

(vii) 1, -3, 5, -7, 9, -11

تہذیبی
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Exercise: 6.2

(4)

$$a_1 = 1 \quad a_2 = -3$$

$$a_3 = 1 + 4 = 5 \quad a_4 = -3 + 4 = -7$$

$$a_5 = 5 + 4 = 9 \quad a_6 = -7 + 4 = -11$$

$$a_7 = 9 + 4 = 13 \quad a_8 = -11 + 4 = -15$$

Hence Sequence:
1, -3, 5, -7, 9, -11, 13, -15, ...

Arithmetic Sequence: (A.P)

"The sequence in which a common difference is exist between two consecutive terms." It is also called Arithmetic progression. Common difference between two terms is denoted by d and $d = a_n - a_{n-1}$

We can expand this sequence using the following formula.

$$l = a_n = a_1 + (n-1)d$$

where a_n or l is n th term and n is an integer (+ve)

NOTE :-

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(i) Arithmetic Sequence is also called Arithmetic progression and is denoted by (A.P) abberivately (تہذیبی)

Q1 Find First Four terms if :

(i) $a_1 = 5$ and 3 consecutive terms 23, 26, 29
 $\therefore 23, 26, 29$ are consecutive terms

$$d = 26 - 23 = 3$$

$$a_2 = 5 + (2-1)3 = 5 + 3 = 8$$

$$a_3 = 5 + (3-1)3 = 5 + 6 = 11$$

$$a_4 = 5 + (4-1)3 = 5 + 9 = 14$$

$$a_5 = 5 + (5-1)3 = 5 + 12 = 17$$

(ii) $a_5 = 17 \quad a_9 = 37$

$$17 = a_1 + 4d \quad (1) \quad 37 = a_1 + 8d \quad (2)$$

$$37 = a_1 + 8d$$

$$-17 = a_1 + 4d$$

$$20 = 4d$$

$$d = 5$$

$$\therefore a_1 + 4(5) = 17$$

$$a_1 = 17 - 20$$

$$a_1 = -3$$

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$$a_2 = -3 + (2-1)5 = -3 + 5 = 2$$

$$a_3 = -3 + (3-1)5 = -3 + 10 = 7$$

$$a_4 = -3 + (4-1)5 = -3 + 15 = 12$$

$$a_5 = -3 + (5-1)5 = -3 + 20 = 17$$

(iii) $7a_4 = 3a_7 \quad a_{10} = 33$

$$33 = a_1 + 9d \quad (1)$$

$$7(a_1 + 3d) = 3(a_1 + 6d)$$

$$7a_1 + 21d = 3a_1 + 18d$$

$$7a_1 - 3a_1 + 21d - 18d = 0$$

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$$4a_1 + 3d = 0 \Rightarrow 4a_1 = -3d$$

$$\Rightarrow a_1 = \frac{-3d}{4}$$

Putting in (1), we get

$$33 = \left(\frac{-3d}{4}\right) + 9d$$

$$33 = \frac{-3d + 36d}{4}$$

$$33 \times 4 = -3d + 36d$$

$$33d = 132 \Rightarrow d = 4$$

$$\text{Now } a_1 = \frac{-3(4)}{4} = -3$$

$$\Rightarrow a_1 = -3$$

$$a_2 = -3 + (2-1)4 \Rightarrow a_2 = -3 + 4 = 1$$

$$a_3 = -3 + (3-1)4 = -3 + 8 = 5$$

$$a_4 = -3 + (4-1)4 = -3 + 12 = 9$$

$$a_5 = -3 + (5-1)4 = -3 + 16 = 13$$

$$\text{Q.2 } a_{n-3} = 2n-5 \quad a_n = ?$$

$$2n-5 = a_{n-3}$$

Put $n+3$ instead of n

$$a_{n+3-3} = 2(n+3)-5$$

$$a_n = 2n+6-5$$

$$a_n = 2n+1$$

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which is n th term.

