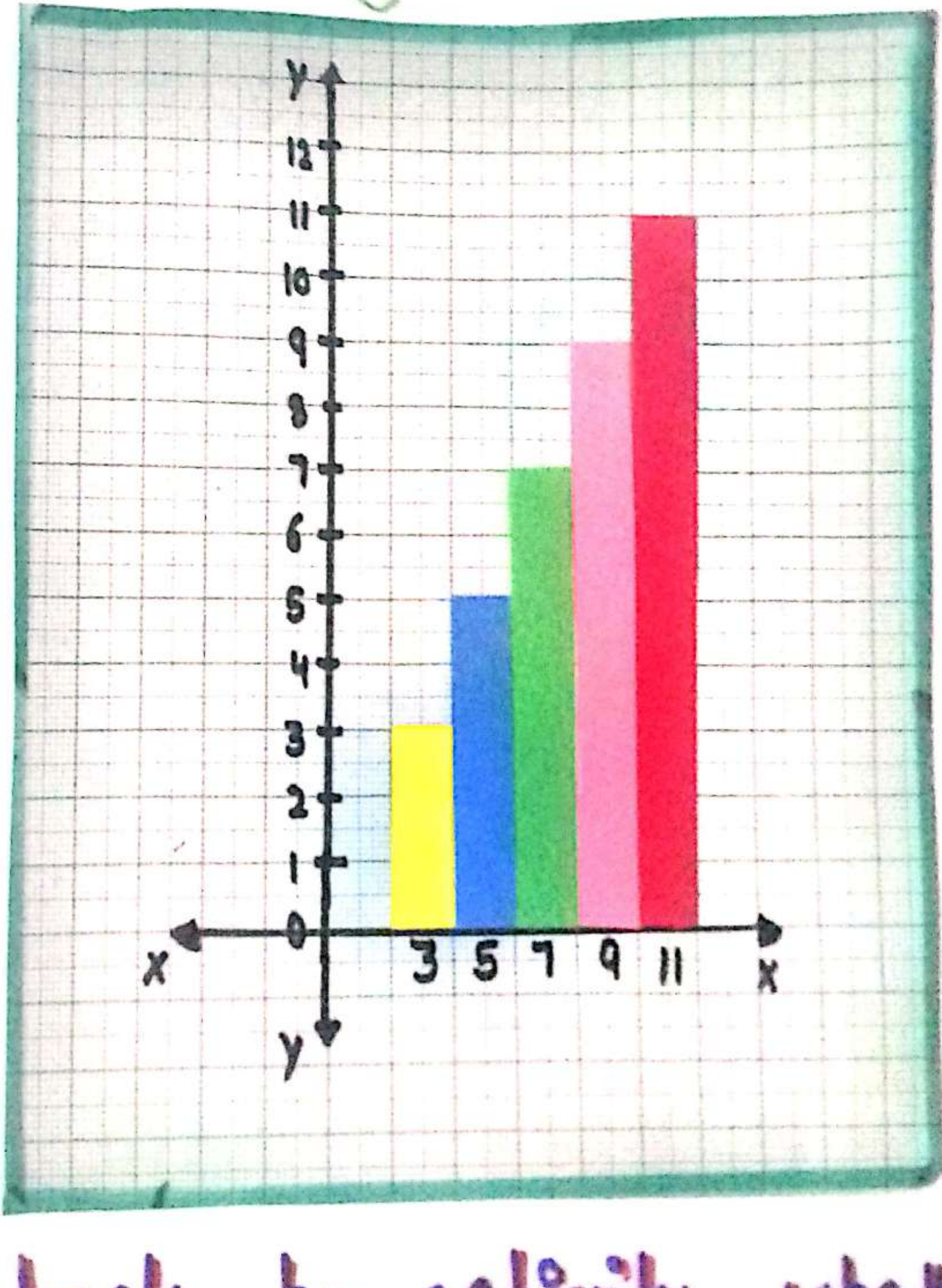
Activity of Arithmetic Progression



To check by activity whether the given series is AP or not....

Chapter : 5
Arithmetic Progression

* **Defination of A.P :-** Arthemetic Progression is a list of numbers in which each term is obtain by adding a fixed number to the preceding except first term.
Here, the fixed number is called the common difference of the AP, and it can be positive, negative or zero.

Eg :- $5^{a_1}, 7^{a_2}, 9^{a_3}, 11^{a_4}, 13^{a_5}, 15^{a_6}$ ———

Here $a = 5$, $c.d_1 = a_2 - a_1$
$= 7 - 5$
$= 2$

$d_2 = a_3 - a_2$
$= 9 - 7$
$= 2$

Here, common difference is same.
It is an A.P

Exercise : 5·1

1.* In which of the following situations, does the list of numbers involved make an arithmetic progression and why?

(i) The taxi fare after each km when the fare is 15 for the first km and 8 for each additional km. (yes)

(ii) The amount of air present in a cylinder when a vacuum pump removes $\frac{1}{4}$ of the air remaining in the cylinder at a time (NO).

(iii) The cost of digging a well after every metre of digging, when it costs 150 for the first metre and rises by 50 for each subsequent metre (yes)

(iv) The amount of money in the account every year, when 10000 is deposited at compound interest at 8% per annum. NO

2. Write first four terms of the AP, when the first term a and the common difference d are given as follows :

(i) $a = 10$, $d = 10$

For 1 mark :- 10, 20, 30, 40.

For 2 marks :- $a_1 = a = 10$

$a_2 = a + d$

$= 10 + 10$

$= 20$

$a_3 = a + 2d$

$= 10 + 2(10)$

$= 10 + 20$

$= 30$

$a_4 = a + 3d$

$= 10 + 3(10)$

$= 10 + 30$

$= 40$

Formula :- $a_n = a + (n-1) \times d$

(ii) $a = -2$, $d = 0$

$a_1 = a = -2$

$a_2 = a + d$

$= -2 + 0$

$= -2$

$a_3 = a + 2d$

$= -2 + 2(0)$

$= -2$

$a_4 = a + 3d$

$= -2 + 3(0)$

$= -2$

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(iii) $a = 4$, $b = -3$

$a_1 = a = 4$

$a_2 = a + d$

$= 4 + (-3)$

$= 1$

$a_3 = a + 2d$

$= 4 + 2(-3)$

$= -2$

$a_4 = a + 3d$

$= 4 + 3(-3)$

$= 4 - 9$

$= -5$

(iv) $a = -1$, $d = \frac{1}{2}$

$a_1 = a = -1$

$a_2 = a + d$

$= \frac{-1}{1} + \frac{1}{2}$

$= \frac{-2+1}{2} = \frac{-1}{2}$

$a_3 = a + 2d$

$= -1 + \cancel{2}\left(\frac{1}{\cancel{2}}\right)$

$= -1 + 1 = 0$

$a_4 = a + 3d$

$= -1 + 3\left(\frac{1}{2}\right)$

$= \frac{-1}{1} + \frac{3}{2}$

$= \frac{-2+3}{2} = \frac{1}{2}$

(v) $a = -1.25$, $d = 0.25$

$a = a = -1.25$

$a_2 = a + d$

$= -1.25 + 0.25$

$= -1.5$

$a_3 = a + 2d$

$= -1.25 + 2(-0.25)$

$= -1.25 - 0.50$

$= -1.75$

$a_4 = a + 3d$

$= -1.25 + 3(-0.25)$

$= -1.25 - 0.75$

$= -2$

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For the following APs, write the first term and the common differences :-

i) $3, 1, -1, -3$ ----

Here $a = 3$, $d = a_2 - a_1$
$= 1 - 3$
$= -2$

(ii) $-5, -1, 3, 7$ ------

Here, $a = -5$, $d = a_2 - a_1$
$= -1 - (-5)$
$= -1 + 5$
$= 4$

(iii) $\frac{1}{3}, \frac{5}{3}, \frac{9}{3}, \frac{13}{3}$ ------

Here, $a = \frac{1}{5}$, $d = a_2 - a_1$
$= \frac{5}{3} - \frac{1}{3}$
$= \frac{4}{3}$

(iv) $0.6, 1.7, 2.8, 3.9$ ---

Here, $a = 0.6$, $d = a_2 - a_1$
$= 1.7 - 0.6$
$= 1.1$

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4. which of the following are APs ? If they form an AP, find the common difference d and write three more terms.

(i) 2, 4, 8, 16 ....

Here $a = 2$, $d_1 = a_2 - a_1$
$= 4 - 2$
$= 2$
$d_2 = a_3 - a_2$
$= 8 - 4$
$= 4$

Here C.d is not same, it is not an A.P.

(ii) $2, \frac{5}{2}, 3, \frac{7}{2}$ ......

