5 Arithmetic Progressions

Chapter

In the Chapter

In this chapter, you will be stuyding the following points:

- An **arithmetic progression** (AP) is a list of numbers in which each term is obtained by adding a fixed number d to the preceeding term, except the first term. The fixed number d is called the **common difference**. The general form of an AP is a, $a + d$, $a + 2d$, $a + 3d$, . . .
- A given list of numbers a_1, a_2, a_3, . . . is an AP, if the differences $a_2 - a_1$, $a_3 - a_2$, $a_4 - a_3$, . . ., give the same value, i.e., if $a_{k+1} - a_k$ is the same for different values of k.
- In an AP with first term a and common difference d, the nth term (or the general term) is given by $a_n = a + (n - 1)\, d$.
- The sum of the first n terms of an AP is given by :

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

- If l is the last term of the finite AP, say the nth term, then the sum of all terms of the AP is given by :

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

NCERT TEXT BOOK QUESTION (SOLVED)

EXERCISE 5.1

Q.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 Rs 15 for the first km and Rs 8 for each additional km.

(ii) The amount of air present in a cylinder when a vacuum pump removes 1/4 of the air remaining in the cylinder at a time.

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

(iv) The amount of money in the account every year, when Rs 10000 is deposited at compound interest at 8 % per annum.

Ans. (i) Taxi fare for 1 km = Rs. 15 = a_1

Taxi fare for 2 kms = Rs. 15 + Rs. 8 = Rs. 23 = a_2

Taxi fare for 3 kms = Rs. 23 + Rs. 8 = Rs. 31 = a_3

Taxi fare for 4 kms = Rs. 31 + Rs. 8 = Rs. 39 = a_4

and so on.

$a_2 - a_1$ = Rs. 23 – Rs.15 = Rs. 8

$a_3 - a_2$ = Rs. 31 – Rs. 23 = Rs. 8

$a_4 - a_3$ = Rs.39 – Rs. 31 = Rs. 8

i.e., $a_{k+1} - a_k$ is the same every time.

So, this list of numbers form an arithmetic progression with the first term a = Rs. 15 and the common difference d = Rs. 8.

(ii) Suppose, the amount of air present in the cylinder be 'a' units

$\therefore$ According to the question, the list giving the air present in the cylinder is given by

$$a, a-\frac{a}{4}=\frac{3a}{4}, \frac{3a}{4}-\frac{1}{4}\times\frac{3a}{4}=\frac{12a-3a}{16}=\frac{9a}{16},....$$

Here, $a_1=a, a_2=\frac{3a}{4}, a_3=\frac{9a}{16}....$

Now, $a_2-a_1=\frac{3a}{4}-a=-\frac{a}{4}$

$$a_3-a_2=\frac{9a}{16}-\frac{3a}{4}=\frac{9a-12a}{16}=-\frac{3a}{16}$$

$\Rightarrow$ $a_2-a_1 \neq a_3-a_2$

$\therefore$ a_1, a_2, a_3, ... do not form an A.P.

(iii) Initial cost = Rs. 150.

Cost rises by Rs.50 each subsequent metre.

$\therefore$ Series is, 150, 200, 250, ...

$\therefore$ 200 – 150 = 250 – 200 = 50

$\therefore$ d is constant

$\therefore$ Series is an A.P.

(iv) Here, P = Rs. 10000, r = 8% p.a.

$$\text{Amount after 1 year} = 10000\left(1+\frac{8}{100}\right)^1$$

$$= 10000\times\frac{108}{100}=\text{Rs.}10800$$

$$\text{Amount after 2 years} = 10000\left(1+\frac{8}{100}\right)^2$$

$$= 10000\times\left(\frac{108}{100}\right)^2=\text{Rs.}11664$$

$\therefore$ The succeeding terms are 10000, 10800, 11668 ...

Here 'd' is not a constant as 10800 – 10000 $\neq$ 11664 – 10800

$\therefore$ It is not an A.P.

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

(i) $a = 10, d = 10$ (ii) $a = -2, d = 0$

(iii) $a = 4, d = -3$ (iv) $a = -1, d = \frac{1}{2}$

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

Ans. (i) Here, a = 10 and d = 10

$\therefore$ A.P. is 10, 10 + 10, 10 + 2 × 10, 10 + 3 × 10, ...

i.e., 10, 20, 30, 40, ...

(ii) Here a = – 2 and d = 0

$\therefore$ A.P. is – 2, – 2 + 0, – 2 + 2 × 0, ...

i.e., –2, – 2, –2, – 2 .....

