

SEQUENCE & PROGRESSION

1. If the sum of the first 40 terms of the series, $3+4+8+9+13+14+18+19+\dots$ is $(102)m$, then m is equal to :

(1) 20 (2) 5
 (3) 10 (4) 25
2. Let a_1, a_2, a_3, \dots be a G.P. such that $a_1 < 0$, $a_1 + a_2 = 4$ and $a_3 + a_4 = 16$. If $\sum_{i=1}^9 a_i = 4\lambda$, then λ is equal to :

(1) -171 (2) 171
 (3) $\frac{511}{3}$ (4) -513
3. Five numbers are in A.P., whose sum is 25 and product is 2520. If one of these five numbers is $-\frac{1}{2}$, then the greatest number amongst them is :

(1) $\frac{21}{2}$ (2) 27
 (3) 16 (4) 7
4. The greatest positive integer k , for which $49^k + 1$ is a factor of the sum $49^{125} + 49^{124} + \dots + 49^2 + 49 + 1$, is :

(1) 32 (2) 60
 (3) 63 (4) 65
5. If the 10th term of an A.P. is $\frac{1}{20}$ and its 20th term is $\frac{1}{10}$, then the sum of its first 200 terms is

(1) $50\frac{1}{4}$ (2) $100\frac{1}{2}$
 (3) 50 (4) 100
6. The sum, $\sum_{n=1}^7 \frac{n(n+1)(2n+1)}{4}$ is equal to _____.

7. The sum $\sum_{k=1}^{20} (1+2+3+\dots+k)$ is
8. If $x = \sum_{n=0}^{\infty} (-1)^n \tan^{2n} \theta$ and $y = \sum_{n=0}^{\infty} \cos^{2n} \theta$, for $0 < \theta < \frac{\pi}{4}$, then :

(1) $y(1+x) = 1$ (2) $x(1+y) = 1$
 (3) $y(1-x) = 1$ (4) $x(1-y) = 1$
9. Let a_n be the n^{th} term of a G.P. of positive terms. If $\sum_{n=1}^{100} a_{2n+1} = 200$ and $\sum_{n=1}^{100} a_{2n} = 100$, then $\sum_{n=1}^{200} a_n$ is equal to :

(1) 225 (2) 175
 (3) 300 (4) 150
10. The number of terms common to the two A.P.'s $3, 7, 11, \dots, 407$ and $2, 9, 16, \dots, 709$ is _____.
11. The product $2^{\frac{1}{4}} \cdot 4^{\frac{1}{16}} \cdot 8^{\frac{1}{48}} \cdot 16^{\frac{1}{128}} \cdot \dots$ to ∞ is equal to :

(1) $2^{\frac{1}{2}}$ (2) $2^{\frac{1}{4}}$
 (3) 2 (4) 1
12. If $|x| < 1$, $|y| < 1$ and $x \neq y$, then the sum to infinity of the following series $(x+y) + (x^2+xy+y^2) + (x^3+x^2y+xy^2+y^3) + \dots$

(1) $\frac{x+y-xy}{(1-x)(1-y)}$ (2) $\frac{x+y-xy}{(1+x)(1+y)}$
 (3) $\frac{x+y+xy}{(1+x)(1+y)}$ (4) $\frac{x+y+xy}{(1-x)(1-y)}$
13. The sum of the first three terms of a G.P. is S and their product is 27. Then all such S lie in :

(1) $[-3, \infty)$ (2) $(-\infty, 9]$
 (3) $(-\infty, -9] \cup [3, \infty)$ (4) $(-\infty, -3] \cup [9, \infty)$

14. If the sum of first 11 terms of an A.P., a_1, a_2, a_3, \dots is 0 ($a_1 \neq 0$), then the sum of the A.P., $a_1, a_3, a_5, \dots, a_{23}$ is ka_1 , where k is equal to :

(1) $\frac{121}{10}$ (2) $-\frac{72}{5}$
 (3) $\frac{72}{5}$ (4) $-\frac{121}{10}$

15. Let S be the sum of the first 9 terms of the series: $\{x + ka\} + \{x^2 + (k+2)a\} + \{x^3 + (k+4)a\} + \{x^4 + (k+6)a\} + \dots$ where $a \neq 0$ and $x \neq 1$.

