

PROGRESSIONS-I ①

Arithmetic Progression up to n th term

Class: VIII, Mathematics

SOLUTIONS

TEACHING TASKS

01. a, b, c AP $\rightarrow 2b = a + c$

$$\begin{aligned} a^3 + c^3 - 8b^3 &= a^3 + c^3 - (2b)^3 \\ &= a^3 + c^3 - (a+c)^3 \\ &= a^3 + c^3 - [a^3 + c^3 + 3ac(a+c)] \\ &= -3ac(2b) \\ &= -6abc \end{aligned}$$

Ans: D

02. a, q, c AP $\Rightarrow 2q = a + c$

$$\Rightarrow \frac{1}{p} + \frac{1}{r} = \frac{2}{q} \quad \text{Since } \frac{1}{p}, q, \frac{1}{r} \rightarrow \text{AP}$$
$$a, \frac{1}{p}, c \rightarrow \text{AP}$$

Ans: B

03. $F(n+1) = \frac{2F(n)+1}{2}$ Given $F(1) = 2$

$$F(1+1) = \frac{2F(1)+1}{2} = \frac{2(2)+1}{2} = \frac{5}{2} \quad \therefore F(2) = \frac{5}{2}$$

$$F(2+1) = \frac{2F(2)+1}{2} = \frac{2 \cdot \frac{5}{2} + 1}{2} = 3$$

$$\therefore F(1), F(2), F(3) \dots$$
$$2, \frac{5}{2}, 3, \dots \quad \text{one in } p$$

$$a=2, \quad d=\frac{1}{2} \quad \left| \quad F(101) = a + 100d = 2 + \frac{1}{2} \times 100 = 52$$

Ans: B



04. $a_3 + a_5 + a_8 = 11$

(2)

$$\Rightarrow (a+2d) + (a+4d) + (a+7d) = 11$$

$$\Rightarrow 3a + 13d = 11 \rightarrow (1)$$

$$a_2 + a_4 = -2$$

$$\Rightarrow a+d + a+3d = -2$$

$$\Rightarrow 2a + 4d = -2$$

$$\Rightarrow a + 2d = -1 \rightarrow (2)$$

$$(1) \Rightarrow 3(-1-2d) + 13d = 11$$

$$\Rightarrow -3 - 6d + 13d = 11$$

$$\Rightarrow -3 + 7d = 11$$

$$\Rightarrow 7d = 14 \Rightarrow \boxed{d=2}$$

$$(2) \Rightarrow a + 2(2) = -1$$

$$\Rightarrow \boxed{a=-5}$$

$$\begin{aligned} \text{Now, } a_1 + a_6 + a_7 &= a + a + 5d + a + 6d \\ &= 3a + 11d \\ &= 3(-5) + 11(2) \\ &= 7 \end{aligned}$$

Ans: C

05 $4x^2 + 9y^2 + 16z^2 - 6xy - 12yz - 8zx = 0$

$$\Rightarrow 8x^2 + 18y^2 + 32z^2 - 12xy - 24yz - 16zx = 0 \quad (\because \times 2)$$

$$\Rightarrow (2x-3y)^2 + (3y-4z)^2 + (4z-2x)^2 = 0$$

$$\Rightarrow 2x-3y=0, 3y-4z=0, 4z-2x=0$$

$$\Rightarrow 2x = 3y = 4z$$

$$\Rightarrow x = \frac{k}{2}, y = \frac{k}{3}, z = \frac{k}{4}$$

$$\therefore \frac{1}{2}, \frac{1}{3}, \frac{1}{4} = \frac{2}{12}, \frac{3}{12}, \frac{4}{12}$$

$\rightarrow AP$

Ans: A

06

(3)

$$\begin{aligned}
& \frac{1}{a_1 a_2} + \frac{1}{a_2 a_3} + \dots + \frac{1}{a_n a_{n+1}} \\
&= \frac{1}{d} \left(\frac{1}{a_1} - \frac{1}{a_2} + \frac{1}{a_2} - \frac{1}{a_3} + \dots + \frac{1}{a_n} - \frac{1}{a_{n+1}} \right) \\
&= \frac{1}{d} \left(\frac{1}{a_1} - \frac{1}{a_{n+1}} \right) \\
&= \frac{1}{d} \left(\frac{1}{a} - \frac{1}{a+nd} \right) \\
&= \frac{1}{d} \left(\frac{a+nd-a}{a(a+nd)} \right) = \frac{n}{a(a+nd)} = \frac{n}{a_1 \cdot a_{n+1}}
\end{aligned}$$