Here, $a = 2$, $d_1 = a_2 - a_1$
$= \frac{5}{2} - \frac{2}{1}$
$= \frac{5-4}{2} = \frac{1}{2}$
$d_2 = a_3 - a_2$
$= \frac{3}{1} - \frac{5}{2}$
$= \frac{6-5}{2} = \frac{1}{2}$

Here C.d is same ∴ for it is an A.P.

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To find more three terms :-

Now, $a = 2$, $d = \frac{1}{2}$

$a_5 = a + 4d$
$= 2 + 4\left(\frac{1}{2}\right)$
$= 2 + 2$
$= 4$

$a_7 = a + 6d$
$= 2 + 6\left(\frac{1}{2}\right)$
$= 2 + 3$
$= 5$

$a_6 = a + 5d$
$= 2 + 5\left(\frac{1}{2}\right)$
$= 2 + \frac{5}{2}$
$= \frac{4+5}{2} = \frac{9}{2}$

(iii) $\overset{a_1}{-1 \cdot 2}, \overset{a_2}{-3 \cdot 2}, \overset{a_3}{-5 \cdot 2}, \overset{a_4}{-7 \cdot 2}$

Here, $a = -1 \cdot 2$, $d_1 = a_2 - a_1$
$= -3 \cdot 2 - (-7 \cdot 2)$
$= -2$

$d_2 = a_3 - a_2$
$= -5 \cdot 2 - (-3 \cdot 2)$
$= -5 \cdot 2 + 3 \cdot 2$
$= -2$

Here c.d is same, ∴ for it is an A.P

To find more three term :-

Now, $a = -1 \cdot 2$, $d = -2$

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$a_5 = a + 4d$
$= -1.2 + 4(-2)$
$= -1.2 - 8$
$= -9.2$

$a_6 = a + 5d$
$= -1.2 + 5(-2)$
$= -1.2 - 10$
$= -11.2$

$a_7 = a + 6d$
$= -1.2 + 6(-2)$
$= -1.2 - 12$
$= -13.2$

(iv) $-10, -6, -2, 2$

Here, $a = -10$, $d_1 = a_2 - a_1$
$= -6 - (-10)$
$= -6 + 10$
$= 4$

$d_2 = a_3 - a_2$
$= -2 - (-6)$
$= -2 + 6$
$= 4$

Here c.d is same, $\therefore$ for it is an A.P.

To find more three term :-

Here, $a = -10$, $d = 4$

$a_5 = a + 4d$
$= -10 + 4(4)$
$= -10 + 16$
$= 6$

$a_6 = a + 5d$
$= -10 + 5(4)$
$= -10 + 20$
$= 10$

$a_7 = a + 6d$
$= -10 + 6(4)$
$= -10 + 24$
$= 14$

(v) $3, 3+\sqrt{2}, 3+2\sqrt{2}, 3+3\sqrt{2}$ ----

Here $a = 3$, $d_1 = a_2 - a_1$

$= \cancel{3} + 2\sqrt{2} - \cancel{3}$

$= \sqrt{2}$

$d_2 = a_3 - a_2$

$= \cancel{3} + 2\sqrt{2} - \cancel{3} + \sqrt{2}$

$= 2\sqrt{2} - \sqrt{2}$

$= \sqrt{2}$

Here c.d is same, $\therefore$ it is an A.P.

To find more three term :-

$a_5 = a + 4d$

$= 3 + 4(\sqrt{2})$

$= 3 + 4\sqrt{2}$

$a_7 = a + 6d$

$= 3 + 6(\sqrt{2})$

$= 3 + 6\sqrt{2}$

$a_6 = a + 5a$

$= 3 + 5(\sqrt{2})$

$= 3 + 5\sqrt{2}$

(vi) $\overset{a_1}{0.2}, \overset{a_2}{0.22}, \overset{a_3}{0.222}, \overset{a_4}{0.2222}$ ----

Here, $a = 0.2$, $d_1 = a_2 - a_1$

$= 0.22 - 0.2$

$= 0.02$

$d_2 = a_3 - a_2$

$= 0.222 - 0.22$

$= 0.002$

Here c.d is not same,

$\therefore$ it is not an A.P

(vii) $0, -4, -8, -12$ ------

Here, $a = 0$, $d_1 = a_2 - a_1$
$= -4 - 0$
$= -4$

$d_2 = a_3 - a_2$
$= -8 - (-4)$
$= -8 + 4$
$= -4$

Here C.d is same, it is an A.P.
To find more three terms :-

$a = 0$, $d = -4$

$a_5 = a + 4d$
$= 0 + 4(-4)$
$= 0 - 16$
$= -16$

$a_6 = a + 5d$
$= 0 + 5(-4)$
$= 0 - 20$
$= -20$

$a_7 = a + 6d$
$= 0 + 6(-4)$
$= 0 - 24$
$= -24$

(viii) $\frac{-1}{2}, \frac{-1}{2}, \frac{-1}{2}, \frac{-1}{2}$ ------

Here $a = \frac{-1}{2}$, $d_1 = a_2 - a_1$
$= \frac{-1}{2} - \left(\frac{-1}{2}\right)$
$= \frac{-1}{2} + \frac{1}{2} = 0$

$d_2 = a_3 - a_2$
$= \frac{-1}{2} - \left(\frac{-1}{2}\right)$
$= \frac{-1}{2} + \frac{1}{2}$
$= 0$

Here C.d is ~~no~~ 0 so next three term are also $\frac{-1}{2}, \frac{-1}{2}, \frac{-1}{2}$.

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(ix) 1, 3, 9, 27

Here, $a = 1$, $d_1 = a_2 - a_1$
$= 3 - 1$
$= 2$

$d_2 = a_3 - a_2$
$= 9 - 3$
$= 6$

Here c.d is not same, ∴ it is not A.P.

(x) $a, 2a, 3a, 4a$ ———

Here, $a = a$, $d_1 = a_2 - a_1$
$= a - 2a = a$

$d_2 = a_3 - a_2$
$= 3a - 2a$
$= a$

Here c.d is not same, ∴ ~~it is not an A.P~~.

(xi) a, a^2, a^3, a^4 ——
Here, $a = a$, $d_1 = a_2 - a_1$
$= a^2 - a$

$d_2 = a_3 - a_2$
$= a^3 - a^2$

Here c.d is not same.
∴ ~~It is not A.P~~

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(xii) $\sqrt{2}, \sqrt{8}, \sqrt{18}, \sqrt{32} \ldots$

Here, $a = \sqrt{2}$, $d_1 = a_2 - a_1$

$= \sqrt{8} - \sqrt{2}$

$= 2\sqrt{2} - \sqrt{2}$

$d = \sqrt{2}$

$d_2 = a_3 - a_2$

$= \sqrt{18} - \sqrt{8}$

$= 3\sqrt{2} - 2\sqrt{2}$

$= \sqrt{2}$

Here c.d is same, $\therefore$ it is an A.P

(xiii) $\sqrt{3}, \sqrt{6}, \sqrt{9}, \sqrt{12} \ldots$

Here, $a = \sqrt{3}$, $d_1 = a_2 - a_1$

$= \sqrt{6} - \sqrt{3}$

$d_2 = a_3 - a_2$

$= \sqrt{9} - \sqrt{6}$

$= 3 - \sqrt{6}$

Here c.d is not same, $\therefore$ it is not an A.P.

xiv) $1^2, 3^2, 5^2, 7^2 \ldots$

Here, $a = 1$, $d_1 = a_2 - a_1$

$= (3)^2 - (1)^2$

$= 9 - 1$

$= 8$

$d_2 = a_3 - a_2$

$= 5^2 - 3^2$

$= 25 - 9$

$= 16$

Here c.d is not same, $\therefore$ It is not an A.P

) $1^2, 5^2, 7^2, 73$ ---

Here, $a = 1^2$, $d_1 = a_2 - a_1$
$= 5^2 - 1^2$
$= 25 - 1$
$= 24$

$d_2 = a_3 - a_2$
$= 7^2 - 5^2$
$= 49 - 25$
$= 24$

Here c.d is same, $\therefore$ It is an A.P.

Now, to find o these three terms :-

$a_5 = a + 4d$
$= (1)^2 + 4(24)$
$= 1 + 96$
$= 97$

$a_6 = a + 5d$
$= (1)^2 + 5(24)$
$= 1 + 120$
$= 121$

$a_7 = a + 6d$
$= (1)^2 + 6(24)$
$= 1 + 144$
$= 145$

Exercise : 5.2

. Fill in the blanks in the following table, given that a is the first term, d the common difference and a_n the n^{th} term of the A.P.