(iii) Here, a = 4 and d = – 3

$\therefore$ A.P. is 4, 4 + (–3), 4 + 2 × (–3), 4 + 3 × (–3), ...

i.e. 4, 1, – 2, – 5, ...

(iv) Here, a = –1 and $d = \frac{1}{2}$

$\therefore$ A.P. is $-1, -1+\frac{1}{2}, -1+2\times\frac{1}{2}, -1+3\times\frac{1}{2}, ...$

$$= -1, -\frac{1}{2}, 0, \frac{1}{2}, ...$$

(v) Here, a = –1.25 and d = – 0.25

$\therefore$ A.P. is – 1.25, – 1.25 – 0.25, – 1.25 – 2 × 0.25, ..

= – 1.25, – 1.50, – 1.75, ...

Q.3. For the following APs, write the first term and the common difference:

(i) 3, 1, – 1, – 3, . . . (ii) – 5, – 1, 3, 7, . . .

(iii) $\frac{1}{3}, \frac{5}{3}, \frac{9}{3}, \frac{13}{3}$,.... (iv) 0.6, 1.7, 2.8, 3.9, . . .

Ans. (i) Here, given, A.P. is 3, 1, –1, –3, ...

$\therefore$ a = 3, d = 1 – 3 = – 2.

(ii) Here, given A.P. is – 5, –1, 3, 7, ...

Hence, a = –5, d = –1 – (–5)

= – 1 + 5

= 4.

(iii) Here, given A.P. is

$$\frac{1}{3}, \frac{5}{3}, \frac{9}{3}, \frac{13}{3},....$$

Hence, $a = \frac{1}{3}$, $d = \frac{5}{3}-\frac{1}{3}=\frac{4}{3}$.

(iv) Here, given A.P. is 0.6, 1.7, 2.8, ...

Hence, a = 0.6, d = 1.7 – 0.6 = 1.1.

Q.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, . . .

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

(iii) – 1.2, – 3.2, – 5.2, – 7.2, . . .

(iv) – 10, – 6, – 2, 2, . . .

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

(vi) 0.2, 0.22, 0.222, 0.2222, . . .

(vii) 0, – 4, – 8, –12, . . .

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

(ix) 1, 3, 9, 27, . . .

(x) $a, 2a, 3a, 4a, ...$

(xi) $a, a^2, a^3, a^4, ...$

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

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

(xiv) $1^2, 3^2, 5^2, 7^2, ...$

(xv) $1^2, 5^2, 7^2, 7^3, ...$

Ans. (i) Given series is

2, 4, 8, 16, ...

Here, $a_2 - a_1 = 4 - 2 = 2$

$a_3 - a_2 = 8 - 4 = 4$

$a_4 - a_3 = 16 - 8 = 8, ...$

$\therefore$ $a_2 - a_1 \neq a_3 - a_2 \neq a_4 - a_3$

$\therefore$ The given series is not A.P.

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

Here, $a_2 - a_1 = \frac{5}{2} - 2 = \frac{1}{2}$,

$a_3 - a_2 = 3 - \frac{5}{2} = \frac{1}{2}$,

$a_4 - a_3 = \frac{7}{2} - 3 = \frac{1}{2}$,

$\therefore$ $d = a_2 - a_1 = a_3 - a_2 = a_4 - a_3 = ... = \frac{1}{2}$.

$\therefore$ It is an A.P.

the next three terms are $\frac{7}{2} + \frac{1}{2}, \frac{7}{2} + 2 \times \frac{1}{2}, \frac{7}{2} + 3 \times \frac{1}{2}$

i.e., $4, \frac{9}{2}, 5$.

(iii) Given series is $-1.2, -3.2, -5.2, -7.2, ...$

$a_2 - a_1 = -3.2 - (-1.2)$
$= -3.2 + 1.2$
$= -2.0$

$a_3 - a_2 = -5.2 - (-3.2)$
$= -5.2 + 3.2$
$= -2.0$

$a_4 - a_3 = -7.2 - (-5.2)$
$= -7.2 + 5.2$
$= -2.0$

$d = a_2 - a_1 = a_3 - a_2 = a_4 - a_3 = -2.$

It is anA.P.

The next three terms are

$-7.2 + (-2), -7.2 + 2 \times (-2), -7.2 + 3 \times (-2)$

i.e., $-9.2, -11.2, -13.2$

(iv) Here, given series is $-10, -6, -2, 2, ...$

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

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

$a_4 - a_3 = 2 - (-2) = 2 + 2 = 4$

$\therefore$ $d = a_2 - a_1 = a_3 - a_2 = a_4 - a_3 = 4.$

It is an A.P.

