[4+(n-1)3] = 60100$$
$$n(3n+1) = 120200$$
$$3n^2+n-120200 = 0$$
$$(n-200)(3n+601) = 0$$
$$n = 200$$
$$n = -\frac{601}{3} \quad (n \text{ can not be fraction})$$

2. If the common difference of an AP is 5, then what is $a_{18}-a_{13}$?

(a) 5 (b) 20
(c) 25 (d) 30

Ans : (c) 25

Given, the common difference of AP i.e., $d=5$

Now, $a_{18}-a_{13} = a+(18-1)d-[a+(13-1)d]$

$[\text{Since}, a_n = a+(n-1)d]$

$$= a+17\times 5-a-12\times 5$$
$$= 85-60 = 25$$

3. What is the common difference of four terms in A.P. such that the ratio of the product of the first fouth term to that of the second and third term is $2:3$ and the sum of all four terms is 20?

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

Ans : (d) 2

Take the four terms as $a-3x$, $a-x$, $a+x$, $a+3x$

The sum $= 4a = 20$

$$a = 5$$

Also, $3(a^2-(3x)^2) = 2(a^2-x^2)$

$$x = 1$$

However, the common difference is $2x$ and not x

When, $x = 1,\ d = 2x = 2$

4. There are 60 terms is an A.P. of which the first term is 8 and the last term is 185. The 31^{st} term is

(a) 56 (b) 94
(c) 85 (d) 98

Ans : (d) 98

Let d be the common difference;

Then 60^{th} term, $= 8+59d = 185$

$$59d = 177$$
$$d = 3$$

31^{th} term $= 8+30\times 3 = 98$

5. The first and last term of an A.P. are a and ℓ respectively. If S is the sum of all the terms of the A.P. and the common difference is $\frac{\ell^2-a^2}{k-(\ell+a)}$, then k is equal to

(a) S (b) $2S$
(c) $3S$ (d) None of these

Ans : (b) $2S$

We have, $S = \frac{n}{2}(a+\ell)$

$$\frac{2S}{a+\ell} = n \text{.......... (1)}$$

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

$$d = \frac{\ell-a}{n-1} = \frac{\ell-a}{\frac{2S}{a+\ell}-1}$$
$$= \frac{\ell^2-a^2}{2S-(\ell+a)}$$
$$k = 2S$$

6. The sum of 11 terms of an A.P. whose middle term is 30, is

(a) 320 (b) 330
(c) 340 (d) 350

Ans : (b) 330

$$S_n = \frac{n}{2}[2a+(n-1)d]$$
$$S_n = \frac{11}{2}(2a+10d) \quad \text{...(1)}$$

$$\text{Middle term} = a_6 = a + (n-1)d$$
$$a_6 = a + 5d$$
Also, $a_6 = 30$

Hence, $30 = a + 5d$
$$a = 30 - 5d$$
$$a = 30 - 5d$$
Putting value of a in eq^n (1):
$$S_{11} = \frac{11}{2}[2(30-5d)+10d]$$
$$S_{11} = \frac{11}{2}[60-10d+10d]$$
$$S_{11} = 11 \times 30$$
$$S_{11} = 330$$

7. There are four arithmetic means between 2 and -18. The means are

(a) $-4, -7, -10, -13$ (b) $1, -4, -7, -10$

(c) $-2, -5, -9, -13$ (d) $-2, -6, -10, -14$

Ans : (d) $-2, -6, -10, -14$

Let the means be X_1, X_2, X_3, X_4 and the common difference be b; then $2, X_1, X_2, X_3, X_4, -18$ are in A.P.;
$$-18 = 2 + 5b$$
$$5b = -20$$
$$b = -4$$
Hence, $X_1 = 2 + b = 2 + (-4) = -2;$
$$X_2 = 2 + 2b = 2 - 8 = -6$$
$$X_3 = 2 + 3b = 2 - 12 = -10$$
$$X_4 = 2 + 4b = 2 - 16 = -14$$
The required means are $-2, -6, -10, -14$.

8. If the nth term of an A.P. is given by $a_n = 5n - 3$, then the sum of first 10 terms if

(a) 225 (b) 245

(c) 255 (d) 270

Ans : (b) 245

Putt ing, $n = 1, 10$

we get, $a = 2$
$$l = 47$$
$$S_{10} = \frac{10}{2}(2+47) = 5 \times 49 = 245$$

9. Find the sum of the series 1+(1+2)+(1+2+3)+(1+2 +3+4)+...+(1+2+3+...+20)

(a) 1470 (b) 1540

(c) 1610 (d) 1370

Ans : (b) 1540

$$\text{Let } S = 1 + (1+2) + (1+2+3) + (1+2+3+4) + ... + (1+2+3+...+20)$$
$$= 1 + 3 + 6 + 10 + 15 + 21 + 28 + 36 + 45 + 55 + 66 + 78 + 91$$
$$+ 105 + 120 + 136 + 153 + 171 + 190 + 210$$
$$= 1540 \qquad \left[\text{Since}, 1+2+3+...+n = \frac{n(n+1)}{2}\right]$$
Hence, Four numbers in A.P. are 5, 10, 15 and 20.