(i) $a = 7$, $d = 3$, $n = 8$, $a_n = ?$

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$\therefore a_n = a + (n-1) d$
$a_8 = a + 7d$
$= 7 + 7(3)$
$= 7 + 21$
$= 28$

(iii) $a = -18$, $d = ?$, $n = 10$, $a_n = 0$
$a_n = 0$
$\therefore a_{10} = 0$
$a + 9d = 0$
$-18 + 9(d) = 0$
$9d = 18$
$d = \cancel{18}/\cancel{9}$
$d = 2$

(iii) $a = ?$, $d = -3$, $n = 18$, $a_n = -5$
$a_n = -5$
$\therefore a_{18} = -5$
$a + 17d = -5$
$a + 17(-3) = -5$
$a - 15 = -5$
$a = -5 + 15$
$a = 46$

i) $a = -18.9$, $d = 2.5$, $n = ?$, $a_n = 3.6$
Now, $a_n = 3.6$
$a + (n-1)d = 3.6$
$-18.9 + (n-1)\,2.5 = 3.6$
$(n-1)\,2.5 = 3.6 + 18.9$
$\frac{25}{\cancel{10}} = 22.5 = \frac{225}{\cancel{10}}$

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$$(n-1)\,25 = 255$$

$$n-1 = \frac{\cancel{255}}{\cancel{25}} = 9$$

$$n = 9+1$$

$$n = 10$$

(v) $a = 3.5$, $d = 0$, $n = 105$, $a_n = ?$

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

$$= 3.5 + 104(0)$$

$$= 3.5 + 0$$

$$= 3.5$$

2. Choose the correct choice in the following and just :-

(i) 30^{th} term of the A.P : 10, 7, 4 ———

(a) 97 (b) 77 (c) −77 (d) −87

Here :- $a = 10$, $d = a_2 - a_1$

$$= 7 - 10$$

$$= -3$$

$$a_{30} = ?$$

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

Put $n = 30$

$$a_n = a + 29d$$

$$a_{30} = 10 + 29(-3)$$

$$= 10 - 87$$

$$= -77$$

(ii) 11^{th} term of the A.P :- $-3, -\frac{1}{2}, 2$ —— is

(a) 28 (b) 22 (c) −38 (d) $-48\frac{1}{2}$

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Here, $a = -3$, $d_1 = a_2 - a_1$

$= \frac{-1}{2} - (-3)$

$= \frac{-1}{2} + \frac{3}{1}$

$= \frac{-1+6}{2} = \frac{5}{2}$

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

Put $n = 11$

$a_{11} = a + 10d$

$= -3 + \cancel{10}5\left(\frac{5}{\cancel{2}}\right)$

$= -3 + 25$

$= 22$

7. In the following APs, find the missing terms in the boxes.

(i) $2, \boxed{}, 26$

Now, $a_3 = 26$

$a + 2d = 26$

$2 + 2d = 26$

$2d = 26 - 2$

$2d = 24$

$d = \frac{24}{2}$

$d = 12$

Now,

$a_2 = a + 1d$

$= 2 + 1(12)$

$= 2 + 12$

$= 14$

$\therefore 2, \boxed{14}, 26$ Ans

(ii) $\boxed{}, 13, \boxed{}, 3$

Now, $a_2 = 13$ and $a_4 = 3$

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$a + 1d = 13$ — (1) and $a + 3d = 3$ — (2)

Now :- $a + 1d = 13$ — (1)

$a + 3d = 3$ — (2)

$-\quad -\quad -$

$-2d = 10$

$d = \frac{\cancel{10}}{-\cancel{2}}$

$d = -5$

Put in — (1)

$a + d = 13$

$a + (-5) = 13$

$a - 5 = 13$

$a = 13 + 5$

$a = 18$

Here, $a = 18$, $d = -5$

$a_1 = 18$

$a_3 = a + 2d$

$= 18 + 2(-5)$

$= 18 - 10$

$= 8$

$\therefore$ $\boxed{18}$, 13, $\boxed{8}$, 3

(iii) 5, $\boxed{}$, $\boxed{}$, $9\frac{1}{2}$

Here, $a_1 = 5$, $a_2 = ?$, $a_3 = ?$, $a_4 = 9\frac{1}{2}$

$a_4 = 9\frac{1}{2} = \frac{19}{2}$

$5 + 3(d) = \frac{19}{2}$

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$$3d = \frac{19}{2} - \frac{5}{1}$$

$$3d = \frac{19-10}{2} = \frac{9}{2}$$

$$\cancel{3}d = \frac{{}^{3}\cancel{9}}{2} \times \frac{1}{\cancel{3}_{1}}$$

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

Here, $d = \frac{3}{2}$, $a = 5$

$$a_2 = a + d$$
$$= 5 + \frac{3}{2}$$
$$= \frac{10+3}{2} = \frac{13}{2}$$
$$= 6\tfrac{1}{2}$$

$$a_3 = a + 2d$$
$$= \frac{5}{1} + 2\left(\frac{3}{2}\right)$$

$$a_3 = \frac{5}{1} + \frac{3}{1} = 8$$

$\therefore$ 5, $\boxed{6\tfrac{1}{2}}$, $\boxed{8}$, $9\tfrac{1}{2}$

(iv) -4, $\boxed{}$, $\boxed{}$, $\boxed{}$, $\boxed{}$, 6

Here, $a_1 = -4$, $a_2 = ?$, $a_3 = ?$, $a_4 = ?$, $a_5 = ?$
$a_6 = 6$

$$a_6 = 6$$
$$a + 5d = 6$$
$$-4 + 5d = 6$$

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$$5d = 6 + 4$$
$$5d = 10$$
$$d = \frac{\cancel{10}}{\cancel{5}}$$
$$d = 2$$

<u>Now :-</u> $a_2 = a + d$
$= -4 + 2$
$= -2$

$a_3 = a + 2d$
$= -4 + 2(2)$
$= -4 + 4$
$= 0$

$a_4 = a + 3d$
$= -4 + 3(2)$
$= -4 + 6$
$= 2$

$a_5 = a + 4d$
$= -4 + 4(2)$
$= -4 + 8$
$= 4$

$\therefore -4, \boxed{-2}, \boxed{0}, \boxed{2}, \boxed{4}, 6$

v) $\boxed{}, 38, \boxed{}, \boxed{}, \boxed{}, -22$

$a_1 = ?$, $a_2 = 38$, $a_3 = ?$, $a_4 = ?$, $a_5 = ?$, $a_6 = -$

<u>Now :-</u> $a_2 = 38$ and $a_6 = -22$

$a + 1d = 38$ —(1) $\quad a + 5d = -22$ —(2)

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Now :-

$$a + 1d = 38 \quad -(1)$$
$$a + 5d = -22 \quad -(2)$$
$$- \quad\quad +$$

$$-4d = 60$$
$$d = \frac{60}{-4}$$
$$d = -15$$

Put in $-(1)$

$$a + d = 38$$
$$a + (-15) = 38$$
$$a - 15 = 38$$
$$a = 38 + 15$$
$$a = 53$$

Here $a = 53$, $d = -15$

$$a_3 = a + 2d$$
$$= 53 + 2(-15)$$
$$= 53 - 30$$
$$= 23$$

$$a_4 = a + 3d$$
$$= 53 + 3(-15)$$
$$= 53 - 45$$
$$= 8$$

$$a_5 = a + 4d$$
$$= 53 + 4(-15)$$
$$= 53 - 60$$
$$= -7$$

$\therefore$ $\boxed{53}$, 38, $\boxed{23}$, $\boxed{8}$, $\boxed{-7}$, -22

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4. Which term of the A.P :- 3, 8, 13, 18 ... is 78

Sol^n :- Here, $a = 3$, $d = a_2 - a_1$
$= 8 - 3$
$= 5$

Now :- $a_n = 78$

$a + (n-1)d = 78$

$3 + (n-1)5 = 78$

$(n-1)5 = 78 - 3$

$(n-1)5 = 75$

$n - 1 = \frac{\cancel{75}}{\cancel{5}} = 15$

$n - 1 = 15$

$n = 15 + 1$

$n = 16$

Extra Sums :- Which term of A.P 5, 10, 15 ... is 625!

Here, $a = 5$, $d = a_2 - a_1$
$= 10 - 5$
$= 5$

$a = 5$, $d = 5$

$a_n = 625$

$a + (n-1)d = 625$

$5 + (n-1)5 = 625$

$(n-1)5 = 625 - 5$

$n - 1 = \frac{\cancel{620}}{\cancel{5}}$ 124

$n - 1 = 124$

$n = 124 + 1 = 125$

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Extra Sum: which term of A.P 4, 7, 10, ... is 113,

Here $a = 4$, $d = a_2 - a_1$
$= 7 - 4$
$= 3$

$a_n = 113$
$a + (n-1)d = 113$
$4 + (n-1)3 = 113$
$(n-1)3 = 113 - 4$
$(n-1)3 = 109$
$n - 1 = \frac{109}{3}$

$n - 1 = \frac{109}{3} + \frac{1}{1}$

$n - 1 = \frac{109+3}{3} = \frac{112}{3}$

Not Possible because n is not a natural integers.