The next three terms are

$2 + 3, 2 + 2 \times 4, 2 + 3 \times 4$

i.e., 6, 10, 14.

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

$a_2 - a_1 = 3 + \sqrt{2} - 3 = \sqrt{2}$

$a_3 - a_2 = (3 + 2\sqrt{2}) - (3 + \sqrt{2})$
$= 3 + 2\sqrt{2} - 3 - \sqrt{2} = \sqrt{2}$

$\therefore$ $d = a_2 - a_1 = a_3 - a_2 = \sqrt{2}.$

It is an A.P.

The next three terms are

$3 + 3\sqrt{2} + \sqrt{2}, 3 + 3\sqrt{2} + \sqrt{2} \times \sqrt{2}, 3 + 3\sqrt{2} + 3 \times \sqrt{2}$

i.e. $3 + 4\sqrt{2}, 3 + 5\sqrt{2}, 3 + 6\sqrt{2}$

(vi) Here, the given series is

0.2, 0.22, 0.222, ...

$a_2 - a_1 = 0.22 - 0.2 = 0.02,$

$a_3 - a_2 = 0.222 - 0.22 = 0.002, ...$

$a_2 - a_1 \neq a_3 - a_2$

It is not an A.P.

(vii) Here, the given series is

$0, -4, -8, -12, ...$

$a_2 - a_1 = -4 - 0 = -4$

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

$a_4 - a_3 = -12 - (-8) = -12 + 8 = -4$

$\therefore$ $d = a_2 - a_1 = a_3 - a_2 = a_4 - a_3 = -4.$

$\therefore$ It is an A.P.

The next three terms are

$-12 + (-4), -12 + 2 \times (-4), -12 + 3(-4)$

i.e., $-16, -20, 25$

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

$a_2 - a_1 = -\frac{1}{2} - \left(-\frac{1}{2}\right) = 0$

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

$a_4 - a_3 = -\frac{1}{2} - \left(-\frac{1}{2}\right) = 0$

$\therefore\quad d = a_2 - a_1 = a_3 - a_2 = a_4 - a_3 = 0.$

$\therefore$ It is an A.P.

The next three terms are

$$-\frac{1}{2}+0,\ -\frac{1}{2}+2\times 0,\ -\frac{1}{2}+3\times 0$$

i.e. $-\frac{1}{2}, -\frac{1}{2}, -\frac{1}{2}.$

(ix) Here, the given series is

1, 3, 9, 27, ...

$a_2 - a_1 = 3 - 1 = 2,$

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

$a_4 - a_3 = 27 - 9 = 18$

$\therefore\quad a_2 - a_1 \neq a_3 - a_2 \neq a_4 - a_3$

$\therefore$ It is not A.P.

(x) Here, the given series is

$a, 2a, 3a, 4a, ...$

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

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

$a_4 - a_3 = 4a - 3a = a, ...$

Clearly,it is an A.P. whose common difference is a.

The next three terms are

$4a + a, 4a + 2 \times a, 4a + 3 \times a$

i.e. $5a, 6a, 7a,$

(xi) Here, the given series is

$a, a^2, a^3, a^4, ...$

$a_2 - a_1 = a^2 - a = a(a-1)$

$a_3 - a_2 = a^3 - a^2 = a^2(a-1)$

$a_4 - a_3 = a^4 - a^3 = a^3(a-1)$

$\therefore\quad a_2 - a_1 \neq a_3 - a_2 \neq a_4 - a_3$

$\therefore$ It is not A.P.

(xii) Here, the given series is

$\sqrt{2}, \sqrt{8}, \sqrt{18}, \sqrt{32}, \ldots$

$a_2 - a_1 = \sqrt{8} - \sqrt{2} = 2\sqrt{2} - \sqrt{2} = \sqrt{2}$

$a_3 - a_2 = \sqrt{18} - \sqrt{8} = 3\sqrt{2} - 2\sqrt{2} = \sqrt{2}$

$\therefore\quad d = a_2 - a_1 = a_3 - a_2 = \sqrt{2}$

$\therefore$ It is an A.P.