$$\text{Q.3 } a_5 = 16 \quad a_{20} = 46 \quad a_{12} = ?$$

$$16 = a_1 + 4d \quad \text{--- (1)} \quad 46 = a_1 + 19d \quad \text{--- (2)}$$

$$46 = a_1 + 19d$$

$$16 = a_1 + 4d$$

$$30 = 15d$$

$$d = \frac{30}{15} = 2$$

(5)

$$\therefore d = 2$$

$$16 = a_1 + 4(2)$$

$$16 = a_1 + 8 \Rightarrow a_1 = 16 - 8$$

$$a_1 = 8$$

$$a_{12} = a_1 + (12-1)d$$

$$a_{12} = 8 + 11(2)$$

$$a_{12} = 8 + 22$$

$$a_{12} = 30$$

$$\text{Q.4 } a_{13} = ?$$

$$\text{Sequence} = x, 1, 2-x, 3-2x, \dots$$

$$a_1 = x \quad d = 1-x$$

$$a_{13} = a_1 + (13-1)d$$

$$a_{13} = x + 12(1-x)$$

$$a_{13} = x + 12 - 12x$$

$$a_{13} = 12 - 11x$$

$$\text{Q.5 } a_{18} = ? \quad a_6 = 19 \quad a_9 = 31$$

$$19 = a_1 + 5d \quad \text{--- (1)} \quad 31 = a_1 + 8d \quad \text{--- (2)}$$

$$31 = a_1 + 8d$$

$$19 = a_1 + 5d$$

$$12 = 3d$$

$$3d = 12 \Rightarrow d = 4$$

$$\therefore 19 = a_1 + 5d$$

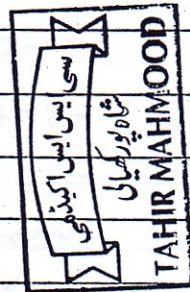
$$a_1 = 19 - 5d$$

$$a_1 = 19 - 5(4) \Rightarrow a_1 = 19 - 20 = -1$$

$$\therefore a_{18} = a_1 + 17d$$

$$a_{18} = -1 + 17(4)$$

$$a_{18} = -1 + 68 = 67$$



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Q.6

A.P. = 5, 2, -1, ..., -85

$\therefore a_n = a_1 + (n-1)d$

$a = 5 \quad d = 2 - 5 = -3 \quad a_n = -85$

$\therefore -85 = 5 + (n-1)(-3)$

$-85 - 5 = (n-1)(-3)$

$-3n + 3 = -90$

$-3n = -90 - 3$

$+3n = +93$

$n = \frac{93}{3} = 31$

$n = 31$

So $a_{31} = -85$ term.

Q.7 A.P. = -2, 4, 10, ..., 148

$a_1 = -2 \quad d = 4 - (-2) = 6 \quad a_n = 148$

$\therefore a_n = a_1 + (n-1)d$

$148 = -2 + (n-1)6$

$148 + 2 = 6n - 6$

$150 + 6 = 6n$

$n = \frac{26 \times 156}{6} = 26$

$n = 26$

$a_{26} = 148$ term.

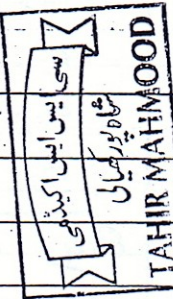
Q.8 $a_1 = 11 \quad a_n = 68 \quad d = 3$

$n = ?$

$\therefore a_n = a_1 + (n-1)d$

$68 = 11 + (n-1)3$

$68 - 11 = 3n - 3$



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$57 = 3n - 3$

(6)

$3n = 57 + 3$

$3n = 60$

$n = \frac{60}{3} = 20$

Hence there are 20 term in A.P.

Q.9 $a_n = 3n - 1$

$a_1 = 3(1) - 1 = 2 \quad \text{at } n = 1$

$a_2 = 3(2) - 1 = 6 - 1 = 5 \quad \text{at } n = 2$

$a_3 = 3(3) - 1 = 9 - 1 = 8 \quad \text{at } n = 3$

$a_4 = 3(4) - 1 = 12 - 1 = 11 \quad \text{at } n = 4$

Hence

A.P. = 2, 5, 8, 11, ..., $3n - 1$

Q.10 A.P. = 17, 13, 9, ...