Extra Sum: which term of A.P 21, 18, 15 is -18.

$a = 21$, $d_1 = a_2 - a_1$
$= 18 - 21$
$= -3$

$a_n = -81$
$a + (n-1)d = -81$
$21 + (n-1)-3 = -81$
$(n-1)-3 = -81 - 21$
$(n-1)-3 = -102$
$n - 1 = \frac{-102}{-3} = 34$

$n - 1 = 34$

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$n = 34 + 1$

$= 35$

Now :- $a_n = 0$

$a + (n-1)d = 0$

$21 + (n-1) - 3 = 0$

$(n-1) - 3 = -21$

$(n-1) = \frac{\cancel{-21}}{\cancel{-3}} \; 7$

$n = 7 + 1$

$n = 8$

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5. Find the numbers of terms in each of the following APs:

(i) $7, 13, 19 \ldots 205$

Here,

$a = 7, \quad d_1 = a_2 - a_1$

$= 13 - 7$

$= 6$

Let $a_n = 205$

$a + (n-1)d = 205$

$7 + (n-1)6 = 205$

$(n-1)6 = 205 - 7 \qquad 205 - 7$

$(n-1)6 = 198$

$n - 1 = \frac{198}{6} = 33$

$n = 33 + 1$

$n = 34$

(ii) $18, 15\frac{1}{2}, 13 \ldots, -47$

Here,

$a = 18, \quad d_1 = a_2 - a_1$

$= \frac{31}{2} - \frac{18}{1}$

$= \frac{31 - 36}{2}$

$= \frac{-5}{2}$

Let $a_n = -47$

$a + (n-1)d = -47$

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$18 + (n-1)\frac{-5}{2} = -47$

$(n-1)\frac{-5}{2} = -47 - 18$

$(n-1)\frac{-5}{2} = -65$

$n - 1 = \overset{-13}{\cancel{-65}} \times \left(\frac{-2}{\cancel{5}}\right)$

$n-1 = 26$

$n = 26 + 1$

$n = 27$

6. Check whether -150 is a term of the AP : $11, 8, 5, 2$ ------.

Sol^n :- Here, $a = 11$, $d = a_2 - a_1$
$= 8 - 11$
$= -3$

Let if Possible,

$a_n = -150$

$a + (n-1)d = -150$

$11 + (n-1)-3 = -150$

$(n-1)-3 = -150 - 11$

$(n-1)-3 = -161$

$(n-1) = \frac{\cancel{+}161}{\cancel{+}3}$

$n - 1 = \frac{161}{3}$

$n = \frac{161}{3} + \frac{1}{1}$

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$$n = \frac{161+3}{3}$$

$$n = \frac{164}{3}$$

which is not a natural number.
$\therefore$ -150 is not a term of given A.P.

7. Find the 31st term of an AP whose 11 term is 38 and the 16^{th} term is 73.

Sol^n:- Here,

$a_{11} = 38$, $a_{16} = 73$.

$a + 10d = 38$ — (1) $\qquad a + 15d = 73$ — (2)

Now:-
$a + 10d = 38$ — (1)
$a + 15d = 73$ — (2)
$\quad - \qquad\quad -$

$-5d = -35$

$$d = \frac{\cancel{-}35}{\cancel{-}5}$$

$d = 7$

Put in — (1)

$a + 10(d) = 38$
$a + 10(7) = 38$
$a + 70 = 38$
$a = 38 - 70$
$a = -32$

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$a = -32, \quad d = 7$

Now:-
$a_n = a + (n-1)d$
$a_{31} = -32 + (31-1)7$
$a_{31} = -32 + 30(7)$
$a_{31} = -32 + 210$
$a_{31} = 178$

8. An AP consists of 50 terms of which 3rd term is 12 and the last term is 106 and find the 29th term.

Soln:
$a_1, a_3 \text{ ------- } a_{50}$?

$a_3 = 12, \quad a_{50} = 106$

$a + 2d = 12 \quad -(1), \quad a + 49d = 106 \quad -(2)$

Now:- $a + 2d = 12 \quad -(1)$
$a + 49d = 106 \quad -(2)$

$-47d = -94$
$d = \frac{-94}{-47}$
$d = 2$
Put in $-(1)$
Here $d = 2, \quad a = ?$

$a + 2d = 12$
$a + 2(2) = 12$
$a + 4 = 12$

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$a = 12 - 4$

$a = 8$

Now to find 29^{th} term :-

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

$a_{29} = 8 + (29-1)2$

$= 8 + 28(2)$

$= 8 + 56$

$= 64$

9. If the 3rd and the 9^{th} term of an AP are 4 and -8 respectively which term of this AP is zero?

Sol^n:- $a_3 = 4$, $a_9 = -8$

$a + 2d = 4$ — (1) , $a + 8d = -8$ — (2)

Now,

$\cancel{a} + 2d = 4$ — (1)

$\cancel{a} + 8d = -8$ — (2)

$- \quad\quad -\ \quad +$

$-6d = 12$

$d = \frac{12}{-6}$

$d = -2$

Put in — (1)

$a + 2d = 4$

$a + 2(-2) = 4$

$a - 4 = 4$

$a = 4 + 4$

$a = 8$

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$$a_n = 0$$
$$a+(n-1)d = 0$$
$$8+(n-1)-2 = 0$$
$$(n-1)-2 = 0-8$$
$$(n-1)-2 = -8$$
$$n-1 = \frac{-8}{-2}$$
$$n-1 = 4$$
$$n = 4+1$$
$$n = 5^{th} \text{ term}$$

10. The 17^{th} term of an AP exceeds its 10^{th} term, by 7. find the common difference.

Sol^n:- A.T.Q

$$17^{th} \text{ term} = 10^{th} \text{ term} + 7$$
$$a_{17} = a_{10} + 7$$
$$\cancel{a}+16d = \cancel{a}+9d+7$$
$$16d-9d = 7$$
$$7d = 7$$
$$d = \frac{7}{7}$$
$$d = 1$$

11. Which term of AP: 3, 15, 27, 39 ___ will be 132 more than its 54^{th} term

Sol^n:- $a = 3$, $d = a_2 - a_1$
$= 15 - 3 = 12$

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Let $a_n = 54^{th} + 132$

$\cancel{a} + (n-1)d = \cancel{a} + 53d + 132$

$(n-1)d = 53(12) + 132$

$(n-1)12 = 636 + 132$

$n - 1 = \frac{768}{12}$

$n - 1 = 64$

$n = 64 + 1$

$n = 65$

$\therefore$ Required term $= 65^{th}$ term.

12. Two APs have the same common difference. The difference between their 100^{th} terms is 100, what is the difference between their 1000^{th} term?

Sol^n:- $a_1\ a_2\ a_3\ a_4 \ldots$ / $b_1\ b_2\ b_3\ b_4 \ldots$

Let first term of two A.P are $= a, b$

common difference $= d$

A.T.Q

$a_{100} - b_{100} = 100$

$a + 99d - (b + 99d) = 100$

$a + \cancel{99d} - b - \cancel{99d} = 100$

$a - b = 100$

Now:- $a_{1000} - b_{1000}$

$a + 999d - (b + 999d)$

$a + \cancel{999d} - b - \cancel{999d}$

$a - b = 100$

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15. How many three-digits numbers are divisible by 7 ?

for I term

$7 \overline{)100}$ 14
7
30
28
×2

Sol^n: 105, 112, 119 ——— 994

$a = 105$, $d = a_2 - a_1$
$= 112 - 105$
$= 7$

100
−2
98

98
+7
105

$a_n = 994$
$a + (n-1)d = 994$
$105 + (n-1)7 = 994$
$(n-1)7 = 994 - 105$
$(n-1)7 = 889$
$n - 1 = \frac{889}{7}$
$n - 1 = 127$
$n = 127 + 1$
$n = 128$

For last term

$7 \overline{)999}$ (142
7
29
28
19
14
×5

999
−5
994

Extra 15. How many two-digits numbers are divisible by 3 ?

$3 \overline{)100}$ (33
9
10
9
1

100
−1
99

Sol^n: 12, 15, 18 ——— 99.

$a = 12$, $d = a_2 - a_1$
$= 15 - 12$
$= 3$

$a_n = 99$
$a + (n-1)d = 99$
$12 + (n-1)3 = 99$
$(n-1)3 = 99 - 12$

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$$(n-1)3 = 87$$
$$n-1 = \frac{87}{3}$$
$$n-1 = 29$$
$$n = 29+1$$
$$n = 30$$

So, there are 30 two - digit number divisible by 3.