10. An AP starts with a positive fraction and every alternate term is an integer. If the sum of the first 11 terms is 33, then the fourth term is

(a) 2 (b) 3

(c) 5 (d) 6

Ans : (a) 2

Given, $S_{11} = 33$
$$\frac{11}{2}[2a+10d] = 33 \Rightarrow a + 5d = 3$$
i.e., $a_6 = 3 \Rightarrow a_4 = 2$

[Since, Alternate terms are integers and the given sum is possible]

11. Five distinct positive integers are in a arithmetic progression with a positive common difference. If their sum is 10020, then the smallest possible value of the last term is

(a) 2002 (b) 2004

(c) 2006 (d) 2007

Ans : (c) 2006

Let the five integers be $a-2d$, $a-d$, a, $a+d$, $a+2d$.
Then, we have,
$$(a-2d)+(a-d)+a+(a+d)+(a+2d) = 10020$$
$$5a = 10020 \Rightarrow a = 2004$$
Now, as smallest possible value of d is 1.
Hence, the smallest possible value of $a + 2d$ is 2004+2 = 2006

12. In an AP, if $a = 3.5$, $d = 0$ and $n = 101$, then a_n will be

(a) 0 (b) 3.5

(c) 103.5 (d) 104.5

Ans : (b) 3.5

For an AP, $a_n = a + (n-1)d$
$$= 3.5 + (101-1) \times 0$$
[by given conditions]
$$= 3.5$$

13. The number of common terms to the two sequences 17, 21, 25, ..., 417 and 16, 21, 26, ..., 466 is

(a) 19 (b) 20

(c) 21 (d) 91

Ans : (b) 20

Common terms will be 21, 41, 61, ...
$$21 + (n-1)20 \le 417$$
$$n \le 20.8$$
$$n = 20$$

14. If the sum of the first $2n$ terms of 2, 5, 8, ... is equal to the sum of the first n terms of 57, 59, 61, ..., then n is equal to

(a) 10 (b) 12

(c) 11 (d) 13

Ans : (c) 11

Given, $\frac{2n}{2}\{2.2+(2n-1)3\} = \frac{n}{2}\{2.57+(n-1)2\}$

$$\text{or} \quad 2(6n+1) = 112+2n$$
$$\text{or} \quad 10n = 110$$
$$n = 11$$

15. Let T_r be the r^{th} term if an A.P. for $r = 1, 2, 3, ...$ If for some positive integers m, n we have $T_m = \frac{1}{n}$ and $T_n = \frac{1}{m}$, then T_{mn} equals

(a) $\frac{1}{mn}$ (b) $\frac{1}{m}+\frac{1}{n}$

(c) 1 (d) 0

Ans : (c) 1

Let, $T_m = a+(m-1)d = \frac{1}{n}$ ...(1)

and $T_n = a+(n-1)d = \frac{1}{m}$ ...(2)

On subtracting Eq. (2) from Eq. (1), we get

$$(m-n)d = \frac{1}{n}-\frac{1}{m} = \frac{m-n}{mn}$$
$$d = \frac{1}{mn}$$

Again, $T_{mn} = a+(mn-1)d$

$$= a+(mn-n+n-1)d$$
$$= a+(n-1)d+(mn-n)d$$
$$= T_n+n(m-1)$$
$$\frac{1}{mn} = \frac{1}{m}+\frac{(m-1)}{m} = 1$$

16. In an AP, if $d = -4$, $n = 7$ and $a_n = 4$, then a is equal to

(a) 6 (b) 7

(c) 20 (d) 28

Ans : (d) 28

In an AP, $a_n = a+(n-1)d$

$$4 = a+(7-1)(-4)$$

[by given conditions]

$$4 = a+6(-4)$$
$$4+24 = a$$
$$a = 28$$

17. If four numbers in A.P. are such that their sum is 50 and the greatest number is 4 times the least, then the numbers are

(a) 5, 10, 15, 20 (b) 4, 10, 16, 22

(c) 3, 7, 11, 15 (d) None of these

Ans : (a) 5, 10, 15, 20

Let the four numbers in A.P. be $a-3d$, $a-d$, $a+d$, $a+3d$.