Ans: D

07

$$t_p = a \mid t_q = b, \mid t_r = c$$

$$\Rightarrow x + (p-1)y = a \mid x + (q-1)y = b \mid x + (r-1)y = c$$

$$\text{Now } a(q-r) + b(r-p) + c(p-q)$$

$$= \sum a(q-r)$$

$$= \sum a \left[\left(\frac{b-a}{y} + 1 \right) - \left(\frac{c-a}{y} + 1 \right) \right]$$

$$= \sum a \left[\frac{b-c}{y} \right]$$

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

$$= \frac{0}{y}$$

$$= 0$$

Ans: A

Q8 a, b, c, d, e form an AP.
 let $a=1, b=2, c=3, d=4, e=5$

(4)

$$\begin{aligned} \text{Now } a-4b+6c-4d+e \\ = 1-4(2)+6(3)-4(4)+5 \\ = 1-8+18-16+5 \\ = 0 \end{aligned}$$

Ans: C

Q9. We observe

$$a_1 + a_{2n} = a + a + (2n-1)d = 2a + (2n-1)d$$

$$a_2 + a_{2n-1} = a + d + a + (2n-2)d = 2a + (2n-2)d$$

$$\therefore \text{let } a_1 + a_{2n} = a_2 + a_{2n-1} = \dots = a_n + a_{n+1} = K$$

$$K \left[\frac{1}{\sqrt{a_1} + \sqrt{a_2}} + \frac{1}{\sqrt{a_2} + \sqrt{a_3}} + \dots + \frac{1}{\sqrt{a_n} + \sqrt{a_{n+1}}} \right]$$

$$= K \left[\frac{\sqrt{a_1} - \sqrt{a_2}}{-d} + \frac{\sqrt{a_2} - \sqrt{a_3}}{-d} + \dots + \frac{\sqrt{a_n} - \sqrt{a_{n+1}}}{-d} \right]$$

$$= K \left[\frac{\sqrt{a_1} - \sqrt{a_{n+1}}}{-d} \right] = K \left[\frac{a_1 - a_{n+1}}{-d} \times \frac{1}{\sqrt{a_1} + \sqrt{a_{n+1}}} \right]$$

$$= K \left[\frac{a - a - (n-1)d}{-d(\sqrt{a_1} + \sqrt{a_{n+1}})} \right]$$

$$= \frac{K(n)}{\sqrt{a_1} + \sqrt{a_{n+1}}} = \frac{n[2a + (2n-1)d]}{\sqrt{a_1} + \sqrt{a_{n+1}}}$$

$$= \frac{n[a_1 + a_{2n}]}{\sqrt{a_1} + \sqrt{a_{n+1}}}$$

Ans: B

10

$$3 + 7 + \textcircled{11} + \dots$$

$$d = 7 - 3 = 4$$

(5)

$$1 + 6 + \textcircled{11} + \dots$$

$$d = 6 - 1 = 5$$

$$\text{L.C.M of } \{4, 5\} = 20$$

$$10^{\text{th}} \text{ Common term} = \text{first common term} + (10-1) \times$$

$$\text{L.C.M of } \{4, 5\}$$

$$= 11 + 9 \times 20$$

$$= 191$$

Ans: A

11.

$$\frac{1}{\sqrt{2} + \sqrt{5}} + \frac{1}{\sqrt{5} + \sqrt{8}} + \frac{1}{\sqrt{8} + \sqrt{11}} + \dots, n \text{ terms}$$

$$\text{Now, } 2, 5, 8, \dots \text{ AP} \Rightarrow t_n = 2 + (n-1)3$$

$$= 3n - 1$$

$$5, 8, 11, \dots \text{ AP} \Rightarrow t_n = 5 + (n-1)3$$

$$= 3n + 2$$

$$\therefore \frac{1}{\sqrt{2} + \sqrt{5}} + \frac{1}{\sqrt{5} + \sqrt{8}} + \dots + \frac{1}{\sqrt{3n-1} + \sqrt{3n+2}}$$