14. How many multiples of 4 lie between 10 and 250?

→ The number from 10 to 250 which are multiply of 4 are 12, 16, 20 ---- 248 an.

$$a = 12, \quad d = a_2 - a_1$$
$$= 16 - 12$$
$$= 4$$

$$a_n = 248$$
$$a + (n-1)d = 248$$
$$12 + (n-1)4 = 248$$
$$(n-1)4 = 248 - 12$$
$$(n-1)4 = 236$$
$$n-1 = \frac{236}{4}$$
$$n-1 = 59$$
$$n = 59+1$$
$$n = 60$$

15. for what value of n, are the n^{th} terms of two APs :- 63, 65, 67 ---- and 3, 10, 17 ---- equal?

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Solⁿ: Ist A.P :- 63, 65, 67 ---

Here, $a = 63$, $d_1 = 65 - 63$
$= 2$

$$a_n = a + (n-1)d$$
$$= 63 + (n-1)2$$
$$= 63 + 2n - 2$$
$$= 61 + 2n \quad -(1)$$

2nd A.P = 3, 10, 17 ---

Here $a = 3$, $d_2 = a_2 - a_1$
$= 10 - 3$
$= 7$

$$a_n = a + (n-1)d$$
$$= 3 + (n-1)7$$
$$= 3 + 7n - 7$$
$$= -4 + 7n \quad -(2)$$

A.T.Q

$$a_n = b_n$$
$$61 + 2n = -4 + 7n$$
$$2n - 7n = -4 - 61$$
$$-5n = -65$$
$$n = \frac{-65}{-5}$$
$$n = 13$$

16. Determine the AP whose third term is 16 and 17th term exceeds the 5th term by 12.

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Sol^n:- Here, $a_3 = 16$, $a_7 = a_5 + 12$

$a + 2d = 16$ —(1) , $a + 6d = a + 4d + 12$

$a + 2(6) = 16$ $\quad$ $6d = 4d + 12$

$a + 12 = 16$ $\quad$ $6d - 4d = 12$

$a = 16 - 12$ $\quad$ $2d = 12$

$a = 4$ $\quad$ $d = \frac{12}{2}$

$d = 6$

Now $a = 4$, $d = 6$

$a = 4$

$a_2 = a + d$
$= 4 + 6$
$= 10$

$a_3 = a + 2d$ $\quad$ Here, AP is :- 4, 10, 16 ——
$= 4 + 2(6)$
$= 4 + 12$
$= 16$

17. Find the 20^{th} term from the last term of the AP ; 3, 8, 13 ——, 253.

$253 - 5 = 248$ $\quad$ $d = 5$

Sol^n:- On reversing, New A.P

253, 248 —— 13, 8, 3

$a = 253$, $d = a_2 - a_1$
$= 248 - 253$
$= -5$

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

$a_{20} = 253 + (20-1) - 5$

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$= 253 + (-95)$

$= 253 - 95$

$= 158$ Ans.

Extra
17. Find the 11^{th} term from the last term of the AP : 10, 7, 4 ---, -62

On reversing this A.P

$-62, -59 \ldots\ldots 4, 7, 10$

$a = -62$, $d = -59 - (-62)$

$= -59 + 62$

$= 3$

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

$= a + 10 \times d$

$= -62 + 10 \times (3)$

$= -62 + 30$

$= -32$ Ans.

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18. The sum of the 4^{th} and 8^{th} term of an AP is 24 and the sum of the 6^{th} and 10^{th} term is 44. find the first three terms of the AP.

Soln:- $a_4 + a_8 = 24$, $a_6 + a_{10} = 44$

$a+3d + a+7d = 24$ $\quad$ $a+5d + a+9d = 44$

$2a + 10d = 24$ — (1) $\quad$ $2a + 14d = 44$ — (2)

Now:-

$$\cancel{2a} + 10d = 24 \quad -(1)$$
$$\cancel{2a} + 14d = 44 \quad -(2)$$
$$- \qquad\quad -$$

$$\cancel{-}4d = \cancel{-}20$$
$$d = \frac{20}{4}$$
$$d = 5$$

Put in — (1)

$$2a + 10d = 24$$
$$2a + 10(5) = 24$$
$$2a + 50 = 24$$
$$2a = 24 - 50$$
$$2a = -26$$
$$a = \frac{-\cancel{26}}{\cancel{2}}$$
$$a = -13$$

Here

$a = -13$, $d = 5$

$a_1 = -13$, $a_2 = a + d$, $a_3 = a + 2d$

$\quad = -13 + 5 \qquad = -13 + 2(5)$

$\quad = -8 \qquad = -13 + 10$

$\qquad\qquad = -3$

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19. Subba Rao started work in 1995 at an annual salary of 5000 and received an increment of 200 each year. In which year did his income reach 7000?

Sol^n: Annual salary of Subba Rao in 1 year = 5000

" " " " " " 2
" = 5000 + 200
= 5200

--- soon ----

We get AP : 5000, 5200, 5400 ---- 7000.

$a = 5000, \quad d = 200$

Let $a_n = 7000$

$a + (n-1)d = 7000$

$5000 + (n-1)200 = 7000$

$(n-1)200 = 7000 - 5000 = 2000$

$n - 1 = \frac{\cancel{2000}}{\cancel{200}}$

$n - 1 = 10$

$n = 10 + 1$

$n = 11$

In 11th year his income will Rs. 7000.

20. Rampali saved 5 in the first week of a year and then increased her weekly saving by 1.75. If in the

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n^{th} week, her weekly saving become 20.75, find n.

Sol^n:- Saving of Ramkali in first week = Rs 5

Saving of " " 2nd " = Rs 5 + 1.75
= 6.75

" " " " 3rd " = 6.75 + 1.75
= Rs 8.50

- - - Soon - - - -

we get A.P ; 5 , 6.75 , 8.50 - - - - 20.75

$a = 5$, $d = 1.75$

Let $a_n = 20.75$

$a + (n-1)d = 20.75$

$5 + (n-1)1.75 = 20.75$

$(n-1)1.75 = 20.75 - 5$

$= 15.75$

$(n-1)1.75 = 15.75$

$n - 1 = \frac{15.75}{1.75} = \frac{1575}{175} = 9$

$n - 1 = 9$

$n = 9 + 1$

$n = 10$

In 10^{th} week her saving become - Rs 20.75

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Exercise : 5.3

1. Find the sum of the following APs :

(i) 2, 7, 12 ----, to 10 terms.

Note :-

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

OR

$$S_n = \frac{n}{2}\left[a + l\right]$$

Sol^n :- Here $a = 2$, $d = 7-2 = 5$, $n = 10$

$$S_n = \frac{n}{2}\left(2a + (n-1) \times d\right)$$

$$= \cancel{\frac{10}{2}}5\left(2(2) + (10-1) \times 5\right)$$

$$= 5\,(4 + 45)$$

$$= 5\,(49)$$

$$= 245$$

(ii) $-37, -33, -29$ ----, to 12 terms.

Sol^n :- Here $a = -37$, $d = a_2 - a_1$

$$= -33 - (-37)$$

$$= 4$$

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

$$S_{12} = \frac{12}{2}\left[2(-37) + (12-1) \times 4\right]$$

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$= \frac{\cancel{12}^{6}}{\cancel{2}} \left[-74 + (11) \times 4 \right]$

$= 6 \left(-74 + 44 \right)$

$= 6 \left(-30 \right)$

$= -180$ Ans.

(iii) $0.6, 1.7, 2.8$ ____ to 100 terms.

Solⁿ: Here $a = 0.6$, $d = a_2 - a_1$

$= 1.7 - 0.6$

$= 1.1$

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

$= \frac{\cancel{100}^{50}}{\cancel{2}} \left(2(0.6) + (100-1) \times 1.1 \right]$

$= 50 \left(1.2 + 99 \times 1.1 \right)$

$= 50 \left(1.2 + 108.9 \right)$

$= 50 \times 110.1$

$= \cancel{50}^{5} \times \frac{1101}{1\cancel{0}} = 5505$ Ans.

(iv) $\frac{1}{15}, \frac{1}{12}, \frac{1}{10}$ ____ to 11 terms.