If $S = \frac{x^{10} - x + 45a(x-1)}{x-1}$, then k is equal to :

(1) -5 (2) 1
 (3) -3 (4) 3

16. If the first term of an A.P. is 3 and the sum of its first 25 terms is equal to the sum of its next 15 terms, then the common difference of this A.P. is :

(1) $\frac{1}{4}$ (2) $\frac{1}{5}$
 (3) $\frac{1}{7}$ (4) $\frac{1}{6}$

17. If the sum of the series $20 + 19\frac{3}{5} + 19\frac{1}{5} + 18\frac{4}{5} + \dots$ upto n^{th} term is 488 and the n^{th} term is negative, then :

(1) n^{th} term is $-4\frac{2}{5}$ (2) $n = 41$
 (3) n^{th} term is -4 (4) $n = 60$

18. If m arithmetic means (A.Ms) and three geometric means (G.Ms) are inserted between 3 and 243 such that 4^{th} A.M. is equal to 2^{nd} G.M., then m is equal to _____.

19. If $1 + (1-2^2 \cdot 1) + (1-4^2 \cdot 3) + (1-6^2 \cdot 5) + \dots + (1-20^2 \cdot 19) = \alpha - 220\beta$, then an ordered pair (α, β) is equal to:

(1) (10, 97) (2) (11, 103)
 (3) (10, 103) (4) (11, 97)

20. Let a_1, a_2, \dots, a_n be a given A.P. whose common difference is an integer and $S_n = a_1 + a_2 + \dots + a_n$. If $a_1 = 1$, $a_n = 300$ and $15 \leq n \leq 50$, then the ordered pair (S_{n-4}, a_{n-4}) is equal to :

(1) (2480, 249) (2) (2490, 249)
 (3) (2490, 248) (4) (2480, 248)

21. The minimum value of $2^{\sin x} + 2^{\cos x}$ is :-

(1) $2^{-\frac{1}{\sqrt{2}}}$ (2) $2^{-1+\sqrt{2}}$
 (3) $2^{1-\sqrt{2}}$ (4) $2^{-1+\frac{1}{\sqrt{2}}}$

22. If $3^2 \sin 2\alpha - 1$, 14 and $3^4 - 2 \sin 2\alpha$ are the first three terms of an A.P. for some α , then the sixth term of this A.P. is :

(1) 66 (2) 65
 (3) 81 (4) 78

23. If $2^{10} + 2^9 \cdot 3^1 + 2^8 \cdot 3^2 + \dots + 2 \cdot 3^9 + 3^{10} = S - 2^{11}$, then S is equal to :

(1) $\frac{3^{11}}{2} + 2^{10}$ (2) $3^{11} - 2^{12}$
 (3) 3^{11} (4) $2 \cdot 3^{11}$

24. If the sum of the first 20 terms of the series $\log_{(7^{1/2})} x + \log_{(7^{1/3})} x + \log_{(7^{1/4})} x + \dots$ is 460, then x is equal to:

(1) $7^{46/21}$ (2) $7^{1/2}$
 (3) e^2 (4) 7^2

25. If the sum of the second, third and fourth terms of a positive term G.P. is 3 and the sum of its sixth, seventh and eighth terms is 243, then the sum of the first 50 terms of this G.P. is :

(1) $\frac{2}{13}(3^{50} - 1)$ (2) $\frac{1}{26}(3^{50} - 1)$
 (3) $\frac{1}{13}(3^{50} - 1)$ (4) $\frac{1}{26}(3^{49} - 1)$