Given, $(a-3d)+)(a-d)+(a+d)+(a+3d) = 50$

$$4a = 50$$
$$a = \frac{25}{2}$$

Greatest number $= 4 \times$ Least number

$$(a+3d) = 4\,(a-3d)$$
$$\left(\frac{25}{2}+3d\right) = 4\left(\frac{25}{2}-3d\right)$$
$$\frac{25}{2}+3d = 50-12d$$
$$15d = 50-\frac{25}{2} = \frac{75}{2}$$
$$d = \frac{5}{2}$$
$$a-3d = \frac{25}{2}-3\times\frac{5}{2}$$
$$= \frac{25}{2}-\frac{15}{2} = \frac{10}{2} = 5$$
$$a-d = \frac{25}{2}-\frac{5}{2} = \frac{20}{2} = 10$$
$$a+d = \frac{25}{2}+\frac{5}{2} = \frac{30}{2} = 15$$
$$a+3d = \frac{25}{2}+3\times\frac{5}{2}$$
$$= \frac{25}{2}+\frac{15}{2} = \frac{40}{2} = 20$$

18. The first four terms of an AP whose first term is -2 and the common difference is -2 are

(a) $-2, 0, 2, 4$ (b) $-2, 4, -8, 16$

(c) $-2, -4, -6, -8$ (d) $-2, -4, -8, -16$

Ans : (c) $-2, -4, -6, -8$

Let the first four terms of an AP are $a, a+d, a+2d$ and $a+3d$.

Given, that first term, $a = -2$ and common difference, $d = -2$, then we have an AP as follows

$$-2, -2-2, -2+2(-2), -2+3(-2)$$
$$= -2, -4, -6, -8$$

19. If the first, second and the last terms of an A.P. are a, b, c respectively, then the sum is:

(a) $\frac{(a+b)(a+c-2b)}{2(b-a)}$ (b) $\frac{(b+c)(a+b-2c)}{2(b-a)}$

(c) $\frac{(a+c)(b+c-2a)}{2(b-a)}$ (d) None of these

Ans : (c) $\frac{(a+c)(b+c-2a)}{2(b-a)}$

First term $= a$

Common differences $= b-a$

$$a_n = C$$
$$C = a+(n-1)(b-a)$$
$$\frac{C-a}{b-a} = n-1$$

$$\frac{C-a}{b-a}+1 = n$$

$$\frac{C-a+b-a}{b-a} = \frac{C+b-2a}{b-a} = n$$

$$S_n = \frac{11}{2}[a+a_n] = \frac{n}{2}[a+c]$$

$$= \frac{b+c-2a}{2\times(b-a)}(a+c)$$

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

20. The 21th term of an AP whose first two terms are -3 and 4, is

(a) 17 (b) 137

(c) 143 (d) -143

Ans : (b) 137

Given, first two terms of an AP are $a = -3$

and $a + d = 4$

$$-3+d = 4$$

Common difference, $d = 7$

$$a_{21} = a+(21-1)d$$

$$[\text{Since}, a_n = a+(n-1)d]$$

$$= -3+(20)7$$

$$= -3+140 = 137$$

21. The number of terms of the series 5, 7, 9, ... that must be taken in order to have the sum 1020 is

(a) 20 (b) 30

(c) 40 (d) 50

Ans : (b) 30

Let n number be taken in the series.

Given first term, $a = 5$

Common difference, $d = 7-5 = 2$

and Sum of n terms, $S_n = 1020$

We know that,

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

Putting above values in eq (1)

$$1020 = \frac{n}{2}[2\times 5+(n-1)2]$$

$$2040 = n[10+2n-2]$$

$$2040 = 10n+2n^2-2n$$

$$2040 = 2n^2+8n$$

$$1020 = n^2+4n$$

$$n^2+4n-1020 = 0$$

$$n^2+34n-30n-1020 = 0$$

$$n(n+34)-30(n+34) = 0$$

$$((n-30)(n+34) = 0$$

$$n = 30, -34$$

Negative term is neglected Hence, $n = 30$ number be taken in the series.

22. A circle with area A_1 is contained in the interior of a larger circle with area $A_1 + A_2$. If the radius of the larger circle is 3 and A_1, A_2 and $A_1 + A_2$ are in AP, then the radius of the smaller circle is

(a) 3 (b) $\sqrt{3}$

(c) 2 (d) $\sqrt{2}$

Ans : (b) $\sqrt{3}$

Let R and r be the radius of larger and smaller circle respectively.