$$= \frac{\sqrt{2} - \sqrt{5}}{-3} + \frac{\sqrt{5} - \sqrt{8}}{-3} + \dots + \frac{\sqrt{3n-1} - \sqrt{3n+2}}{-3}$$

$$= \frac{\sqrt{2} - \sqrt{3n+2}}{-3} = \frac{\sqrt{3n+2} - \sqrt{2}}{3} \rightarrow \text{opt A}$$

$$\frac{\sqrt{3n+2} - \sqrt{2}}{3} \times \frac{\sqrt{3n+2} + \sqrt{2}}{\sqrt{3n+2} + \sqrt{2}} = \frac{3n+2-2}{3(\sqrt{3n+2} + \sqrt{2})} = \frac{n}{\sqrt{2+3n} + \sqrt{2}}$$

$$\text{Since } n < \sqrt{2+3n} + \sqrt{2}$$

$$\therefore \frac{n}{\sqrt{2+3n} + \sqrt{2}} < n$$

Ans: A, B, C



$$12. \quad \begin{array}{l} a_1 + a_3 + a_5 = -12 \\ \Rightarrow a + a + 2d + a + 4d = -12 \\ \Rightarrow 3a + 6d = -12 \\ \Rightarrow a + 2d = -4 \rightarrow (1) \end{array} \quad \begin{array}{l} a_1 \cdot a_3 \cdot a_5 = 80 \quad (6) \\ \Rightarrow a(a+2d)(a+4d) = 80 \\ \Rightarrow a(-4)(a+4d) = 80 \\ \Rightarrow a(a+4d) = -20 \\ \rightarrow (2) \end{array}$$

$$(2) \Rightarrow a(a+8-2a) = -20 \quad \text{Since } 4d = -8-2a$$

$$\Rightarrow a(-8-a) = -20$$

$$\Rightarrow a(a+8) = 20$$

$$\Rightarrow \boxed{a=2}$$

$$\text{Now } (1) \Rightarrow a+2d = -4$$

$$\Rightarrow 2+2d = -4$$

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

$$\text{Now A) } a_1 = 2$$

$$B) a_2 = a+d = 2-3 = -1$$

$$C) a_3 = a+2d = 2+2(-3) = 2-6 = -4$$

$$D) a_5 = a+4d = 2+4(-3) = 2-12 = -10$$

Ans: B, C

$$13. \quad \text{Let } t_l = p, \quad t_m = q, \quad t_n = r$$

$$\Rightarrow a+(l-1)d = p \quad a+(m-1)d = q \quad a+(n-1)d = r$$

$$\Rightarrow \text{Now } \frac{r-q}{q-p} = \frac{[a+(n-1)d] - [a+(m-1)d]}{[a+(m-1)d] - [a+(l-1)d]} = \frac{n-m}{m-l},$$

which is a rational number since $l, m, n \in \mathbb{Z}^+$

Now $\sqrt{2}, \sqrt{3}, \sqrt{5} \Rightarrow \frac{\sqrt{3}-\sqrt{2}}{\sqrt{5}-\sqrt{3}}$ is not a rational number.

Hence Both the statements are true

Ans: A

14

Statement I: $9 \times t_9 = 4 \times t_4$

(7)

$$\Rightarrow 9(a+8d) = 4(a+3d)$$

$$\Rightarrow 9a + 72d = 4a + 12d$$

$$\Rightarrow 5a + 60d = 0$$

$$\Rightarrow a + 12d = 0$$

$$\Rightarrow t_{13} = 0$$

(True)

Ans: A

Statement II: Conceptual (True)

15

2, 5, 8, 11, ... 59

here $a=2$, $d=3$, $l=59$

$$\begin{aligned} 5^{\text{th}} \text{ term from the end} = t_5 &= l - (m-1)d \\ &= 59 - (5-1) \times 3 \\ &= 59 - 12 \\ &= 47 \end{aligned}$$

