PROGRESSIONS-I

Arithmetic Progression upto nth term

Class: VIII, Mathematics

SOLUTIONS

TEACHING TASK

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

$$a^3 + c^3 - 8b^3 = a^3 + c^3 - (2b)^3$$
$$= a^3 + c^3 - (a+c)^3$$
$$= a^3 + c^3 - [a^3 + c^3 + 3ac(a+c)]$$
$$= -3ac(2b)$$
$$= -6abc$$

Ans : D

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

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

$a, \frac{1}{p}, c \rightarrow AP$

Ans : B

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

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

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

$\therefore F(1), F(2), F(3) \ldots$ are in AP

$2, \frac{5}{2}, 3, \ldots$

$a = 2,$
$d = 1/2$

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

Ans : B

(2)

04. $a_3 + a_5 + a_8 = 11$

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

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

$a_2 + a_4 = -2$

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

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

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

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

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

$\Rightarrow -3 + 7d = 11$

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

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

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

Now, $a_1 + a_6 + a_7 = a + a + 5d + a + 6d$

$= 3a + 11d$

$= 3(-5) + 11(2)$

$= 7$

Ans : C

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

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

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

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

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

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

$\therefore \frac{1}{x}, \frac{1}{y}, \frac{1}{z} = \frac{2}{k}, \frac{3}{k}, \frac{4}{k}$

$\longrightarrow$ AP

Ans. A

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06 $\frac{1}{a_1 a_2} + \frac{1}{a_2 a_3} + \cdots + \frac{1}{a_n \cdot a_{n+1}}$ (3)

$= \frac{1}{d}\left(\frac{1}{a_1} - \frac{1}{a_2} + \frac{1}{a_2} - \frac{1}{a_3} + \cdots + \frac{1}{a_n} - \frac{1}{a_{n+1}}\right)$

$= \frac{1}{d}\left(\frac{1}{a_1} - \frac{1}{a_{n+1}}\right)$

$= \frac{1}{d}\left(\frac{1}{a} - \frac{1}{a+nd}\right)$

$= \frac{1}{d}\left(\frac{a+nd-a}{a(a+nd)}\right) = \frac{n}{a(a+nd)} = \frac{n}{a_1 \cdot a_{n+1}}$

Ans: D

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07 $t_p = a \mid t_q = b, \mid t_r = c$

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

Now $a(q-r) + b(r-p) + c(p-q)$

$= \sum a(q-r)$

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

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

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

$= \frac{0}{y}$

$= 0$

Ans: A

08 a, b, c, d, e form an AP.

let $a=1,\ b=2,\ c=3,\ d=4,\ e=5$

(4)

Now $a-4b+6c-4d+e$

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

$= 1-8+18-16+5$

$= 0$

Ans: C

09. We observe

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

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

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

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

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

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

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

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

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

Ans: B

10 $3+7+11+\cdots$ $\quad d=7-3=4$

$1+6+11+\cdots$ $\quad d=6-1=5$

5

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

10^{th} common term = first common term + $(10-1)\times$ L.C.M of $\{4,5\}$

$= 11 + 9\times 20$

$= 191$

Ans: A

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11. $\frac{1}{\sqrt{2}+\sqrt{5}} + \frac{1}{\sqrt{5}+\sqrt{8}} + \frac{1}{\sqrt{8}+\sqrt{11}} + \cdots$ n terms

Now, $2, 5, 8, \cdots$ AP $\Rightarrow t_n = 2+(n-1)3$
$= 3n-1$

$5, 8, 11 \cdots$ AP $\Rightarrow t_n = 5+(n-1)3$
$= 3n+2$

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

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

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

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

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

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

Ans: A, B, C

12. $a_1 + a_3 + a_5 = -12$

$\Rightarrow a + a + 2d + a + 4d = -12$

$\Rightarrow 3a + 6d = -12$

$\Rightarrow a + 2d = -4 \rightarrow (1)$

$a_1 \cdot a_3 \cdot a_5 = 80$

$\Rightarrow a(a+2d)(a+4d) = 80$

$\Rightarrow a(-4)(a+4d) = 80$

$\Rightarrow a(a+4d) = -20 \rightarrow (2)$

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

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

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

$\Rightarrow \boxed{a = 2}$

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

$\Rightarrow 2 + 2d = -4$

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

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. Let $t_{\cancel{q}} = p$, $t_m = q$, $t_n = r$