Solⁿ: $a = \frac{1}{15}$, $d = a_2 - a_1$

$= \frac{1}{12} - \frac{1}{15}$

$= \frac{5-4}{60} = \frac{1}{60}$

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

$$= \frac{11}{2}\left[\frac{2(1)}{15} + (11-1) \times \frac{1}{60}\right]$$

$$= \frac{11}{2}\left[\frac{2}{15} + \cancel{10} \times \frac{1}{6\cancel{0}}\right]$$

$$= \frac{11}{2}\left[\frac{2}{15} + \frac{1}{6}\right]$$

$$= \frac{11}{2}\left(\frac{4+5}{30}\right)$$

$$= \frac{11}{2} \times \frac{9}{30} = \cancel{\frac{99}{60}} = \frac{33}{20} \text{ Ans}$$

2. Find the sums given below :

(ii) $7 + 10\frac{1}{2} + 14 + \_\_\_\_ + 84$

Sol^n:- Here, $a = 7$, $d = a_2 - a_1$

$$= 10\frac{1}{2} - 7$$

$$= \frac{21}{2} - \frac{7}{1} = \frac{21-14}{2}$$

$$= \frac{7}{2}$$

Let, $l = a_n = 84$

$$a_n = 84$$

$$a + (n-1)d = 84$$

$$7 + (n-1)\frac{7}{2} = 84$$

$$(n-1)\frac{7}{2} = 84 - 7$$

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$$(n-1)\frac{7}{2} = 77$$

$$n-1 = \frac{\cancel{77}^{11}}{1} \times \frac{2}{\cancel{7}}$$

$$n-1 = 22$$

$$n = 22+1$$

$$n = 23$$

$$S_n = \frac{n}{2}\left[a+l\right]$$

$$= \frac{23}{2}\left(7+84\right)$$

$$= \frac{23}{2}\left(91\right)$$

$$= \frac{23}{2} \times 91 = \frac{2093}{2}$$

(ii) $34 + 32 + 30 + \_\_\_\_\_\_ + 10$

Solⁿ: $a = 34$, $d = a_2 - a_1$

$$= 32 - 34$$

$$= -2$$

Let $l = a_n = 10$

$$a_n = 10$$

$$a + (n-1)d = 10$$

$$34 + (n-1) - 2 = 10$$

$$(n-1) - 2 = 10 - 34$$

$$(n-1) \cancel{-} 2 = \cancel{-}24$$

$$(n-1) = \frac{\cancel{24}}{\cancel{2}}$$

$$n-1 = 12$$

$$n = 12 + 1 = 13$$

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$$S_n = \frac{n}{2}[a+l]$$

$$= \frac{13}{2}[34+10]$$

$$= \frac{13}{\cancel{2}} \times \cancel{44}\,22$$

$$= 286 \quad \underline{\text{Ans.}}$$

(iii) $-5+(-8)+(-11)+ \text{------} + (-230)$

$\underline{\text{sol}^n:}$ Here, $a=-5$, $d = -8-(-5)$, $l=-230$

$$= -8+5$$

$$= -3$$

$$l = a_n = -230$$

$$a_n = -230$$

$$a+(n-1)d = -230$$

$$-5+(n-1)(-3) = -230$$

$$(n-1)(-3) = -230+5$$

$$(n-1)(\cancel{-}3) = \cancel{-}225$$

$$n-1 = \frac{\cancel{225}}{\cancel{3}}$$

$$n-1 = 75$$

$$n = 75+1$$

$$n = 76$$

$$S_n = \frac{n}{2}(a+l)$$

$$= \frac{\overset{38}{\cancel{76}}}{\cancel{2}}(-5+(-230))$$

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$= 38\ (-5-230)$

$= 38\ (-235)$

$= -8930$ Ans.

In An AP:

given $a = 5$, $d = 3$, $a_n = 50$, find n and S_n.

Give, $a=5$, $d=3$, $a_n = 50$ find n and S_n

$l = a_n = 50$

$a_n = 50$

$a+(n-1)d = 50$

$5+(n-1)3 = 50$

$(n-1)3 = 50-5$

$(n-1) = \frac{45}{3}$

$n-1 = 15$

$n = 15+1$

$n = 16$

$S_n = \frac{n}{2}(a+l)$

$= \frac{16}{2}(5+50)$

$= \frac{\cancel{16}^{8}}{\cancel{2}}(55)$

$= 440$ Ans.

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(ii) given $a = 7$, $a_{13} = 35$, find d and S_{13}.

Sol^n :-

$$a_n = 35$$
$$a + (n-1)d = 35$$
$$7 + (13-1)d = 35$$
$$7 + (12)d = 35$$
$$12d = 35 - 7$$
$$12d = 28$$
$$d = \frac{28}{12}$$
$$d = \frac{7}{3}$$

$$S_n = \frac{n}{2}\left(2a + (n-1) \times d\right)$$
$$S_{13} = \frac{13}{2}\left(2(7) + (13-1) \times \frac{7}{3}\right)$$
$$= \frac{13}{2}\left(14 + \cancel{12}^{4} \times \frac{7}{\cancel{3}}\right)$$
$$= \frac{13}{2}\left(14 + 28\right)$$
$$= \frac{13}{\cancel{2}} \times \cancel{42}^{21}$$
$$= 273 \text{ Ans.}$$

(iii) given $a_{12} = 37$, $d = 3$, find a and S_{12}.

Sol^n :-

$$a_{12} = 37$$
$$a + 11d = 37$$
$$a + 11(3) = 37$$
$$a + 33 = 37$$
$$a = 37 - 33 = 4$$

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$$S_n = \frac{n}{2}\left(2a + (n-1) \times d\right)$$

$$S_{12} = \frac{12}{2}\left(2(4) + (12-1) \times 3\right)$$

$$= \frac{\cancel{12}^{6}}{\cancel{2}}\left(8 + 33\right)$$

$$= 6\,(41)$$

$$= 246 \quad \text{Ans.}$$

(iv) given $a_3 = 15$, $S_{10} = 125$, find d and a_{10}

Sol^n:-

$a_3 = 15$

$a + 2d = 15 \quad -(1)$

$S_{10} = 125$

$$S_n = \frac{n}{2}\left(2a + (n-1) \times d\right) = 125$$

$$= \frac{\cancel{10}^{5}}{\cancel{2}}\left(2a + (10-1) \times d\right) = 125$$

$$= 5\left(2a + 9d\right) = 125$$

$$= 2a + 9d = \frac{\cancel{125}^{25}}{\cancel{5}}$$

$$= 2a + 9d = 25 \quad -(2)$$

Now:-

$a + 2d = 15 \quad -(1) \times 2$

$2a + 9d = 25 \quad -(2) \times 1$

we get,

$\cancel{2a} + 4d = 30$

$\cancel{2a} + 9d = 25$

$- \quad - \quad -$

$-5d = 5$

$d = \frac{5}{-5}$

$d = -1$ (Put in $-(1)$)

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To find a, $a+2d = 15$

$a+2(-1) = 15$

$a-2 = 15$

$a = 15+2$

$a = 17$

$a_{10} = a+9d$

$= 17+9(-1)$

$= 17-9$

$= 8$

(v) given, $d = 5$, $S_9 = 75$, find a and a_9

Here, $S_n = \frac{n}{2}\left(2a+(n-1)\times d\right) = 75$

$\frac{9}{2}(2a+8\times5) = 75$

$\frac{9}{2}(2a+40) = 75$

$2a+40 = \frac{75\times2}{9}$

$2a+40 = \frac{150}{9}$

To find a_9

$2a = \frac{150}{9} - \frac{40}{1}$

$2a = \frac{-210}{9}$

$a = \frac{-\cancel{210}^{-105}}{9}\times\frac{1}{\cancel{2}_{1}}$

$a = \frac{-\cancel{105}}{\cancel{9}} = \frac{-35}{3}$

$a+8d$

$= \frac{-35}{3}+8(5)$

$= \frac{-35}{3}+\frac{40}{1}$

$= \frac{-35+120}{3}$

$= \frac{85}{3}$

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(vi) given $a = 2$, $d = 8$, $S_n = 90$, find n and a_n.

Sol :-

$$S_n = 90$$

$$\frac{n}{2}\left[2a + (n-1) \times d\right] = 90$$

$$\frac{n}{2}\left(2(2) + (n-1) \times 8\right) = 90$$

$$n(4 + 8n - 8) = 90 \times 2$$

$$n(8n - 4) = 180$$

$$8n^2 - 4n = 180$$

$$8n^2 - 4n - 180 = 0$$

$$4(2n^2 - n - 45) = 0$$

$$2n^2 - n - 45 = \frac{0}{4} = 0$$

$$2n^2 - n - 45 = 0$$

Descriminent method :- here $a = 2$, $b = -1$, $c = -45$

$$D = b^2 - 4ac$$

$$= (-1)^2 - 4(2)(-45)$$

$$= 1 + 360$$

$$= 361$$

$$n = \frac{-b + \sqrt{D}}{2a}, \frac{-b - \sqrt{D}}{2a}$$

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$$= \frac{-(-1) + \sqrt{361}}{2(2)} \quad , \quad \frac{-(-1) - \sqrt{361}}{2(2)}$$

$$= \frac{1+19}{4} \quad , \quad \frac{1-19}{4}$$

$$= \frac{\cancel{20}\ 5}{\cancel{4}} \quad , \quad \frac{-18}{4}$$

$\frac{-18}{4}$ Rejected ($\because$ n can't be $-ve$)

$$n = 5$$

Now to find a_n,

$$a_5 = a + 4d$$
$$= 2 + 4(8)$$
$$= 2 + 32$$
$$= 34$$

(vii) given $a = 8$, $a_n = 62$, $S_n = 210$, find n and d.