The next three terms are

$\sqrt{32} + \sqrt{2}, \sqrt{32} + 2\sqrt{2}, \sqrt{32} + 3\sqrt{2}$

i.e., $5\sqrt{2}, 6\sqrt{2}, 7\sqrt{2}$

or $\sqrt{50}, \sqrt{72}, \sqrt{98}.$

(xiii) Here, the given series is

$\sqrt{3}, \sqrt{6}, \sqrt{9}, \sqrt{12}, \ldots$

$a_2 - a_1 = \sqrt{6} - \sqrt{3} = \sqrt{3} - (\sqrt{2} - 1)$

$a_3 - a_2 = \sqrt{9} - \sqrt{6} = \sqrt{3}(\sqrt{3} - \sqrt{2})$

$a_2 - a_1 \neq a_3 - a_2$

It is not A.P.

(xiv) Here, the given series is

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

$a_2 - a_1 = 3^2 - 1^2 = 9 - 1 = 8$

$a_3 - a_2 = 5^2 - 3^2 = 25 - 16 = 9$

$a_4 - a_3 = 7^2 = 49 - 25 = 24$

$\therefore\quad a_2 - a_1 \neq a_3 - a_2 \neq a_4 - a_3$

$\therefore$ It is not A.P.

(xv) Here, the given series is

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

$a_2 - a_1 = 5^2 - 1^2 = 25 - 1 = 24$

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

$a_4 - a_3 = 7^3 - 7^2 = 73 - 49 = 24$

$\therefore\quad d = a_2 - a_1 = a_3 - a_2 = a_4 - a_3 = 24.$

It is an A.P.

The next three terms are

$73 + 24, 73 + 2 \times 24, 73 + 3 \times 24$

i.e., $97, 73 + 48, 73 + 72$

or. $97, 121, 145.$

EXERCISE 5.2

Q.1. Fill in the blanks in the following table, given that a is the first term, d the common difference and a_n the nth term of the AP:

	a	d	n	a_n
(i)	**7**	**3**	**8**	**–**
(ii)	**–18**	**–**	**10**	**0**
(iii)	**–**	**–3**	**18**	**–5**
(iv)	**–18.9**	**2.5**	**–**	**3.6**
(v)	**3.5**	**0**	**105**	**–**

Ans. (i) 28.

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

$= 7 + (8-1)3$

$= 7 + 21$

$\Rightarrow\quad a_n = 28.$

(ii) 2.

Hint : Using the formula

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

$0 = -18 + (10-1)d$

$18 = 9d$

$2 = d$

(iii) 46

Hint : Using the formula

$$a + (n-1)\,d = a_n$$
$$a + (18-1)(-3) = -5$$
$$a + 17 \times (-3) = -5$$
$$a - 51 = -5$$
$$a = -5 + 51$$
$$a = 46.$$

(iv) 10.

Hint : Using the formula

$$a + (n-1)\,d = a_n$$
$$-18.9 + (n-1)\,2.5 = 3.6$$
$$(n-1)\,2.5 = 3.6 + 18.9$$
$$(n-1)\,2.5 = 22.5$$
$$n - 1 = \frac{22.5}{2.5}$$
$$n - 1 = 9$$
$$n = 9 + 1 = 10.$$

(v) 3.5

Hint : On using the formula,

$$a_n = a + (n-1)\,d$$
$$= 3.5 + (105 - 1) = 0$$
$$= 3.5 + 0$$
$$= 3.5$$

Q.2. Choose the correct choice in the following and justify :

(i) 30th term of the AP: 10, 7, 4, . . . , is

(a) 97 (b) 77

(c) –77 (d) – 87

(ii) 11th term of the AP: $-3, -\frac{1}{2}, 2, \ldots$, is

(a) 28 (b) 22

(c) –38 (d) $-48\frac{1}{2}$

Ans. (i) Here, $a = 10$, $n = 30$, $d = 7 - 10 = -3$

Using the formula,

$$a_n = a + (n-1)d$$
$$a_{30} = 10 + (30-1)(-3)$$
$$= 10 + 29 \times (-3)$$
$$= 10 - 87$$
$$\Rightarrow \quad a_{30} = -77$$

30th term of A.P. = – 77. **(c)**

(ii) Here, $a = -4$, $n = 11$, $d = -\frac{1}{2} - (-3)$

$$= -\frac{1}{2} + 3$$
$$= \frac{5}{2}$$

Using the formula

$$a_n = a + (n-1)d$$
$$a_{11} = -3 + (11-1)\left(\frac{5}{2}\right)$$
$$= -3 + 10 \times \frac{5}{2}$$
$$= -3 + 25 \Rightarrow a_{11} = 22 \text{ (b)}$$

Q.3. In the following APs, find the missing terms in the boxes :

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

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

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

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

(v) $\boxed{}$, 38, $\boxed{}$, $\boxed{}$, $\boxed{}$, – 22

Ans. (i) Here, $n = 3$, $a = 2$, and $a_n = l = 26$

$$\therefore \quad a_n = a + (n-1)\,d$$
$$\Rightarrow \quad 26 = 2 + (3-1)\,d$$
$$\Rightarrow \quad 2d = 26 - 2$$
$$\Rightarrow \quad 2d = 24$$
$$\Rightarrow \quad d = \frac{24}{2}$$
$$\Rightarrow \quad d = 12.$$

Hence, missing term = $a + d = 2 + 12 = 14$.