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

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

which is a rational number since l, m, n ~~are~~ $\in Z^+$

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

Hence Both the statements are True

Ans: A

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

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

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

$\Rightarrow 5a + 60d = 0$

$\Rightarrow a + 12d = 0$

$\Rightarrow t_{13} = 0$ (True)

Statement II: Conceptual (True)

Ans: A

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15 $2, 5, 8, 11, \ldots 59$

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

5^{th} term from the end $= t_5 = l - (n-1)d$

$= 59 - (5-1) \times 3$

$= 59 - 12$

$= 47$

Ans: B

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16. $1, \frac{5}{2}, 4, \frac{11}{2}, \ldots 28$

here $a = 1$, $d = \frac{3}{2}$, $l = 28$, $n = 10$

$\therefore t_n = l - (n-1)d$

$t_{10} = 28 - (10-1) \times \frac{3}{2}$

$= 28 - \frac{27}{2}$

$= \frac{29}{2}$

Ans: C

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

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

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

Now, $t_n = a + (n-1)d$

$= 20 + (n-1)\left(-\frac{3}{4}\right)$

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

$\Rightarrow 3n > 83$

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

$\Rightarrow n > 27.\text{—}$

$\Rightarrow n \geq 28$

Ans. A

18 $a = 4, \quad t_9 = 20$

$a + 8d = 20$

$\Rightarrow 4 + 8d = 20$

$\Rightarrow d = 2$

$t_{15} = a + 14d$

$= 4 + 14(2)$

$= 32$

Ans.. D

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

here $a = 9, \quad d = 9$

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

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

$\Rightarrow 111 = 1 + n - 1$

$\Rightarrow \boxed{n = 111}$

Ans: 111

20 Given a, b, c, d are distinct integers in A.P. (9)

Let x be the common difference.

Now $a = a$, $b = a+x$, $c = a+2x$, $d = a+3x$

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

$\therefore \quad x = \dfrac{-(6a-3) \pm \sqrt{(6a-3)^2 - 4.5(3a^2-a)}}{2\times 5}$

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

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

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

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

$\Rightarrow \quad a = -1, 0 \quad$ [since $a \in I$]

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

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

When $\boxed{a=-1}$ (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

(10)

21) a) $-2, 0, 2, 4, \ldots$

$a = -2, \quad d = 2$

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

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

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

$a = 1, \quad d = \frac{1}{2} \quad \therefore t_{17} = a + 16d$

$= 1 + 16\left(\frac{1}{2}\right) = 9$

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

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

$\therefore t_{20} = a + 19d$

$= 14 + 19(-2) = -24$

Ans: t, r, s, q

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

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

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

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

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

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

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

CUQ'S

01. All the given terms form a sequence. Ans: D

02. All the given terms from a series Ans: D

03. m^{th} term from the end = $(n-m+1)^{th}$ term from the begining 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 $m t_n = n \times t_m \Rightarrow m(a + (n-1)d) = n(a + (m-1)d)$

$\Rightarrow a + (m+n-1)d = 0$

$\Rightarrow t_{m+n} = 0$

Ans: A

08 All the given statements are true — 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. $t_n = 2n+5$ | $t_4 = 2(4)+5 = 13$

$t_2 = 2(2)+5 = 9$ | $t_5 = 2(5)+5 = 15$

$\therefore \dfrac{t_5 - t_4}{t_2} = \dfrac{15-13}{9} = \dfrac{2}{9}$ — Ans: C

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

$t_5 = (-1)^{5-1} \cdot 2^5$

$= 32$ — Ans: A

~~03~~ $\cancel{a_n = n^3 - 6n^2 + 11n - 6}$

$\cancel{a_0 = 0^3 - 6\cdot 0^2 + 11\cdot 0 - 6 = -6}$

$\cancel{a_1 = 1^3 - 6\cdot 1^2 + 11\cdot 1 - 6 = 1-6+11-6 = 0}$

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 $a_1 = 1, a_2 = 1$

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

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

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

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

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

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

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

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06 All the Expressions are linear in n.