26. If $f(x+y) = f(x)f(y)$ and $\sum_{x=1}^{\infty} f(x) = 2, x, y \in N$, where N is the set of all natural numbers, then

the value of $\frac{f(4)}{f(2)}$ is

(1) $\frac{1}{9}$

(2) $\frac{4}{9}$

(3) $\frac{1}{3}$

(4) $\frac{2}{3}$

27. Let a, b, c, d and p be any non zero distinct real numbers such that

$$(a^2 + b^2 + c^2)p^2 - 2(ab + bc + cd)p + (b^2 + c^2 + d^2) = 0. \text{ Then :}$$

(1) a, c, p are in G.P.

(2) a, c, p are in A.P.

(3) a, b, c, d are in G.P.

(4) a, b, c, d are in A.P.

28. The common difference of the A.P. b_1, b_2, \dots, b_m is 2 more than the common difference of A . P . .

a_1, a_2, \dots, a_n . If $a_{40} = -159, a_{100} = -399$ and $b_{100} = a_{70}$, then b_1 is equal to :

(1) -127

(2) -81

(3) 81

(4) 127

SOLUTION

1. NTA Ans. (1)

Sol. Sum of the 40 terms of

$$\begin{aligned}3 + 4 + 8 + 9 + 13 + 14 + 18 + 19 \dots \\= (3 + 8 + 13 + \dots \text{upto 20 term}) \\+ [4 + 9 + 15 + \dots \text{upto 20 terms}] \\= 10 [\{6 + 19 \times 5\} + \{8 + 19 \times 5\}] \\= 10 \times 204 = 20 \times 102\end{aligned}$$

2. NTA Ans. (1)

$$\begin{aligned}\text{Sol. } a_1 + a_2 = 4 \\r^2 a_1 + r^2 a_2 = 16 \\ \Rightarrow r^2 = 4 \Rightarrow r = -2 \quad \text{as } a_1 < 0 \\ \text{and } a_1 + a_2 = 4 \\ a_1 + a_1(-2) = 4 \Rightarrow a_1 = -4 \\ 4\lambda = (-4)\left(\frac{(-2)^9 - 1}{-2 - 1}\right) = (-4) \times \frac{513}{3} \\ \Rightarrow \lambda = -171\end{aligned}$$

3. NTA Ans. (3)

Sol. Let the A.P is

$$a - 2d, a - d, a, a + d, a + 2d$$

$$\therefore \text{sum} = 25 \Rightarrow a = 5$$

$$\text{Product} = 2520$$

$$(25 - 4d^2)(25 - d^2) = 504$$

$$4d^4 - 125d^2 + 121 = 0$$

$$\Rightarrow d^2 = 1, \frac{121}{4}$$

$$\Rightarrow d = \pm 1, \pm \frac{11}{2}$$

$d = \pm 1$ is rejected because none of the term

$$\text{can be } \frac{-1}{2}.$$

$$\Rightarrow d = \pm \frac{11}{2}$$

$$\Rightarrow \text{AP will be } -6, -\frac{1}{2}, 5, \frac{21}{2}, 16$$

Largest term is 16.

4. NTA Ans. (3)

$$\text{Sol. } 1 + 49 + 49^2 + \dots + 49^{12}$$

$$= (49)^{126} - 1 = (49^{63} + 1) \frac{(49^{63} - 1)}{(48)}$$

So greatest value of k = 63

5. NTA Ans. (2)

$$\text{Sol. } T_{10} = \frac{1}{20} = a + 9d \quad \dots(i)$$

$$T_{20} = \frac{1}{10} = a + 19d \quad \dots(ii)$$

$$a = \frac{1}{200} = d$$

$$\text{Hence, } S_{200} = \frac{200}{2} \left[\frac{2}{200} + \frac{199}{200} \right] = \frac{201}{2}$$