(ii) Here, 2nd term = 13

$\Rightarrow \quad a + d = 13$ ...(i)

and 4th term = 3

$\Rightarrow \quad a + 3d = 3$ ...(ii)

On solving equation (i) and equation (ii), we get

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

$\therefore$ 1st term = 18

3rd term = $a + 2d$

$$= 18 + 2 \times (-5)$$
$$= 18 - 10$$
$$= 8$$

Hence required terms are 18 and 8.

(iii) Here, $a = 5$ and $a_4 = 9\frac{1}{2} = \frac{19}{2}$

$$\Rightarrow \quad a + 3d = \frac{19}{2}$$

$\Rightarrow \quad 5 + 3d = \frac{19}{2}$

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

$\Rightarrow \quad 3d = \frac{9}{2}$

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

$\therefore$ 2nd term $= a + d = 5 + \frac{3}{2} = \frac{10+3}{2} = \frac{13}{2}$

3rd term $= a + 2d = 5 + 2 \times \frac{3}{2} = 8$

$\therefore$ Missing terms are $\frac{13}{2}$ and 8.

(iv) Here, $a = -3$ ...(i)

and $a_6 = 6$

$\Rightarrow \quad a + 5d = 6$

$\Rightarrow \quad -4 + 5d = 6$ [using (i)]

$\Rightarrow \quad 5d = 6 + 4$

$\Rightarrow \quad 5d = 10$

$\Rightarrow \quad d = 2$

$\therefore$ Missing terms are $a + d, a + 2d, a + 3d, a + 4d$

$= -4 + 2, -4 + 2 \times 2, -4 + 3 \times 2, -4 + 4 \times 2$

$= -2, -4 + 4, -4 + 6, -4 + 8$

$= -2, 0, 2, 4.$

(v) $a_2 = 38$

$\Rightarrow \quad a + d = 38$ ...(i)

and $a_6 = -22$

$a + 5d = -22$ ...(ii)

On solving equation (i) and equation (ii), we get

$a = 53, d = -15$

Hence missing terms are

$= a, a_3, a_4, a_5$

$= a, a + 2d, a + 3d, a + 4d$

$= 53, 53 + 2 \times (-15), 53 + 3 \times (-15), 53 + 4 \times (-15)$

$= 53, 23, 8, -7$

Q.4. Which term of the AP : 3, 8, 13, 18, . . . ,is 78?

Ans. Given series is

3, 8, 13, 18, ...

Here, $a = 3$, $d = 8 - 3 = 5$

Let 78 be the nth term fo the given A.P.

Using the formula,

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

$\Rightarrow \quad 3 + (n-1)(5) = 78$

$\Rightarrow \quad (n-1)\,5 = 78 - 3$

$\Rightarrow \quad (n-1)\,5 = 75$

$\Rightarrow \quad n - 1 = \frac{75}{5}$

$\Rightarrow \quad n - 1 = 15$

$\Rightarrow \quad n = 15 + 1$

$\Rightarrow \quad n = 16$

Hence 16th term of A.P. is 78.

Q.5. Find the number of terms in each of the following APs :

(i) 7, 13, 19, . . . , 205

(ii) 18, 15 $\frac{1}{2}$, 13, . . . , – 47

Ans. (i) Given series is 7, 13, 19, ..., 205

Here, $a = 7$, $d = 13 - 7 = 6$, $a_n = 205$, $n = ?$

Using the formula,

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

$\Rightarrow \quad 7 + (n-1)\,6 = 205$

$\Rightarrow \quad (n-1)\,6 = 205 - 7$

$\Rightarrow \quad (n-1)\,6 = 198$

$\Rightarrow \quad n - 1 = 33$

$\Rightarrow \quad n = 33 + 1$

$\Rightarrow \quad n = 34$

Hence, the given A.P. contains 34 terms.