We know that, Area of circle $= \pi \times (\text{Radius})^2$

Area of the larger circle be,

$$A_1+A_2 = \pi R^2 = \frac{22}{7}\times 3^2$$

$$= \frac{198}{7}\ [R=3] \quad ...(1)$$

Since, A_1 and A_2, $A_1 + A_2$ are in AP

$$2A_2 = A_1+(A_1+A_2) \Rightarrow A_2 = 2A$$

$$A_1+A_2 = A_1+2A_1$$

[adding both sides A_1]

$$A_1+A_2 = 3A$$

$$\frac{198}{7} = 3A_1 \quad \text{[From Eq. (1)\}}$$

$$A_1 = \frac{66}{7} \Rightarrow \pi r^2 = \frac{66}{7}$$

$$\frac{22}{7}\times r^2 = \frac{66}{7}$$

$$r^2 = 3 \Rightarrow r = \sqrt{3}$$

[Since, Radius cannot be negative]

23. The number of two digit numbers which are divisible by 3 is

(a) 33 (b) 31

(c) 30 (d) 29

Ans : (c) 30

Two digit numbers which are divisible by 3 are 12, 15, 18, ..., 99;

So, $99 = 12+(n-1)\times 3$

$$99-12 = 3n-3$$

$$99-12+3 = 3n$$

$$90 = 3n$$

$$n = 30$$

24. The sum of the series

$45^2-43^2+44^2-42^2+43^2-41^2$

$+42^2-40^2+$ ...upto 30 terms.

(a) 1110 (b) 2220

(c) 3330 (d) 4440

Ans : (b) 2220

Let $S = (45^2-43^2)+(44^2-42^2)+(43^2-41^2)$

$+(42^2-40^2)+$...upto 15 terms

$= (45+43)(45-43)+(44+42)(44-42)$

$+(43+41)(43-41)+(42+40)(42-40)$

$+$... upto 15 terms

$[\text{Since}, a^2-b^2 = (a-b)(a+b)]$

$= (45+43)2+(44+42)2+(43+41)2$

$+(42+40)2+$ ...upto 15 terms

$= 2[\{45+44+43+$ ..upto 15 terms$\}$

$\{+43+42+41+$ ...upto 15 terms$\}]$

$$= 2 \times \left[\frac{15}{2}\{2 \times 45 + (15-1)(-1)\} + \frac{15}{2}\{2 \times 43 + (15-1)(-1)\}\right]$$

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

$$= 2\left[\frac{15}{2}\{76\} + \frac{15}{2}\{72\}\right]$$

$$= 15(76 + 72)$$

$$= 15 \times 148 = 2220$$

Hence, the sum of the given series is 2220.

25. Take a point $A(3,4)$ on the graph and draw two lines from it, one is parallel to X-axis and another parallel to Y-axis. Again, take four points on both lines on both sides of A, such that their x-coordinates and y-coordinates form an AP with common difference 2. Then, the area of circle, passing through these four points is

(a) 12 sq units (b) 13 sq units
(c) 12.56 sq units (d) 13.56 sq units

Ans : (c) 12.56 sq units.

Given point is $A(3,4)$. The x-coordinate of A is 3. Since, the common difference is 2.

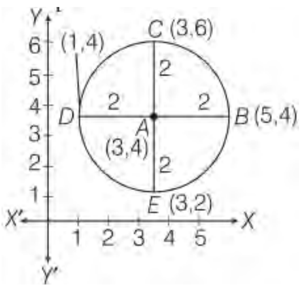
x-coordinates of the point before A is $(3-2)$, i.e. 1 and after A is $(3+2)$, i.e. 5.

$\Rightarrow D(1,4)$ and $B(5,4)$ are the required points.

The y-coordinates of A is 4. Since, the common difference is 2.

Hence, y-coordinates of the point above A is (4+2), i.e. 6 and below A is $(4-2)$ i.e. 2.

$\Rightarrow C(3,6)$ and $E(3,2)$ are the required points



A circle shown in the figure having centre $A(3,4)$ and passing through the points A, B, C and D.

Clearly, radius of circle is,

$$AB = 5 - 3$$
$$= 2 \text{ units.}$$

Hence, Area of circle $= \pi r^2 = 3.14 \times (2)^2$

$$= 3.14 \times 4$$
$$= 12.56 \text{ sq.units}$$

26. The sum of n terms of sequence $\frac{1}{1 \times 2}, \frac{1}{2 \times 3}, \frac{1}{3 \times 4}, \ldots$ is

(a) $\frac{1}{n+1}$ (b) $\frac{1}{n}$
(c) $\frac{n+1}{n}$ (d) $\frac{n}{n+1}$

Ans : (d) $\frac{n}{n+1}$

The sum of given sequence is $\frac{1}{1 \times 2} + \frac{1}{2 \times 3} + \frac{1}{3 \times 4} + \ldots$