(2) Option

6. NTA Ans. (504)

$$\text{Sol. } \frac{1}{4} \left(\sum_{n=1}^7 2n^3 + \sum_{n=1}^7 3n^2 + \sum_{n=1}^7 n \right)$$

$$= \frac{1}{4} \left(2 \left(\frac{7 \times 8}{2} \right)^2 + 3 \left(\frac{7 \times 8 \times 15}{6} \right) + \frac{7 \times 8}{2} \right)$$

$$= 504$$

Ans. 504.00

7. NTA Ans. (1540.00)

$$\text{Sol. } \sum_{k=1}^{20} \frac{k(k+1)}{2} = \frac{1}{2} \sum_{k=1}^{20} \frac{k(k+1)(k+2) - (k-1)k(k+1)}{3}$$

$$= \frac{1}{6} \times 20 \times 21 \times 22 = 1540.00$$

8. NTA Ans. (3)

$$\text{Sol. } x = \sum_{n=0}^{\infty} (-1)^n \tan^{2n} \theta = 1 - \tan^2 \theta + \tan^4 \theta + \dots$$

$$\Rightarrow x = \cos^2 \theta$$

$$y = \sum_{n=0}^{\infty} \cos^{2n} \theta \Rightarrow y = 1 + \cos^2 \theta + \cos^4 \theta + \dots$$

$$\Rightarrow y = \frac{1}{\sin^2 \theta} \Rightarrow y = \frac{1}{1-x}$$

$$\Rightarrow y(1-x) = 1$$

9. NTA Ans. (4)

Sol. $\sum_{n=1}^{100} a_{2n+1} = 200 \Rightarrow a_3 + a_5 + a_7 + \dots + a_{201} = 200$

$$\Rightarrow ar^2 \frac{(r^{200}-1)}{(r^2-1)} = 200$$

$$\sum_{n=1}^{100} a_{2n} = 100 \Rightarrow a_2 + a_4 + a_6 + \dots + a_{200} = 100$$

$$\Rightarrow \frac{ar(r^{200}-1)}{(r^2-1)} = 100$$

On dividing $r = 2$

on adding $a_1 + a_3 + a_5 + \dots + a_{201} = 300$

$$\Rightarrow r(a_1 + a_2 + a_3 + \dots + a_{200}) = 300$$

$$\Rightarrow \sum_{n=1}^{200} a_n = 150$$

10. NTA Ans. (14)

Sol. Common term are : 23, 51, 79, T_n

$$T_n \leq 407 \Rightarrow 23 + (n-1)28 \leq 407$$

$$\Rightarrow n \leq 14.71$$

$$n = 14$$

11. NTA Ans. (1)

Sol. $2^{\frac{1}{4}} \cdot 4^{\frac{1}{16}} \cdot 8^{\frac{1}{48}} \cdot 16^{\frac{1}{128}} \cdot \dots \infty$

$$= 2^{\frac{1}{4}} \cdot 2^{\frac{2}{16}} \cdot 2^{\frac{3}{48}} \cdot 2^{\frac{4}{128}} \cdot \dots \infty$$

$$= 2^{\frac{1}{4}} \cdot 2^{\frac{1}{8}} \cdot 2^{\frac{1}{16}} \cdot 2^{\frac{1}{32}} \cdot \dots \infty$$

$$= 2^{\frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \dots \infty} = (2)^{\left(\frac{1/4}{1-1/2}\right)} = 2^{1/2}$$