Ans: B

16. $1, \frac{5}{2}, 4, \frac{11}{2}, \dots 28$ here $a=1$, $d=\frac{3}{2}$, $l=28$, $m=10$

$$\therefore t_m = l - (m-1)d$$

$$\begin{aligned} t_{10} &= 28 - (10-1) \times \frac{3}{2} \\ &= 28 - \frac{27}{2} \end{aligned}$$

$$= \frac{29}{2}$$

Ans: C

17 Given $20, 19\frac{1}{4}, 18\frac{1}{2}, 17\frac{3}{4}, \dots$

(8)

$$= 20, \frac{77}{4}, 18\frac{1}{2}, \dots$$

$$a = 20, d = \frac{77}{4} - 20 = -\frac{3}{4}$$

$$\text{now, } t_n = a + (n-1)d \\ = 20 + (n-1)\left(-\frac{3}{4}\right)$$

$$= -\frac{3n}{4} + \frac{83}{4} < 0$$

$$\Rightarrow 3n > 83$$

$$\Rightarrow n > \frac{83}{3}$$

$$\Rightarrow n > 27. \dots$$

$$\Rightarrow n \geq 28$$

Ans. A

18 $a = 4, t_9 = 20$
 $a + 8d = 20$
 $\Rightarrow 4 + 8d = 20$
 $\Rightarrow d = 2$

$$t_{15} = a + 14d \\ = 4 + 14(2) \\ = 32$$

Ans. D

19 The numbers which are divisible by 9 between 1 and 1000 is 9, 18, $\dots$ 999.

$$\text{here } a = 9, d = 9$$

$$: l = a + (n-1)d$$

$$999 = 9 + (n-1) \times 9$$

$$\Rightarrow 111 = 1 + n - 1$$

$$\Rightarrow \boxed{n = 111}$$

Ans: 111

20

Given a, b, c, d are distinct integers in A.P. (9)
 let x be the common difference.

$$\text{Now } a = a, b = a + x, c = a + 2x, d = a + 3x$$

$$\text{Given } d = a^2 + b^2 + c^2$$

$$\Rightarrow a + 3x = a^2 + (a+x)^2 + (a+2x)^2$$

$$\Rightarrow a + 3x = 3a^2 + 6ax + 5x^2$$

$$\Rightarrow 5x^2 + (6a-3)x + 3a^2 - a = 0 \rightarrow (1)$$

This is a Q.E. in x

$$\therefore x = \frac{-(6a-3) \pm \sqrt{(6a-3)^2 - 4 \cdot 5 (3a^2 - a)}}{2 \times 5}$$

$$\Rightarrow x = \frac{-(6a-3) \pm \sqrt{-24a^2 - 16a + 9}}{10}$$

$$\text{We have } -24a^2 - 16a + 9 \geq 0$$

$$\Rightarrow 24a^2 + 16a - 9 \leq 0$$

$$\Rightarrow -\frac{1}{3} - \frac{\sqrt{70}}{3} \leq a \leq -\frac{1}{3} + \frac{\sqrt{70}}{12}$$

$$\Rightarrow a = -1, 0 \quad (\text{since } a \in \mathbb{Z})$$

$$\textcircled{1} \Rightarrow \text{when } a = 0 \quad (1) \Rightarrow 5x^2 - 3x = 0$$

$$\Rightarrow x = 0, \frac{3}{5} \quad (\text{Not possible})$$

$$\text{When } \boxed{a = -1} \quad (1) \Rightarrow 5x^2 - 9x + 4 = 0$$

$$\Rightarrow x = 1, \frac{4}{5} \Rightarrow \boxed{x = 1}$$

$$\therefore a + b + c + d = -1 + 0 + 1 + 2 = 2$$

Ans: 2



21

a) $-2, 0, 2, 4, \dots$

$$a = -2, d = 2$$

$$\therefore t_{20} = a + 19d = -2 + 38 = 36$$

b) $t_{19} = a + 18d$

c) $1, \frac{3}{2}, 2, \frac{5}{2}, \dots, t_{17}$

$$a = 1, d = \frac{1}{2} \quad \therefore t_{17} = a + 16d = 1 + 16\left(\frac{1}{2}\right) = 9$$

d) $14, 12, 10, \dots$

$$a = 14, d = -2$$

$$\therefore t_{20} = a + 19d = 14 + 19(-2) = -24$$

Ans: t, r, s, v

~~22 a) $1, -\frac{1}{2}, 2, \dots, -26$~~

~~$a = 1, d = -\frac{3}{2}$~~

~~$\therefore t_{15} = a + 14d = 1 + 14\left(-\frac{3}{2}\right) = -20$~~

22 a) $1, -\frac{1}{2}, 2, \dots, -26$

$$a = 1, d = -\frac{3}{2}, l = -26, m = 15$$

$$t_m = l - (m-1)d = -26 - (15-1)\left(-\frac{3}{2}\right) = -5$$

b) $t_{18} = a + 17d = a - d + 17d = a + 16d$

c) $t_{12} = a + 11d = 0.1 + 11(0.01) = 0.21$

d) $t_{10} = a + 9d = \sqrt{2} + 9\sqrt{2} = 10\sqrt{2}$

Ans: p, q, r, s

LEARNERS TASK

(11)