(i) Is -19 the term of A.P. = ?

$a_n = -19 \quad a_1 = 17 \quad d = 13 - 17 = -4$

$\therefore -19 = 17 + (n-1)(-4)$

$-19 - 17 = -4n + 4$

$-38 - 4 = -4n$

$+4n = +40$

$n = 10 \quad n \text{ is an integer}$

So $a_{10} = -19$ and is the term of A.P.

(ii) Is 2 the term of A.P.

$a_n = 2 \quad a_1 = 17 \quad d = -4$

$\therefore 2 = 17 + (n-1)(-4)$

$2 - 17 = -4n + 4$

$-15 - 4 = -4n \Rightarrow +4n = +19$

$n = \frac{19}{4}$ which is not integer $\therefore \notin$ A.P.

Q.11

$$a_p = l \quad a_q = m \quad a_r = n$$

$$\therefore l = a_1 + (p-1)d = a_1 + pd - d \quad \text{--- (1)}$$

$$m = a_1 + (q-1)d = a_1 + qd - d \quad \text{--- (2)}$$

$$n = a_1 + (r-1)d = a_1 + rd - d \quad \text{--- (3)}$$

$$\text{(i) } \text{Eq (1)} - \text{Eq (2)} \quad \text{--- Eq (2)} - \text{Eq (3)}$$

$$l - m = a_1 + pd - a_1 - qd + d$$

$$l - m = (p - q)d \quad \text{--- (4)}$$

$$m - n = a_1 + qd - a_1 - rd + d$$

$$m - n = (q - r)d \quad \text{--- (5)}$$

Dividing (4) by (5)

$$\frac{l - m}{m - n} = \frac{(p - q)d}{(q - r)d}$$

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$$(p - q)(m - n) = (l - m)(q - r)$$

$$pm - pn - qm + qn = lq - lr + qm + mr$$

$$pm - pn + qn - lq + lr - mr = 0$$

$$p(m - n) + q(n - l) + r(l - m) = 0$$

(Proved)

$$\text{(ii) } \therefore pm - pn + qn - lq + lr - mr = 0$$

Multiplying both sides by (-1), we get

$$-pm + pn - qn + lq - lr + mr = 0$$

$$lq - lr + mr - mp + np - nq = 0$$

$$l(q - r) + m(r - p) + n(p - q) = 0$$

(Proved)

Q.12 $a_0 = ?$

$$\text{Sequence } \left\{ \frac{4}{3}, \left[\frac{7}{3} \right], \left[\frac{10}{3} \right], \dots \right.$$

(7)

Let 4, 7, 10, ... is A.P.

$$\therefore a_1 = 4 \quad d = 7 - 4 = 3$$

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

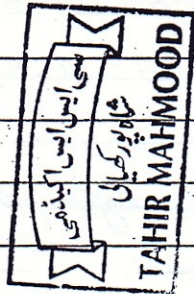
$$a_n = 4 + (n - 1)3$$

$$a_n = 4 + 3n - 3$$

$$a_n = 3n + 1$$

 $\therefore a_n$ of the Given Sequence is

$$a_n = \left(\frac{3n + 1}{3} \right)^2$$

Q.13 $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in A.P.

$$\therefore \frac{1}{b} - \frac{1}{a} = \frac{1}{c} - \frac{1}{b}$$

$$\frac{a - b}{ab} = \frac{b - c}{bc}$$

$$\Rightarrow c(a - b) = a(b - c)$$

$$ac - bc = ab - ac$$

$$ac + ac = ab + bc$$

$$b(ac) = 2ac$$

$$\therefore b = \frac{2ac}{a + c} \quad \text{(Proved)}$$

Q.14 $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in A.P. &

$$d = \frac{1}{b} - \frac{1}{a} = \frac{a - b}{ab}$$

$$d = \frac{1}{c} - \frac{1}{b} = \frac{b - c}{bc}$$

By Adding them

$$2d = \frac{1}{c} - \frac{1}{a} = \frac{a - c}{ac}$$

$$d = \frac{a - c}{2ac} \quad \text{(Proved)}$$

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