(ii) Given series is

$8, 15\frac{1}{2}, 13, \ldots, -47$

Here, $a = 18$, $d = \frac{31}{2} - 18 = \frac{-5}{2}$, $a_n = -47$, $n = ?$

Using the formula,

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

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

$\Rightarrow \quad (n-1)\left(\frac{-5}{2}\right) = -47 - 18$

$\Rightarrow \quad (n-1)\left(\frac{-5}{2}\right) = -65$

$\Rightarrow \quad n - 1 = 26 + 1$

$\Rightarrow \quad n = 27.$

Hence, the given A.P. contains 27 terms.

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

Ans. Let – 150 is a nth term of A.P.

$\therefore \quad -150 = a + (n-1)d$

$\Rightarrow \quad -150 = 11 + (n-1)(-3)$

$\Rightarrow \quad -3(n-1) = -150 - 11$

$\Rightarrow \quad -3(n-1) = -161$

$\Rightarrow \quad (n-1) = \dfrac{161}{3}$

$\Rightarrow \quad n = \dfrac{161}{3} + 1 = \dfrac{164}{3} = 54\dfrac{1}{3}$

Since n cannot be a fraction.

$\therefore$ –150 is not a term of 11, 8, 5, 2, ...

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

Ans. We have, $a_{11} = a + 10d = 38$ ...(i)

$a_{16} = a + 15d = 73$ ...(ii)

On subtracting equation (ii) from equation (i), we get

$-5a = -35 \Rightarrow d = 7$

From (i) $a + 10 \times 7 = 38 \Rightarrow a = 38 - 70 = -32$

Now, $a_{31} = a + 30d$

$= -32 + 30 \times 7$

$= -32 + 210$

$a_{31} = 178$

Hence, 31st term of an A.P. is 178.

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

Ans. We have, $a_3 = a + 2d = 12$ ...(i)

last term $a_{50} = a + 49d = 106$ ...(ii)

On solving equation (i) and equation (ii),we get

$a = 8, d = 2.$

$a_{29} = a + 28d$

$= 8 + 28 \times 2$

$= 8 + 56$

$a_{29} = 64$

Hence, 29th term of A.P. is 64.

Q9. If the 3rd and the 9th terms of an AP are 4 and – 8 respectively, which term of this AP is zero?

Ans. We have

$a_3 = a + 2d = 4$ ...(i)

$a_9 = a + 8d = -8$ ...(ii)

On solving equation (i) and equation (ii),we get

$a = 8, d = -2$

Let $a_n = 0$, then

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

$\Rightarrow \quad 8 + (n-1)(-2) = 0$

$\Rightarrow \quad (n-1)(-2) = 4$

$\Rightarrow \quad n - 1 = 4$

$\Rightarrow \quad n = 5$

Hence, 5th term of this A.P. is zero.

Q.10. The 17th term of an AP exceeds its 10th term by 7. Find the common difference.

Ans. We have, $a_{17} - a_{10} = 7$

$\therefore \quad (a + 16d) - (a + 9d) = 7$

$\Rightarrow \quad 7d = 7$

$\Rightarrow \quad d = 7$

Hence, common difference $= 1$

Q.11. Which term of the AP : 3, 15, 27, 39, . . . will be 132 more than its 54th term?

Ans. We have $a_n - a_{54} = 132$

$\Rightarrow \quad [a + (n-1)d] - [a + 53d] = 132$

$\Rightarrow \quad (n - 1 - 53)d = 132$

$\Rightarrow \quad (n - 54)d = 132$

$\Rightarrow \quad (n - 52)\,12 = 132$

$(d = 15 - 3 = 12)$

$\Rightarrow \quad n - 54 = 11$

$\Rightarrow \quad n = 65$

Hence, 65th term is 132 more than its 54th term.

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

Ans. Let $d_1 = d_2 = d$

$\therefore$ We have, $a_{100} - b_{100} = 100$

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

$\Rightarrow \quad a - b = 100$

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

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

$= a - b$

$= 100.$ [using (i)]

Q.13. How many three-digit numbers are divisible by 7?

Ans. The three digit numbers divisible by 7 are 105, 112, 119, ..., 994.

Here, $a = 105$, $d = 112 - 105 = 7$, $a_n = 994$, $n = ?$

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

$\Rightarrow \quad 105 + (n-1)7 = 994$

$\Rightarrow \quad (n-1)7 = 994 - 105$

$\Rightarrow \quad (n-1)7 = 889$

$\Rightarrow \quad n - 1 = \dfrac{889}{7}$

$\Rightarrow \quad n = 127 + 1$

$\Rightarrow \quad n = 128.$

Hence, there are 128 three-digit numbers which are divisible by 7.