CUQ'S

01. All the given terms form a sequence. Ans: D
02. All the given terms form a series. Ans: D
03. m^{th} term from the end = $(n-m+1)^{\text{th}}$ term from the beginning. Ans: A
04. P, Q, R AP $\Rightarrow 2Q = P + R$
 $\Rightarrow Q = \frac{P+R}{2}$ Ans: D
05. Need not be in A.P. Ans: B
06. Common difference = $d + K$ Ans: A
07. $t_m = n, t_n = m \Rightarrow a + (m-1)d = n$
 $a + (n-1)d = m$
 ~~$t_{m+n} = a + (m+n-1)d$~~
 $= 0$
07. Change the question as follows
If m times the n^{th} term is equal to n times the m^{th} term, then $t_{m+n} = 0$
Given $m t_n = n t_m \Rightarrow m(a + (n-1)d) = n(a + (m-1)d)$
 $\Rightarrow a + (m+n-1)d = 0$
 $\Rightarrow t_{m+n} = 0$
- Ans: A

08 All the given statements are true ⁽¹²⁾ Ans: D

09 Common difference = Kd Ans: C

10 $t_n = 2n + 3$
 $t_{10} = 2(10) + 3 = 23$ Ans: B

JEE MAINS LEVEL

01. $t_n = 2n + 5$ | $t_4 = 2(4) + 5 = 13$
 $t_2 = 2(2) + 5 = 9$ | $t_5 = 2(5) + 5 = 15$

$\therefore \frac{t_5 - t_4}{t_2} = \frac{15 - 13}{9} = \frac{2}{9}$

Ans: C

02 $t_n = (-1)^{n-1} \cdot 2^n$
 $t_5 = (-1)^{5-1} \cdot 2^5$
 $= 32$

Ans: A

~~$a_n = n^3 - 6n^2 + 11n - 6$
 $a_0 = 0^3 - 6 \cdot 0^2 + 11 \cdot 0 - 6 = -6$
 $a_1 = 1^3 - 6 \cdot 1^2 + 11 \cdot 1 - 6 = 1 - 6 + 11 - 6 = 0$~~

03 $a_n = n^3 - 6n^2 + 11n - 6$
 $a_1 = 1^3 - 6 \cdot 1^2 + 11 \cdot 1 - 6 = 1 - 6 + 11 - 6 = 0$
 $a_2 = 2^3 - 6 \cdot 2^2 + 11 \cdot 2 - 6 = 8 - 24 + 22 - 6 = 0$
 $a_3 = 3^3 - 6 \cdot 3^2 + 11 \cdot 3 - 6 = 27 - 54 + 33 - 6 = 0$
 $a_4 = 4^3 - 6 \cdot 4^2 + 11 \cdot 4 - 6 = 64 - 96 + 44 - 6 = 6 > 0$
 $\therefore$ Ans: C

04 $a_1 = 1, a_2 = 1$

(13)

$$a_n = a_{n-1} + a_{n-2}$$

$$a_3 = a_2 + a_1 = 1 + 1 = 2$$

$$a_4 = a_3 + a_2 = 2 + 1 = 3$$

$$a_5 = a_4 + a_3 = 3 + 2 = 5$$

$$a_6 = a_5 + a_4 = 5 + 3 = 8$$

Now $\frac{a_{n+1}}{a_n} = \frac{a_6}{a_5} = \frac{8}{5}$

Ans: —

05 $t_{m+1} = a + (m+1-1)d = a + md$

Ans: B

06 All the Expressions are linear in n .

Hence all are n th terms of an A.P. Ans: D

07 option: B $1^2, 5^2, 7^2, \textcircled{3}$

$$1, 25, 49, \dots$$

$$\Rightarrow \text{Common difference} = 24.$$

Ans: B

08 $9, 12, 15, 18, \dots$

$$a = 9, d = 12 - 9 = 3$$

$$\begin{aligned} \therefore t_n &= a + (n-1)d \\ &= 9 + (n-1)3 \\ &= 3n + 6 \end{aligned}$$

Ans: B



09. 4, 9, 14, ... 254.