Sol^n:- $S_n = 210$

$$\frac{n}{2}(a + l) = 210$$

$$\frac{n}{2}(8 + 62) = 210$$

$$\frac{n}{2}(70) = 210$$

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$n(70) = 210 \times 2$

$n(70) = 420$

$n = \frac{42\cancel{0}}{7\cancel{0}}$

$n = 6$

$a_6 = 62$

$a + 5d = 62$

$8 + 5d = 62$

$5d = 62 - 8$

$d = \frac{54}{5}$ Ans.

(viii) given $a_n = 4$, $d = 2$, $S_n = -14$, find n and a

Sol^n:-

$a + (n-1) \times d = 4$

$a + (n-1) \times 2 = 4$

$a + 2n - 2 = 4$

$a = 4 - 2n + 2$

$a = 6 - 2n$ — (1)

$S_n = \frac{n}{2}(a + l)$

$-14 = \frac{n}{2}(a + 4)$

$-14 \times 2 = n(a + 4)$

$-28 = 4(a + 4)$

$-28 = 4(6 - 2n + 4)$

$-28 = n(10 - 2n)$

$-28 = 10n - 2n^2$

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$$2x^2 - 10x - 28 = 0$$
$$2(x^2 - 5x - 14) = 0$$
$$x^2 - 5x - 14 = 0 \quad \text{[factorisation method]}$$
$$x^2 - 7x + 2x - 14 = 0$$
$$x(x-7) + 2(x-7) = 0$$
$$(x+2)\ (x-7) = 0$$

$x + 2 = 0$	$x - 7 = 0$
$x = -2$	$x = 7$

Reject $= -2$ [$\because$ it cannot be -ve]

$$\therefore x = 7$$

Putn in - (1)

$$a = 6 - 2(7)$$
$$= 6 - 14$$
$$= -8$$

(ix) given $a = 3$, $n = 8$, $S = 192$, find d.

Sol :-
$$S_8 = 192$$
$$\frac{n}{2}(2a + (n-1) \times d) = 192$$
$$\frac{\cancel{8}^{4}}{\cancel{2}}(2(3) + (8-1) \times d) = 192$$
$$(6 + 7d) = \frac{192}{4}$$
$$6 + 7d = 48$$
$$7d = 48 - 6$$
$$7d = 42$$

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$$d = \frac{42}{7}$$

$$d = 6$$

(x) given $l = 28$, $S = 144$, and there are total 9 terms. find a.

Sol^n:

$$S_n = \frac{n}{2}(a + l) = 144$$

$$\frac{9}{2}(a + 28) = 144$$

$$9(a + 28) = 144 \times 2$$

$$a + 28 = \frac{288}{9}$$

$$a + 28 = 32$$

$$a = 32 - 28$$

$$a = 4 \quad \text{Ans.}$$

4. Qn How many terms of the AP: 9, 17, 25 ___ must be taken to give a sum of 636?

Sol^n:

9, 17, 25 - - - -

$a = 9$, $d = 17 - 9$
$= 8$

$$S_n = 636$$

$$\frac{n}{2}[2a + (n-1) \times d] = 636$$

$$\frac{n}{2}[2(9) + (n-1) \times 8] = 636$$

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$$\frac{n}{2}\left[18 + 8n - 8\right] = 636$$

$$\frac{n}{2}\left[10 + 8n\right] = 636$$

OR

$$n\left[\frac{\cancel{10}^{5}}{\cancel{2}} + \frac{\cancel{8n}^{4n}}{\cancel{2}}\right] = 636$$

$$n\,(5 + 4n) = 636$$

$$5n + 4n^2 = 636$$

$$4n^2 + 5n - 636 = 0$$

here,

$a = 4$, $b = 5$, $c = -636$

$$D = b^2 - 4ac$$
$$= (5)^2 - 4(4)(-636)$$
$$= 25 - 10176$$
$$= 10201$$

$$n = \frac{-b + \sqrt{d}}{2a}, \quad \frac{-b - \sqrt{d}}{2a}$$

$$= \frac{-5 + \sqrt{10201}}{2(4)}, \quad \frac{-5 - \sqrt{10201}}{2(4)}$$

$$= \frac{-5 + 101}{8}, \quad \frac{-5 - 101}{8}$$

$$= \frac{\cancel{96}^{12}}{\cancel{8}}, \quad \frac{-\cancel{106}}{\cancel{8}} \; \frac{-53}{4}$$

Reject $= \frac{-53}{4}$

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$n = 12$ $\quad a_{12} = a + 11d$

$= 9 + 11(8)$

$= 9 + 88 = 97$ ft.

Q. The first term of an AP is 5, last term is 45 and the sum is 400. Find the number of terms and the common difference.

Solⁿ:- $a = 5$, $l = 45$, $S = 400$

$S_n = 400$

$\frac{n}{2}[a + l] = 400$

$\frac{n}{2}(5 + 45) = 400$

$n(5 + 45) = 400 \times 2$

$n(50) = 800$

$n = \frac{80\cancel{0}}{5\cancel{0}}$

$n = 16$

$a_{16} = 45$

$a + 15d = 45$

$5 + 15d = 45$

$15d = 45 - 5$

$15d = 40$

$d = \frac{40}{15} = \frac{8}{3}$

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6. The first and the last term of an AP are 17 and 350 respectively. If the common difference is 9, how many terms are there and what is their sum?

Sol^n:-

$$a_n = 350$$
$$a+(n-1)\times d = 350$$
$$17+(n-1)\times 9 = 350$$
$$(n-1)\,9 = 350-17$$
$$(n-1)\,9 = 333$$
$$n-1 = \frac{333}{9}$$
$$n-1 = 37$$
$$n = 37+1$$
$$n = 38$$

$$S_n = \frac{n}{2}\left(a+l\right)$$
$$= \frac{38}{2}\left(17+350\right)$$
$$= \frac{38}{2}\times 367$$
$$= \frac{13946}{2}$$
$$= 6973$$

7. Find the sum of first 22 terms of an AP in which d = 7, and 22nd term is 149.

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Sol^n $n = 22$, $d = 7$, $a_{22} = 149$
$a = ?$, $S_n = ?$

$$a_{22} = 149$$

$$a + (n-1) \times d = 149$$
$$a + (22-1) \times 7 = 149$$
$$a + (21) \times 7 = 149$$
$$a + 147 = 149$$
$$a = 149 - 147$$
$$a = 2$$

$$S_n = \frac{n}{2}(a + l)$$
$$= \frac{\cancel{22}^{11}}{\cancel{2}}(2 + 149)$$
$$= 11 (151)$$
$$= 1661 \text{ Ans.}$$

8. Find the sum of first 51 terms of an AP whose second and third terms are 14 and 18 respectively.

Sol^n:- $a_2 = 14$
$a + d = 14$ — (1)

$a_3 = 18$
$a + 2d = 18$ — (2)

Now :- $a + d = 14$ — (1)
$a + 2d = 18$ — (2)
$- \quad - \quad -$

$$-1d = -4$$
$$d = \frac{-4}{-1} = 4$$

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Put in – (1)

$$a + d = 14$$
$$a + 4 = 14$$
$$a = 14 - 4$$
$$a = 10$$

$$S_{51} = \frac{n}{2}\left[2a + (n-1) \times d\right]$$
$$= \frac{51}{2}\left[2(10) + (51-1) \times 4\right]$$
$$= \frac{51}{2}\left[20 + 50 \times 4\right]$$
$$= \frac{51}{2}\left[20 + 200\right]$$
$$= \frac{51}{\cancel{2}} \times \cancel{220}^{110}$$
$$= 5610 \text{ Ans.}$$

9. If the sum of first 7 term of an AP is 49 and that of 17 term is 289, find the sum of first n terms.

Solⁿ:

$S_7 = 49$

$$\frac{7}{2}\left[2a + 6d\right] = 49$$
$$2a + 6d = \frac{\cancel{49}^{7} \times 2}{\cancel{7}}$$
$$2a + 6d = 14 \quad -(1)$$