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

Ans. Multiples of 4 between 10 and 250 are 12, 16, ..., 248

Here, $a = 12, d = 16 - 12 = 4, a_n = 248$

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

$\Rightarrow \quad 12 + (n-1)4 = 248$

$\Rightarrow \quad (n-1)4 = 248 - 12$

$\Rightarrow \quad (n-1)4 = 236$

$\Rightarrow \quad n - 1 = 59$

$\Rightarrow \quad n = 60$

Hence, 60 multiples of 4 lie between 10 and 250.

Q.15. For what value of *n*, are the *n*th terms of two APs: 63, 65, 67, . . . and 3, 10, 17, . . . equal?

Ans. We have,

$63 + (n-1)2 = 3 + (n-1)7$

$\Rightarrow \quad (7-2)(n-1) = 63 - 3$

$\Rightarrow \quad 5(n-1) = 60$

$\Rightarrow \quad n - 1 = \dfrac{60}{5}$

$\Rightarrow \quad n - 1 = 12$

$\Rightarrow \quad n = 13$

Q.16. Determine the AP whose third term is 16 and the 7th term exceeds the 5th term by 12.

Ans. Here, $a + 2d = 16$

and $(a + 6d) - (a + 4d) = 12$

or $6d - 4d = 12$

or $2d = 12$

or $d = 6$

Using this value in equation (i), we have

$a + 2 \times 6 = 16$

$\Rightarrow \quad a + 12 = 16$

$\Rightarrow \quad a = 4$

Hence, A.P. is $4, 4 + 6, 4 + 2 \times 6, 4 + 3 \times 6$ *i.e.*, 4, 10, 16, 22, ...

Q.17. Find the 20th term from the last term of the AP : 3, 8, 13, . . ., 253.

Ans. *n*th term fromthe last term of the A.P. $= l - (n-1)d$

The 20th term from the last term of the A.P. 3, 8, 13, ... 253 is

$a_{20} = 253 - (20-1)5$
$= 253 - 95$
$= 158.$

Q.18. The sum of the 4th and 8th terms of an AP is 24 and the sum of the 6th and 10th terms is 44. Find the first three terms of the AP.

Ans. We have $(a + 3d) + (a + 7d) = 24$

or $2a + 10d = 24$

or $a + 5d = 12$

and $(a + 5d) + (a + 9d) = 44$

or $2a + 14d = 44$

or $a + 7d = 22$

On solving equations (i) and (ii), we get

$a = -13, d = 5.$

Hence, first three terms of this A.P. are

$-13, 13 + 5, -13 + 2 \times 5$

i.e., $-13, -8, -3.$

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

Ans. Here, we have,

$a = 5000, d = 200, a_n = 7000, n = ?$

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

$\Rightarrow \quad 5000 + (n-1)200 = 7000$

$\Rightarrow \quad (n-1)200 = 7000 - 5000$

$\Rightarrow \quad (n-1)200 = 2000$

$\Rightarrow \quad (n-1) = \dfrac{2000}{200}$

$\Rightarrow \quad n - 1 = 10$

$\Rightarrow \quad n = 11$ years.

Hence, in 11th year (i.e., in 2005) of his services he drew an annual salary of Rs. 7000.

Q.20. Ramkali saved Rs 5 in the first week of a year and then increased her weekly savings by Rs 1.75. If in the *n*th week, her weekly savings become Rs 20.75, find *n*.

Ans. Here, we have

$a = 5, d = 1.75, a_n = 20.75, n = ?$

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

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

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

$(n-1)1.75 = 15.75$

$n - 1 = \dfrac{15.75}{1.75}$

$n - 1 = 9$

$n = 9 + 1$

$n = 10$

In 10th week Ramkali's saving were Rs. 20.75.

EXERCISE 5.3

Q.1. Find the sum of the following APs:
(i) 2, 7, 12, . . ., to 10 terms.
(ii) –37, –33, –29, . . ., to 12 terms.
(iii) 0.6, 1.7, 2.8, . . ., to 100 terms.
(iv) $\frac{1}{15}, \frac{1}{12}, \frac{1}{10}$, . . ., to 11 terms.

Ans. (i) Here $a = 2$, $d = 7 - 2 = 5$, $n = 10$

Using the formula

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

$$S_{10} = \frac{10}{2}[2 \times 2 + (10-1)5]$$
$$= 5[4 + 9 \times 5]$$
$$= 5[4 + 45]$$
$$= 5 \times 49$$
$$\therefore \quad S_{10} = 245.$$

(ii) Here, $a = -37$, $d = -33 - (-37) = -33 + 37 = 4$, $n = 12$.