$a = 4, d = 5, l = 254, m = 10$

$\therefore t_m = l - (m-1)d$

$= 254 - (10-1) \cdot 5$

$= 254 - 45$

$= 209$

$= 25$

$\begin{array}{r} 254 \\ 45 \\ \hline 209 \end{array}$

$\begin{array}{r} 254 \\ 45 \\ \hline 209 \end{array}$

09. 4, 9, 14, ... 254

$a = 4, d = 5, l = 254, m = 10$

(14)

$\therefore t_m = l - (m-1)d$

$= 254 - (10-1) \times 5$

$= 254 - 45$

$= 209$

Ans: A

10. -1, 3, 7, ...

$a = -1, d = 4, t = 95$

$95 = -1 + (n-1)4$

$\Rightarrow n = 24^{\text{th}} \text{ term.} \therefore 25^{\text{th}} \text{ term}$

Ans: D



11. middle terms are $\left(\frac{n}{2}\right)^{\text{th}}$ term (or) $\left(\frac{n}{2} + 1\right)^{\text{th}}$ term (15)

Ans: A, B

12. 7, 13, 19, ... 241 $\rightarrow$ A.P.

$$a = 7, d = 6, l = 241$$

$$\therefore l = a + (n-1)d$$

$$\Rightarrow 241 = 7 + (n-1) \times 6$$

$$\Rightarrow n = 40, \text{ which is even}$$

$$\therefore \left(\frac{n}{2}\right)^{\text{th}} = \left(\frac{40}{2}\right)^{\text{th}} = 20^{\text{th}} \text{ term \& } 21^{\text{st}} \text{ term are}$$

middle terms

$$\begin{aligned} \therefore t_{20} &= a + 19d = 7 + 19(6) \\ &= 7 + 114 \\ &= 121 \end{aligned}$$

$$\therefore t_{21} = 121 + 6 = 127$$

Ans: —

13. Statement I: 6, 13, 20, ... 216

$$\text{here } a = 6, d = 7, l = 216$$

$$\therefore l = a + (n-1)d$$

$$\Rightarrow 216 = 6 + (n-1)7$$

$$\Rightarrow n = 31 \text{ which is odd}$$

$$\therefore \left(\frac{n+1}{2}\right)^{\text{th}} \text{ term} = \left(\frac{31+1}{2}\right)^{\text{th}} \text{ term} = 16^{\text{th}} \text{ term is middle term}$$

$$\therefore t_{16} = a + 15d$$

$$= 6 + 15(7)$$

$$= 111 \text{ (true)}$$

Statement II: Conceptual (true)

Ans: A

14. Statement I: 2, 5, 8, 11, ... 302

(16)

$$a = 2, d = 3, l = 302$$

$$302 = 2 + (n-1)3$$

$$n = 101, \text{ which is odd}$$

$$\left(\frac{n+1}{2}\right)^{\text{th}} \text{ term} = \left(\frac{101+1}{2}\right) = 51^{\text{st}} \text{ term is the middle term}$$

$$\begin{aligned} \therefore t_{51} &= a + 50d \\ &= 2 + 50(3) \\ &= 152 \end{aligned}$$

$$\text{Now } 2 \times t_{51} = 2 + 302$$

$$\Rightarrow 2 \times 152 = 304$$

$$\Rightarrow 304 = 304 \text{ (True)}$$

Statement II: 5, 15, 25, ...

$$a = 5, d = 10$$

$$\begin{aligned} t_{42} &= a + 41d \\ &= 5 + 41(10) \\ &= 415 \end{aligned}$$

$$\begin{aligned} t_{31} &= a + 30d \\ &= 5 + 30(10) \\ &= 305 \end{aligned}$$

$$\text{Now } t_{31} + 130 = 305 + 130 = 435 \neq 415 \text{ (False)}$$

$\therefore$ ~~A~~

Ans: C

(17)