$S_{17} = 289$

$$\frac{17}{2}\left[2a + 16d\right] = 289$$
$$2a + 16d = \frac{289 \times 2}{17}$$
$$2a + 16d = 34 \quad -(2)$$

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Now :-

$$\cancel{2a} + 6d = \cancel{+}14 \quad -①$$
$$\cancel{2a} \pm 16d = 34 \quad -②$$
$$\cancel{-}10d = \cancel{-}20$$
$$d = \frac{20}{10}$$
$$d = 2$$

Put in $-①$

$$2a + 6d = 14$$
$$2a + 6(2) = 14$$
$$2a + 12 = 14$$
$$2a = 14-12$$
$$2a = 2$$
$$a = \frac{\cancel{2}}{\cancel{2}} = 1$$

$$a = 1, \quad d = 2$$

Now :- $S_n = \frac{n}{2}\left[2a + (n-1)\times d\right]$

$$= \frac{n}{2}\left[2(1) + (n-1)\times 2\right]$$
$$= \frac{n}{2}\left[\cancel{2} + 2n - \cancel{2}\right]$$
$$= \frac{n}{\cancel{2}} \times \cancel{2}n$$
$$S_n = n^2$$

10. Show that $a_1 a_2 \text{———} a_n$ from an AP where a_n is defined as below :-
Also find the sum of the first 15 terms

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(i) $a_n = 3 + 4n$ — (1)

Put in (1)

$a_1 = 3+4(1)$
$= 3+4 = 7$
$a_2 = 3+4(2)$
$= 3+8 = 11$
$a_3 = 3+4(3)$
$= 3+12$
$= 15$

7, 11, 15 ---
here $a = 7$, $d = 4$, $n = 15$

$S_n = \frac{15}{2}\left[2(7) + (15-1) \times 4\right]$

$= \frac{15}{2}\left[14 + 14 \times 4\right]$

$= \frac{15}{2}\left[14 + 56\right]$

$= \frac{15}{\cancel{2}_1} \times \cancel{70}^{35}$

$= 525$ Ans.

(ii) $a_n = 9 - 5n$ — (1)

Put in — (1)

$a_1 = 9-5(1)$
$= 9-5$
$= 4$

$a_2 = 9-5(2)$
$= 9-10$
$= -1$

$a_3 = 9-5(3)$
$= 9-15$
$= -6$

We get AP: 4, -1, -6

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

$= \frac{15}{2}\left[2(4) + (15-1) \times (-5)\right]$

$= \frac{15}{2}\left[8 + 14 \times (-5)\right]$

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$= \frac{15}{2}(8-70)$

$= \frac{15}{\cancel{2}} \times (\cancel{-62})^{-31}$

$= 15 \times (-31)$

$= -465$ Ans.

11. If the sum of the first n term of an AP is $4n - n^2$, what is the first term (that is S_1)? what is the sum of first two terms? what is the second term? Similarly, find the 3rd, the 10^{th} and the n^{th} terms.

Sol^n:- $S_n = 4n - n^2$

Put

(a) $S_1 = 4(1) - (1)^2$

$= 4 - 1$

$= 3$

$\therefore a = 3$

Now put $n = 2$

$S_2 = 4(2) - (2)^2$

$= 8 - 4$

$= 4$

Now $a_2 = S_2 - S_1$

$= 4 - 3$

$= 1$

A.P $- 3, 1$

$d = a_2 - a_1$

$d = 1 - 3 = -2$

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$$a_3 = a + 2d$$
$$= 3 + 2(-2)$$
$$= 3 - 4$$
$$= -1$$

$$a_{10} = a + 9d$$
$$= 3 + 9(-2)$$
$$= 3 + (-18)$$
$$= 3 - 18$$
$$= -15$$

$$a_n = a + (n-1) \times d$$
$$= 3 + (n-1) \times (-2)$$
$$= 3 - 2n + 2$$
$$= 5 - 2n$$

12. find the sum of the first 40 positive integers divisible by 6.

Sol^n: Ist 40 Positive integers divisible by 6 are AP is 6, 12, 18, 24, 30, 36 ——— 240

Here, $a = 6$, $d = 12 - 6 = 6$, $l = 240$

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

$$S_{40} = \frac{\overset{20}{\cancel{40}}}{\cancel{2}}\left[2(6) + (40-1) \times 6\right]$$

$$= 20\left[12 + 39 \times 6\right]$$

$$= 20\,(246)$$

$$= 4920 \quad \text{Ans.}$$

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$$S_n = \frac{n}{2}\left[a + l\right]$$
$$= \frac{\cancel{40}^{20}}{\cancel{2}}\left(6 + 240\right)$$
$$= 20 \times 246$$
$$= 4920 \quad \underline{\text{Ans.}}$$

13. Find the sum of the first 15 multiples of 8. 8, 16, 24 — — — — 120

15
× 8
120

Sol^n: $a = 8$, $d = 8$

$$S_n = \frac{n}{2}\left[a + l\right]$$
$$= \frac{15}{2}\left[8 + 120\right]$$
$$= \frac{15}{\cancel{2}} \times \cancel{128}^{64}$$
$$= 960 \quad \underline{\text{Ans.}}$$

14. Find the sum of the odd numbers between 0 and 50.

Sol^n: Odd numbers between 0 and 50 are,
1, 3, 5 — — — 49

$a = 1$, $d = 3 - 1$, $l = 49$
$= 2$

$$a_n = 49$$
$$a + (n-1) \times d = 49$$
$$1 + (n-1) \times 2 = 49$$

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$$(n-1) \times 2 = 49 - 1$$
$$n-1 = \frac{48}{2}$$
$$n-1 = 24$$
$$n = 24+1$$
$$n = 25$$

$$S_n = \frac{n}{2}\left[a+l\right]$$
$$= \frac{25}{2}\left[1+49\right]$$
$$= \frac{25 \times 50}{2} = \frac{1250}{2}$$
$$= 625$$

Extra Sum :- Find the sum of the even number between 0 and 50.

Solⁿ :- $2, 4, 6 \_\_\_\_\_\_ 50$

$$a = 2, \quad d = 2, \quad l = 50$$

$$a_n = 50$$
$$a + (n-1) \times d = 50$$
$$2 \times (n-1) \times 2 = 50$$
$$(n-1) \times 2 = 50 - 2$$
$$(n-1) \times 2 = 48$$
$$n-1 = \frac{48}{2}$$
$$n-1 = 24$$
$$n = 24 + 1 = 25$$

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$$S_n = \frac{n}{2}\left[a + l\right]$$
$$= \frac{25}{2}(2 + 50)$$
$$= \frac{25}{\cancel{2}} \times \cancel{52}^{26}$$
$$= 650 \text{ Ans}$$

15. A contract on construction job specifies a penalty for delay of completion beyond a certain date as follows ' 200 for the first day ' 250 for the second day ---- days ?

Sol^n:- Penalty for the first day = Rs. 200
" " " 2nd day = Rs 250
" " " 3rd day = Rs 300

---- Soon ----

we get AP:
200, 250, 300 ------

$a = 200$, $d = 50$

Now money pays as panelty for 30 days
$= S_{30}$

$$S_{30} = \frac{\cancel{30}^{15}}{\cancel{2}}\left[2(200) + (30-1) \times 50\right]$$
$$= 15\left[400 + 29 \times 50\right]$$
$$= 15\left[400 + 1450\right]$$
$$= 15(1850) = 27750$$

16. A sum of ' 700 is to be used to give seven cash prizes to students of a school for their overall academic performance. If each prize is ' 20 less than its preceding prize, find the value of each of the prizes.

Sol^n:- Here $S_n = 700$, $n = 7$, $d = -20$

let value of first prize = a
difference = -20 (given)
$S_n = 700$

To find a

$$S_n = \frac{n}{2}\left[2a + (n-1) \times d\right] = 700$$

$$= \frac{7}{2}\left[2a + (7-1) \times (-20)\right] = 700$$

$$= \frac{7}{2}\left[2a + 6 \times (-20)\right] = 700$$

$$= \frac{7}{2}\left[2a + (-120)\right] = 700$$

$$2a - 120 = \frac{\overset{100}{\cancel{700}} \times 2}{\cancel{7}}$$

$$2a - 120 = 200$$

$$2a = 200 + 120$$

$$2a = 320$$

$$a = \frac{320}{2}$$

$$a = 160$$

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To find a:-

$$\therefore \quad a+(a-20)+(a-40)+(a-60)+(a-80)+(a-100)+(a-120) = 700$$

$$7a - 420 = 700$$

$$7a = 700 + 420$$

$$7a = 1120$$

$$a = \frac{1120}{7}$$

$$a = 160$$