12. Official Ans. by NTA (1)

Sol. $|x| < 1, |y| < 1, x \neq y$

$$(x+y) + (x^2 + xy + y^2) + (x^3 + x^2y + xy^2 + y^3) + \dots \dots$$

By multiplying and dividing $x - y$:

$$\frac{(x^2 - y^2) + (x^3 - y^3) + (x^4 - y^4) + \dots \dots}{x - y}$$

$$= \frac{(x^2 + x^3 + x^4 + \dots \dots) - (y^2 + y^3 + y^4 + \dots \dots)}{x - y}$$

$$= \frac{\frac{x^2}{1-x} - \frac{y^2}{1-y}}{x - y}$$

$$= \frac{(x^2 - y^2) - xy(x - y)}{(1-x)(1-y)(x - y)}$$

$$= \boxed{\frac{x + y - xy}{(1-x)(1-y)}}$$

13. Official Ans. by NTA (4)

Sol. Let three terms of G.P. are $\frac{a}{r}, a, ar$

$$\text{product} = 27$$

$$\Rightarrow a^3 = 27 \Rightarrow a = 3$$

$$S = \frac{3}{r} + 3r + 3$$

For $r > 0$

$$\frac{\frac{3}{r} + 3r}{2} \geq \sqrt{3^2} \quad (\text{By AM} \geq \text{GM})$$

$$\Rightarrow \frac{3}{r} + 3r \geq 6 \quad \dots(1)$$

$$\text{For } r < 0 \quad \frac{3}{r} + 3r \leq -6 \quad \dots(2)$$

From (1) & (2)

$$S \in (-\infty, -3] \cup [9, \infty]$$

14. Official Ans. by NTA (2)

Sol. $a_1 + a_2 + a_3 + \dots + a_{11} = 0$

$$\Rightarrow (a_1 + a_{11}) \times \frac{11}{2} = 0$$

$$\Rightarrow a_1 + a_{11} = 0$$

$$\Rightarrow a_1 + a_1 + 10d = 0$$

where d is common difference

$$\Rightarrow \boxed{a_1 = -5d}$$

$$a_1 + a_3 + a_5 + \dots + a_{23}$$

$$= (a_1 + a_{23}) \times \frac{12}{2} = (a_1 + a_1 + 22d) \times 6$$

$$= \left(2a_1 + 22 \left(\frac{-a_1}{5} \right) \right) \times 6$$

$$= -\frac{72}{5} a_1 \Rightarrow K = \frac{-72}{5}$$

15. Official Ans. by NTA (3)

Sol. $S = [x + ka + 0] + [x^2 + ka + 2a] + [x^3 + ka + 4a] + [x^4 + ka + 6a] + \dots, 9 \text{ terms}$
 $\Rightarrow S = (x + x^2 + x^3 + x^4 + \dots, 9 \text{ terms}) + (ka + ka + ka + \dots, 9 \text{ terms}) + (0 + 2a + 4a + 6a + \dots, 9 \text{ terms})$

$$\Rightarrow S = x \left[\frac{x^9 - 1}{x - 1} \right] + 9ka + 72a$$

$$\Rightarrow S = \frac{(x^{10} - x) + (9k + 72)a(x - 1)}{(x - 1)}$$

Compare with given sum, then we get, $(9k + 72) = 45$

$$\Rightarrow \boxed{k = -3}$$

16. Official Ans. by NTA (4)

Sol. Sum of 1st 25 terms = sum of its next 15 terms
 $\Rightarrow (T_1 + \dots + T_{25}) = (T_{26} + \dots + T_{40})$
 $\Rightarrow (T_1 + \dots + T_{40}) = 2(T_1 + \dots + T_{25})$
 $\Rightarrow \frac{40}{2} [2 \times 3 + (39d)] = 2 \times \frac{25}{2} [2 \times 2 + 24d]$

$$\Rightarrow d = \frac{1}{6}$$

17. Official Ans. by NTA (3)

Sol. $S = \frac{100}{5} + \frac{98}{5} + \frac{96}{5} + \frac{94}{5} + \dots, n$

$$S_n = \frac{n}{2} \left(2 \times \frac{100}{5} + (n-1) \left(-\frac{2}{5} \right) \right) = 188$$