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

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07 Option: B $1^2, 5^2, 7^2, \cancel{\ }$

$1, 25, 49, \ldots$

$\Rightarrow$ common difference $= 24$. Ans: B

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

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

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

$= 9 + (n-1)3$

$= 3n+6$ Ans: B

09 $4, 9, 14, \dots 254.$

$a = 4,\ d = 5,\ l = 254,\ m = 50$

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

$= 254 - (10-1).5 \qquad 254 - 45 \qquad 254 - 45 = 209$

$= 254 - 45 \qquad \boxed{190} \quad \boxed{179}$

$= 234. \qquad = 25$

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09. $4, 9, 14, \dots 254$ (14)

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

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

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

$= 254 - 45$

$= 209$

Ans : A

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10 $-1, 3, 7, \dots\dots$

$a = -1,\ d = 4 \quad l = 95$

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

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

Ans : D

15

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

Ans: A, B

12\. 7, 13, 19, ... 241 → A.P.

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

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

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

$\Rightarrow\ n=40$, which is even

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

$\therefore t_{20}=a+19d=7+19(6)$
$=7+144$
$=151$

$\therefore t_{21}=151+6=157$

Ans: —

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

here $a=6,\ d=7,\ l=216$

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

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

$\Rightarrow\ n=31$ which is odd

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

$\therefore t_{16}=a+15d$
$=6+15(7)$
$=111$ (true)

Statement II: Conceptual (true)

Ans: A

16

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

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

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

$n = 101$, which is odd

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

$\therefore \; t_{51} = a + 50d$

$= 2 + 50(3)$

$= 152$

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

$\Rightarrow 2 \times 152 = 304$

$\Rightarrow 304 = 304$ (True)

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

$a = 5, \quad d = 10$

$t_{42} = a + 41d$

$= 5 + 41(10)$

$= 415$

$t_{31} = a + 30d$

$= 5 + 30(10)$

$= 305$

Now $t_{31} + \cancel{305}\, 130 = 305 + 130$

$= 435 \neq 415$ (False)

$\therefore$ ~~G~~

Ans: C

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

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

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

Ans: A

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

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

$\Rightarrow 1, 3, 5, 7 \dots$ AP

Ans: A

17 $t_n = 3n+4$

$t_1 = 3(1)+4$

$= 7$

Ans: B

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

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

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

$\therefore$ Common difference $= t_2 - t_1$

$= \frac{5}{3} - 1$

$= \frac{2}{3}$

Ans: B

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

$t_{16} = a+15d = 82$

$6d = 30$

$\Rightarrow \boxed{d=5}$

$\therefore \boxed{a=7}$

$\therefore t_{32} = a+31d$

$= 7+31(5)$

$= 162$

Ans: 162

(18)

20

$t_5 + t_9 = 72$

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

$\Rightarrow 2a+12d=72$

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

$t_7 + t_{12} = 97$

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

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

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

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

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21 a)

$a+6d=-1$
$a+15d=17$
$- \quad - \quad -$
$-9d=-18$
$\boxed{d=2}$

$\boxed{a=-13}$

$\therefore a_n = a+(n-1)d$
$= -13+(n-1)\cdot 2$
$= 2n-15$

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: r, p, t, q

22 a) $a_5 + a_9 = 30$

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

$\Rightarrow 2a+12d = 30$

$\Rightarrow a+6d = 15$

$a_{25} = 3 \cdot a_8$

$a+24d = 3(a+7d)$

$a+24d = 3a+21d$

$\Rightarrow d = \frac{2a}{3}$

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

$\Rightarrow 15a = 45$

$\Rightarrow a = 3$

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

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

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

$\Rightarrow n = 23$

c) $8, 10, 12, \ldots 126 \rightarrow AP.$

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

$\therefore t_{10} = l - (m-1)d$

$= 126 - (10-1) \cdot 2$

$= 108$

Ans: S,

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

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

$a_{30} - a_{20} = (a+29d) - (a+19d)$

$= 10d$

$= 10(-5)$

$= -50$

$\Rightarrow$ THE END Ans: S, —, 9, 8