Here, n^{th} term is $a_n = \frac{1}{n(n+1)} \Rightarrow a_n = \frac{1}{n} - \frac{1}{n+1}$

On putting $n = 1,2,3,\ldots n$ respectively, we get

$$a_1 = \frac{1}{1} - \frac{1}{2}$$
$$a_2 = \frac{1}{2} - \frac{1}{3}$$
$$a_3 = \frac{1}{3} - \frac{1}{4}$$
$$\vdots \quad \vdots \quad \vdots$$
$$a_n = \frac{1}{n} - \frac{1}{n+1}$$

On adding all terms, we get

$$S_n = a_1 + a_2 + \ldots + a_n$$
$$= \left(\frac{1}{1} - \frac{1}{2}\right) + \left(\frac{1}{2} - \frac{1}{3}\right) + \ldots + \left(\frac{1}{n} - \frac{1}{n+1}\right)$$
$$= \frac{1}{1} - \frac{1}{n+1} = \frac{n+1-1}{n+1}$$
$$= \frac{n}{n+1}$$

27. Suppose $b_1, b_2, \ldots, b_{24}$ are in AP, such that $b_1 + b_5 + b_{10} + b_{15} + b_{20} + b_{25} = 300$. Then the sum of first 24 terms of the AP is

(a) 1200 (b) 900
(c) 600 (d) 1500

Ans : (a) 1200

Let the first term and common difference of an AP be a and d, respectively.

Given, $b_1 + b_5 + b_{10} + b_{15} + b_{20} + b_{24} = 300$

$$a + (a + 4d) + (a + 9d) + (a + 14d) + (a + 19d) + (a + 23d) = 300$$

$$[\text{Since, } b_n = a + (n-1)d]$$

$$6a + 69d = 300 \Rightarrow 2a + 23d = 100 \quad \ldots(1)$$

Now, $S_{24} = \frac{24}{2}[2a + (24-1)d]$

from Eq. (1) $= 12[2a + 23d]$

$$= 12 \times 100 = 1200$$

28. If the nth term of an A.P. is $4n+1$, then the common difference is :

(a) 3 (b) 4
(c) 5 (d) 6

Ans : (b) 4

Given that the n^{th} term of an AP is $4n+1$.

Now, Put $n = 1, 2, 3, \ldots..$

$$a_1 = 4(1) + 1$$
$$a_1 = 5$$
$$a_2 = 4(2) + 1$$
$$a_2 = 9$$

Common difference,

$$d \ a_2 - a_1$$
$$d = 9 - 5$$
$$d = 4$$

29. If a, b, c, d, e, f are in A.P., then $e - c$ is equal to :

(a) $2(c-a)$ (b) $2(d-c)$
(c) $2(f-d)$ (d) $(d-c)$

Ans : (b) $2(d-c)$

Let x be the common difference of the A.P. a, b, c, d, e, f.

$$e = a+(5-1)x \quad [a_n = a+(n-1)d]$$

$$e = a+4x \quad ...(1)$$

and $$c = a+2x \quad ...(2)$$

Using equation (1) and (2), we get

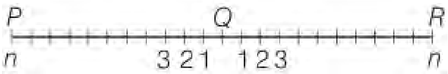
$$e-c = a+4x-a-2x$$

$$e-c = 2x = 2(d-c)$$

30. Along a road line, an odd number of stones placed at intervals of 10 m. These stones have to be assembled around the middle stone. A person can carry only one stone at a time. A man carried the job with one of the end stone by carrying them in succession. In carrying, all the stones he covered a distance of 3 km. Then, the total number of stones is

(a) 10 (b) 15
(c) 12 (d) 25

Ans : (d) 25



Let there are $(2n+1)$ stones. Middle stone is at Q. Then, there are n stones on one side of the middle stone and n stones on other side of the middle stone.
Let the man starts from P.
He picks the stone and travels to Q.

$$\text{Distance covered} = 10n$$

He comes back to pick the next stone and goes back to Q.