$$n(100 - n + 1) = 488 \times 5$$

$$n^2 - 101n + 488 \times 5 = 0$$

$$n = 61, 40$$

$$T_n = a + (n-1)d = \frac{100}{5} - \frac{2}{5} \times 60$$

$$= 20 - 24 = -4$$

18. Official Ans. by NTA (39)

Sol. $3, A_1, A_2, \dots, A_m, 243$

$$d = \frac{243 - 3}{m + 1} = \frac{240}{m + 1}$$

Now $3, G_1, G_2, G_3, 243$

$$r = \left(\frac{243}{3} \right)^{\frac{1}{3+1}} = 3$$

$$\therefore A_4 = G_2$$

$$\Rightarrow a + 4d = ar^2$$

$$3 + 4 \left(\frac{240}{m + 1} \right) = 3(3)^2$$

$$m = 39$$

19. Official Ans. by NTA (2)

Sol. $1 + (1 - 2^2 \cdot 1) + (1 - 4^2 \cdot 3) + \dots + (1 - 20^2 \cdot 19)$

$$= \alpha - 220 \beta$$

$$= 11 - (2^2 \cdot 1 + 4^2 \cdot 3 + \dots + 20^2 \cdot 19)$$

$$= 11 - 2^2 \cdot \sum_{r=1}^{10} r^2 (2r - 1) = 11 - 4 \left(\frac{110^2}{2} - 35 \times 11 \right)$$

$$= 11 - 220(103)$$

$$\Rightarrow \alpha = 11, \beta = 103$$

20. Official Ans. by NTA (3)

Sol. $a_n = a_1 + (n - 1)d$

$$\Rightarrow 300 = 1 + (n - 1)d$$

$$\Rightarrow (n - 1)d = 299 = 13 \times 23$$

since, $n \in [15, 50]$

$\therefore n = 24$ and $d = 13$

$$a_{n-4} = a_{20} = 1 + 19 \times 13 = 248$$

$$\Rightarrow a_{n-4} = 248$$

$$S_{n-4} = \frac{20}{2} \{1 + 248\} = 2490$$

21. Official Ans. by NTA (1)

Sol. Use AM \geq GM

$$\Rightarrow \frac{2^{\sin x} + 2^{\cos x}}{2} \geq \sqrt{2^{\sin x} \cdot 2^{\cos x}}$$

$$\Rightarrow 2^{\sin x} + 2^{\cos x} \geq 2^{1+\left(\frac{\sin x + \cos x}{2}\right)}$$

$$\Rightarrow \min(2^{\sin x} + 2^{\cos x}) = 2^{1-\frac{1}{\sqrt{2}}}$$

22. Official Ans. by NTA (1)

Sol. Given that

$$34 - \sin 2\alpha + 3^2 \sin 2\alpha - 1 = 28$$

Let $3^2 \sin 2\alpha = t$

$$\frac{81}{t} + \frac{t}{3} = 28$$

$$t = 81, 3$$

$$3^2 \sin 2\alpha = 3^1, 3^4$$

$$2 \sin 2\alpha = 1, 4$$

$$\sin 2\alpha = \frac{1}{2}, 2 \text{ (rejected)}$$

First term $a = 3^2 \sin 2\alpha - 1$

$$a = 1$$

Second term = 14

\therefore common difference $d = 13$

$$T_6 = a + 5d$$

$$T_6 = 1 + 5 \times 13$$

$$T_6 = 66$$

23. Official Ans. by NTA (3)

Sol. $a = 2^{10}; r = \frac{3}{2}; n = 11$ (G.P.)