15 $2, 4, 6, 8, \dots$ AP

$$2 + \frac{1}{2}, 4 + \frac{1}{2}, 6 + \frac{1}{2}, 8 + \frac{1}{2} \dots \text{AP}$$

$$\Rightarrow \frac{5}{2}, \frac{9}{2}, \frac{13}{2}, \frac{17}{2} \dots \text{AP}$$

Ans: A

16 $\frac{1}{2}, \frac{3}{2}, \frac{5}{2}, \frac{7}{2} \dots$ A.P.

$$\Rightarrow \frac{1}{2} \times 2, \frac{3}{2} \times 2, \frac{5}{2} \times 2, \frac{7}{2} \times 2 \dots \text{AP}$$

$$\Rightarrow 1, 3, 5, 7 \dots \text{AP}$$

Ans: A

17 $t_n = 3n + 4$

$$t_1 = 3(1) + 4 \\ = 7$$

Ans: B

18 $t_n = \frac{2n+1}{3}$

$$t_1 = \frac{2(1)+1}{3} = \frac{3}{3} = 1$$

$$t_2 = \frac{2(2)+1}{3} = \frac{5}{3}$$

$$\therefore \text{Common difference} = t_2 - t_1 \\ = \frac{5}{3} - 1 \\ = \frac{2}{3}$$

Ans: B

19 $t_{10} = a + 9d = 52$

$$t_{16} = a + 15d = 82 \\ \underline{6d = 30}$$

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

$$\therefore \boxed{a=7}$$

$$\therefore t_{32} = a + 31d \\ = 7 + 31(5) \\ = 162$$

Ans: 162



20

$$t_5 + t_9 = 72$$

$$\Rightarrow a + 4d + a + 8d = 72$$

$$\Rightarrow 2a + 12d = 72$$

$$\Rightarrow a + 6d = 36 \rightarrow (1)$$

Solving (1) & (2) $a = 6$
 $d = 5$

Now, $t_3 = a + 2d$
 $= 6 + 2(5)$
 $= 16$

$$t_7 + t_{12} = 97 \quad (18)$$

$$\Rightarrow a + 6d + a + 11d = 97$$

$$\Rightarrow 2a + 17d = 97 \rightarrow (2)$$

21 a)

$$a + 6d = -1$$

$$a + 15d = 17$$

$$-9d = -18$$

$$\boxed{d = 2}$$

$$\boxed{a = -13}$$

$$\begin{aligned} \therefore a_n &= a + (n-1)d \\ &= -13 + (n-1) \cdot 2 \\ &= 2n - 15 \end{aligned}$$

b) $8 \cdot t_8 = 7 \cdot t_7 \Rightarrow t_{15} = 0$ (Conceptual)

c) 14, 21, ... 98

$$98 = 14 + (n-1)7 \Rightarrow n = 13$$

d) $2x, x+10, 3x+2$

$$\Rightarrow 2(x+10) = 2x + 3x + 2$$

$$\Rightarrow x = 6$$

Ans: 8, 16, 12

22 a) $a_5 + a_9 = 30$

$$\Rightarrow a + 4d + a + 8d = 30$$

$$\Rightarrow 2a + 12d = 30$$

$$\Rightarrow a + 6d = 15$$

$$\Rightarrow a + 6\left(\frac{2a}{3}\right) = 15$$

$$\Rightarrow 15a = 45$$

$$\Rightarrow a = 3$$

b) $213, 205, 197, \dots, 37$

$$a = 213, d = -8, l = 37$$

$$\therefore 37 = 213 + (n-1)(-8)$$

$$\Rightarrow n = 23$$

c) $8, 10, 12, \dots, 126 \rightarrow AP$

$$a = 8, d = 2, l = 126, t_{10} = t_m$$

$$\begin{aligned} \therefore t_{10} &= l - (m-1)d \\ &= 126 - (10-1) \cdot 2 \\ &= 108 \end{aligned}$$

d) $-9, -14, -19, \dots$

$$a = -9, d = -5$$

$$\begin{aligned} a_{30} - a_{20} &= (a + 29d) - (a + 19d) \\ &= 10d \\ &= 10(-5) \\ &= -50 \end{aligned}$$

$\Rightarrow$ THE ENDE Ans: $S, -, 9, 8$