$$\text{Then, distance covered} = 10\times(n-1)+10\times(n-1)$$

$$= 2\times 10(n-1)$$

Similarly distance covered to pick the next stone and placed that stone at $Q = 2\times 10(n-2)$, and so on.
Now, total distance covered,

$$S_1 = 10\times n + 2\times 10(n-1)+2\times 10(n-2) + ...+\text{upto } n \text{ terms}$$

$$S_1\ [2\times 10n+2\times 10(n-1)+2\times 10(n-2) + ...+\text{upto } n \text{ terms}]-10n$$

$$= 20[n+(n-1)+(n-2)+...+\text{upto } n \text{ terms}]-10n$$

$$= 20\times\left[\frac{n}{2}\{2\times n+(n-1)(-1)\}\right]-10n$$

$$= 20\times\left[\frac{n}{2}(n+1)\right]-10n$$

$$= 10n^2+10n-10n = 10n^2$$

Now, in order to pick all the stones, total distance covered will be S_1+S_1+ Distance covered from Q to R
$= S_1+S_1+10n$
But it is given,

$$\text{total distance covered} = 3 \text{ km}$$

$$S_1+S_1+10n = 3000$$

$$[\text{Since}, 1\text{ km} = 100\text{m}]$$

$$2S_1+10n = 3000$$

$$20n^2+10n-3000 = 0$$

$$2n^2+n-300 = 0 \quad [\text{dividing by } 10]$$

$$2n^2+25n-24n+300 = 0$$

$$n(2n+25)-12(2n+25) = 0$$

$$(2n+25)(n-12) = 0$$

$$n = 12, \frac{-25}{2} \Rightarrow n = 12$$

[Since, n cannot be negative]
Hence, total number of stones

$$= 2n+1 = 2\times 12+1$$

$$= 25$$

31. If $S_1 = 3, 7, 11, 15 ...$upto 125 terms and $S_2 = 4, 7, 10, 13, 16, ...$ upto 125 terms, then how many terms are there in S_1 that are in S_2?

(a) 29 (b) 30
(c) 31 (d) 32

Ans : (c) 31

Common terms in S_1 and S_2 are 7, 19, 31, ...

$$\text{Last term (ie.. } 125^{\text{th}} \text{ term) of } S_1 = 3+124\times 4$$

$$= 499$$

$$\text{and, last term (i.e. } 125^{\text{th}} \text{ term) of } S_2 = 4+124\times 3$$

$$= 376$$

Hence, last common term will be less than or equal to 376. By hit and trial, we can find that the last common term is 367. Thus, we get the following common terms in S_1 and S_2, 7, 19, 31, ... 367, which forms an AP with first term $a = 7$, $d = 12$, $l = 367$.
Now, let there are n terms. Then

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

$$367 = 7+(n-1)12$$

$$360 = (n-1)12$$

$$n-1 = 30$$

$$n = 31$$

2. FILL IN THE BLANK

1. In a flower bed, there are 23 rose plants in the first row, 21 in the second, 19 in the third, and so on. There are 5 rose plants in the last row. Number of rows in the flower bed is ....

Ans : $n = 10$

2. In the sequence 5, 6, 7, 8 difference between two consecutive terms is ....

Ans : 1

3. 4, 10, 16, 22, ..., ...

Ans : 28, 34

4. In an AP, the letter d is generally used to denote the ....

Ans : common difference

5. 1, -1, -3, -5, ..., ...
Ans : -7, -9

6. The sum of n terms of an A.P. is $4n^2 - n$. The common difference = ...
Ans : 11 $[S_2 = 4(2)^2 - 2 \Rightarrow 14$
$S_1 = 4(1)^2 - 1 \Rightarrow 3$etc.]

7. 11^{th} term from last term of an A.P. 10, 7, 4 ...., -62, is ....
Ans : -32

8. If a and d are respectively the first term and the common difference of an AP, $a+10d$, denotes the .... term of the AP.
Ans : eleventh

9. If l and d are respectively the last term and the common difference of an AP, then $l-9d$ denotes the .... term of the AP.
Ans : tenth

10. If 1, 4, 9 form a sequence, the next term is ....
Ans : 25

11. An arithmetic progression is a list of numbers in which each term is obtained by .... a fixed number to the preceding term except the first term.
Ans : adding

12. Sum of $1+3+5+$ .... $+1999$ is ....
Ans : $\frac{1000}{2}[2(1)+(1000-1)2]$

13. If S_n denotes the sum of n term of an AP, then $S_{12} - S_{11}$ is the .... term of the AP.
Ans : twelfth

14. The nth term of an AP whose first term is a and common difference is d is ....
Ans : $a+(n-1)d$

15. The nth term of an AP is always a .... expression.
Ans : linear

16. The difference of corresponding terms of two A.P.'s will be ....
Ans : another A.P.

17. The sum of 8 A.Ms between 3 and 15 is ....
Ans : $72\left[8\left(\frac{3+15}{2}\right)\text{etc.}\right]$

18. The sum of the AP, 1 + 2 + ... + 10 is ....
Ans : 55

19. Sum of all the integers between 100 and 1000 which are divisible by 7 is ....
Ans : 70336 [Hint: $S = 105 + 112 +$ ....994 and $105+(n-1)7 = 994$ $\Rightarrow 105+7n-7 = 994$ $\Rightarrow n = 128$ etc.]