$$S' = (2^{10}) \frac{\left(\frac{3}{2}\right)^{11} - 1}{\frac{3}{2} - 1} = 2^{11} \left(\frac{3^{11}}{2^{11}} - 1\right)$$

$$S' = 3^{11} - 2^{11} = S - 2^{11} \text{ (Given)}$$

$$\therefore S = 3^{11}$$

24. Official Ans. by NTA (4)

Sol. $460 = \log_7 x \cdot (2 + 3 + 4 + \dots + 20 + 21)$

$$\Rightarrow 460 = \log_7 x \cdot \left(\frac{21 \times 22}{2} - 1\right)$$

$$\Rightarrow 460 = 230 \cdot \log_7 x$$

$$\Rightarrow \log_7 x = 2 \Rightarrow x = 49$$

25. Official Ans. by NTA (2)

Sol. Let first term = $a > 0$

Common ratio = $r > 0$

$$ar + ar^2 + ar^3 = 3 \quad \dots(i)$$

$$ar^5 + ar^6 + ar^7 = 243 \quad \dots(ii)$$

$$r^4(ar + ar^2 + ar^3) = 243$$

$$r^4(3) = 243 \Rightarrow r = 3 \text{ as } r > 0$$

from (1)

$$3a + 9a + 27a = 3$$

$$a = \frac{1}{13}$$

$$S_{50} = \frac{a(r^{50} - 1)}{(r - 1)} = \frac{1}{26}(3^{50} - 1)$$

26. Official Ans. by NTA (2)

Sol. $f(x+y) = f(x) \cdot f(y)$

$$\sum_{x=1}^{\infty} f(x) = 2 \text{ where } x, y \in \mathbb{N}$$

$$f(1) + f(2) + f(3) + \dots \infty = 2 \dots(1) \text{ (Given)}$$

Now for $f(2)$ put $x = y = 1$

$$f(2) = f(1+1) = f(1) \cdot f(1) = (f(1))^2$$

$$f(3) = f(2+1) = f(2) \cdot f(1) = (f(1))^3$$

Now put these values in equation (1)

$$f(1) + (f(1))^2 + [f(1)]^2 + \dots \infty = 2$$

$$\frac{f(1)}{1-f(1)} = 2$$

$$\Rightarrow f(1) = \frac{2}{3}$$

$$\text{Now } f(2) = \left(\frac{2}{3}\right)^2$$

$$f(4) = \left(\frac{2}{3}\right)^4$$

then the value of $\frac{f(4)}{f(2)} = \frac{\left(\frac{2}{3}\right)^4}{\left(\frac{2}{3}\right)^2} = \frac{4}{9}$

27. Official Ans. by NTA (3)

Sol. $(a^2 + b^2 + c^2)p^2 + 2(ab + bc + cd)p + b^2 + c^2 + d^2 = 0$
 $\Rightarrow (a^2p^2 + 2abp + b^2) + (b^2p^2 + 2bcp + c^2) + (c^2p^2 + 2cdp + d^2) = 0$
 $\Rightarrow (ab + b)^2 + (bp + c)^2 + (cp + d)^2 = 0$
 This is possible only when
 $ap + b = 0$ and $bp + c = 0$ and $cp + d = 0$

$$p = -\frac{b}{a} = -\frac{c}{b} = -\frac{d}{c}$$

$$\text{or } \frac{b}{a} = \frac{c}{b} = \frac{d}{c}$$

$\therefore a, b, c, d$ are in G.P.

28. Official Ans. by NTA (2)

Sol. $a_1, a_2, \dots, a_n \rightarrow (CD = d)$
 $b_1, b_2, \dots, b_m \rightarrow (CD = d + 2)$
 $a_{40} = a + 39d = -159$
 $\dots(1)$

$$a_{100} = a + 99d = -399$$
 $\dots(2)$

$$\text{Subtract : } 60d = -240 \Rightarrow d = -4$$

using equation (1)

$$a + 39(-4) = -159$$

$$a = 156 - 159 = -3$$

$$a_{70} = a + 69d = -3 + 69(-4) = -279 = b_{100}$$

$$b_{100} = -279$$

$$b_1 + 99(d + 2) = -279$$

$$b_1 - 198 = -279 \Rightarrow b_1 = -81$$