3. TRUE/FALSE

1. The general form of an A.P. is a, $a+d$, $a+2d$, $a+3d$, ...
Ans : True

2. If a, b, c are in AP, then $b = \frac{a-c}{2}$.
Ans : False

3. 0, 2, 0, 2, 0 is an AP.
Ans : False

4. In an Arithmetic progression, the first term is denoted by 'a' and 'd' is called the common difference.
Ans : True

5. The list of numbers $3, 3^2, 3^3, 3^4, ...$ forms an AP.
Ans : False

6. In an AP with first term a and common difference d, the nth term (or the general term) is given by $a_n = a+(n-1)d$.
Ans : True

7. Sequence 1, 4, 9, 16,... is an arithmetic progression.
Ans : False

8. If l is the last term, the nth term of the AP $= l+(n-1)(-d) = l-(n-1)d$.
Ans : True

9. The common difference of an AP can be zero or negative.
Ans : True

10. If ℓ is the last term of the finite AP, say the nth term, them the sum of all terms of the AP is given by:

$$S = \frac{n}{2}(a+\ell)$$

Ans : True

11. The balance money (in ₹) after paying 5% of the total loan of ₹1000 every month is 950, 900, 850, 800, ... 50. respresented A.P.
Ans : True

12. IN an AP the letter d is generally used to denote the first term.
Ans : False

13. 2, 4, 8, 16, ... is not an A.P.
Ans : True

14. The amount of money in the account of a person at the end of every year when the interest is calculated at 5% compound interest forms an AP.
Ans : False

15. 10^{th} term of A.P. 2, 7, 12, ... is 45.
Ans : False

16. Common difference of an AP may be positive, negative or zero.
Ans : True

17. 301 is a term of A.P. 5, 11, 17, 23, ...
Ans : False

18. If $a_{n+1} - a_n =$ same for all 'n', then the given numbers form an A.P.
Ans : True

19. If S_n of A.P. is $3n^2 + 2n$, then the first term of A.P. is 3.
Ans : False

20. If a, b, c are in AP then, $2a = b + c$.
Ans : False

4. MATCHING QUESTIONS

DIRECTION : Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in Column-I have to be matched with statements (p, q, r, s) in Column-II.

1.

	Column-I (A.P.)		Column-II (Common Difference)
(A)	$1, \frac{3}{2}, 2, \frac{5}{2}$, ...	(p)	-4
(B)	$\frac{1}{3}, \frac{5}{3}, \frac{9}{3}, \frac{13}{3}$, ...	(q)	0.2
(C)	1.8, 2.0, 2.2, 2.4	(r)	4/3
(D)	$0, -4, -8, -12$	(s)	1/2

Ans : (A) – s, (B) – r, (C) – q, (D) – p

(A) Common difference $= d = \frac{3}{2} - 1 = \frac{1}{2}$

(B) $d = \frac{5}{3} - \frac{1}{3} = \frac{4}{3}$

(C) $d = 2 - 1.8 = 0.2$

(D) $d = -4 - 0 = -4$

2.

	Column-I (A.P.)		Column-II (n^{th} term)
(A)	119, 136, 153, 170, ...	(p)	$13 - 3n$
(B)	7, 11, 15, 19, ...	(q)	$9 - 5n$
(C)	$4, -1, -6, -11$, ...	(r)	$3 + 4n$
(D)	10, 7, 4, 3	(s)	$17n + 102$

Ans : (A) – s, (B) – r, (C) – q, (D) – p

$$13 - 3n = 13 - 3(1) = 10$$
$$9 - 5n = 9 - 5(1) = 4$$
$$3 + 4n = 3 + 4(1) = 7$$
$$17n + 102 = 17(1) + 102 = 119$$

5. ASSERTION AND REASON

DIRECTION : In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

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

1. **Assertion :** Let the positive numbers a, b, c be in A.P., then $\frac{1}{bc}, \frac{1}{ac}, \frac{1}{ab}$ are also in A.P.
Reason : If each term of an A.P. is divided by abc, then the resulting sequence is also in A.P.
Ans : (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

2. **Assertion :** Common difference of the AP -5, -1, 3, 7, ... is 4.
Reason : Common difference of the AP $a, a+d, a+2d$, ... is given by $d =$ 2nd term-1st term.
Ans : (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Common difference, $d = -1 - 1(-5) = 4$
So, both A and R are correct and R explains A.

3. **Assertion :** Sum of first 10 terms of the arithmetic progression $-0.5, -1.0, -1.5$, ... is 27.5
Reason : Sum of n terms of an A.P. is given as $S_n = \frac{n}{2}[2a + (n-1)d]$ where $a =$ first term, $d =$ common difference.
Ans : (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
Both are correct. Reason is the correct reasoning for Assertion.

Assertion, $S_{10} = \frac{10}{2}[2(-0.5) + (10-1)(-0.5)]$
$= 5[-1 - 4.5]$
$= 5(-5.5) = 27.5$

4. **Assertion :** $a_n - a_{n-1}$ is not independent of n then the given sequence is an AP.
Reason : Common difference $d = a_n - a_{n-1}$ is constant

or independent of n.

Ans : (d) Assertion (A) is false but reason (R) is true.
Assertion is incorrect.
We have, common difference of an AP
$d = a_n - a_{n-1}$ is independent of n or constant.
So, A is correct but R is incorrect.

5. **Assertion :** The sum of the series with the nth term. $t_n = (9 - 5n)$ is (465), when no. of terms $n = 15$.
Reason : Given series is in A.P. and sum of n terms of an A.P. is $S_n = \frac{n}{2}[2a + (n-1)d]$

Ans : (d) Assertion (A) is false but reason (R) is true.

6. **Assertion :** Three consecutive terms $2k+1, 3k+3$ and $5k-1$ form an AP than k is equal to 6.
Reason : In an AP $a, a+d, a+2d, \dots\dots\dots,$ the sum to n terms of the AP be $S_n = \frac{n}{2}(2a+(n-1)d)$

Ans : (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

For $2k+1, 3k+3$ and $5k-1$ to form an AP

$$(3k+3) - (2k+1) = (5k-1) - (3k+3)$$
$$k + 2 = 2k - 4$$
$$2 + 4 = 2k - k = k$$
$$k = 6$$

So, both A and R are correct but R does not explain A.

7. **Assertion :** If n^{th} term of an A.P. is $7 - 4n$, then its common differences is -4.
Reason : Common difference of an A.P. is given by $d = a_{n+1} - a_n$.

Ans : (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Both are correct. Reason is the correct explanation.

Assertion, $\quad a_n = 7 - 4n$

$$d = a_{n+1} - a_n$$
$$= 7 - 4(n+1) - (7-4n)$$
$$= 7 - 4n - 4 - 7 + 4n = -4$$

8. **Assertion :** The sum of the first n terms of an AP is given by $S_n = 3n^2 - 4n$. Then its n th term $a_n = 6n - 7$.
Reason : n th term of an AP, whose sum to n terms is S_n, is given by $a_n = S_n - S_{n-1}$

Ans : (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

n th term of an AP be $\quad a_n = S_n - S_{n-1}$

$$a_n = 3n^2 - 4n - 3(n-1)^2 + 4(n-1)$$
$$a_n = 6n - 7$$

So, both A and R are correct and R explains A.

9. **Assertion :** If S_n is the sum of the first n terms of an A.P., then its n^{th} term a_n is given by $a_n = S_n - S_{n-1}$.
Reason : The 10^{th} term of the A.P. 5, 8, 11, 14, ... is 35.

Ans : (c) Assertion (A) is true but reason (R) is false.

$$a_{10} = a + 9d$$
$$= 5 + 9(3) = 5 + 27 = 32$$

10. **Assertion :** Common difference of an AP in which $a_{21} - a_7 = 84$ is 14.
Reason : n th term of AP is given by $a_n = a + (n-1)d$.

Ans : (d) Assertion (A) is false but reason (R) is true.
Assertion is incorrect.

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

$$a_{21} - a_7 = \{a + (21-1)d\} - \{a + (7-1)d\} = 84$$
$$a + 20d - a - 6d = 84$$
$$14d = 84$$
$$d = \frac{18}{14} = 6$$
$$d = 6$$

So, A is incorrect but R is correct

11. **Assertion :** Sum of first hundred even natural numbers divisible by 5 is 500.
Reason : Sum of first n-terms of an A.P. is given by $S_n = \frac{n}{2}[a + \ell]$ where $\ell =$ last term.

Ans : (d) Assertion (A) is false but reason (R) is true.
Assertion is incorrect.
Assertion : Even natural numbers divisible by 5 are 10, 20, 30, 40, ...
They form an A.P. with,

$$a = 10,\ d = 10$$
$$S_{100} = \frac{100}{2}[2(10) + 99(10)] = 50500$$

Reason is correct.

12. **Assertion :** Arithmetic between 8 and 12 is 10.
Reason : Arithmetic between two numbers 'a' and 'b' is given as $\frac{a+b}{2}$.

Ans : (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Both are correct and Reason is the correct explanation for the Assertion.