Now, $$S_n = \frac{n}{2}[2a + (n-1)d]$$

$$\Rightarrow \quad S_{12} = \frac{12}{2}[2 \times (-37) + (12-1)4]$$
$$= 6[-74 + 44]$$
$$= 6 \times (-30)$$
$$\therefore \quad S_{12} = -180$$

(iii) Here, $a = 0.6$, $d = 1.7 - 0.6 = 1.1$, $n = 100$

Now, $$S_n = \frac{n}{2}[2a + (n-1)d]$$

$$\Rightarrow \quad S_{100} = \frac{100}{2}[2 \times (0.6) + (100-1)\,1.1]$$
$$= 50[1.2 + 108.9]$$
$$= 50[110.1]$$
$$\therefore \quad S_{100} = 5505.$$

(iv) Here, we have

$$a = \frac{1}{15},\ d = \frac{1}{12} - \frac{1}{15} = \frac{1}{60},\ n = 11$$

Now, $$S_n = \frac{n}{2}[2a + (n-1)d]$$

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

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

$$= \frac{11}{2} \times \frac{9}{30}$$

$$S_{11} = \frac{33}{20}.$$

Q.2. Find the sums given below :

(i) $7 + 10\frac{1}{2} + 14 + \ldots + 84$
(ii) 34 + 32 + 30 + . . . + 10
(iii) –5 + (–8) + (–11) + . . . + (–230)

Ans. (i) Here, a = 7

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

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

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

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

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

$$\Rightarrow \quad n - 1 = 22$$
$$\Rightarrow \quad n = 23$$

Now using the formula

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

$$\Rightarrow \quad S_{23} = \frac{23}{2}(7 + 84)$$

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

$$\therefore \quad S_{23} = \frac{2093}{2} = 1046\frac{1}{2}$$

(ii) Here, $a = 34$, $d = 32 - 34 = -2, 1$, $l = a_n = 10$

$$a + (n-1)d = a_n$$
$$\Rightarrow \quad 34 + (n-1)(-2) = 10$$
$$\Rightarrow \quad (n-1)(-2) = -24$$
$$\Rightarrow \quad n - 1 = 12$$
$$\Rightarrow \quad n = 13.$$

Now using the formula,

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

We have, $S_{13} = \frac{13}{2}(34+10)$

$$= \frac{13}{2} \times 44$$

$\therefore \quad S_{13} = 286.$

(iii) Here, $a = -5$, $d = -8 - (-5) = -8 + 5 = -3$, $l = a_n = -230$.

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

$\Rightarrow \quad -5 + (n-1)(-3) = -230$

$\Rightarrow \quad (n-1)(-3) = -225$

$\Rightarrow \quad n - 1 = 75$

$\Rightarrow \quad n = 76$

Now using the formula, $S_n = \frac{n}{2}(a+l)$

the sum $= \frac{76}{2}[-5+(-230)]$

$= 38 \times (-5 - 235)$

$= 38 \times (-235)$

$\therefore \quad S_{76} = -8930.$

Q.3. In an AP:

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

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

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

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

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

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

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

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

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

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

Ans. (i) Here, $a = 5$, $d = 3$, $a_n = 50$

Using the formula

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

$\Rightarrow \quad 5 + (n-1)3 = 50$

$\Rightarrow \quad (n-1)3 = 45$

$\Rightarrow \quad n - 1 = 15$

$\Rightarrow \quad n = 16$

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

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

$= 8 \times 55$

$\Rightarrow \quad S_n = 440.$

(ii) Given, $a = 7$, $a_{13} = 35$, $d = ?$, $S_{13} = ?$

$a_{13} = a + 12d$

$\therefore \quad 35 = 7 + 12d$

$\Rightarrow \quad 12d = 28$

$\Rightarrow \quad d = \frac{7}{3}$

and $S_{13} = \frac{13}{2}(7+35)$

$$= \frac{13}{2} \times 42$$

$= 13 \times 21$

$\therefore \quad S_{13} = 273.$

(iii) Given $a_{12} = 37$, $d = 3$, $a = ?$ $S_{12} = ?$

We have, $a_{12} = a + 11d$

$\Rightarrow \quad 37 = a + 11 \times 3$

$\Rightarrow \quad a = 37 - 33$

$\Rightarrow \quad a = 4$

and $S_{12} = \frac{12}{2}(4+37)$

$= 6 \times 41$

$\therefore \quad S_{12} = 246.$

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

We have, $a_3 = a + 2d$

$\Rightarrow \quad 13 = a + 2d$

and $S_{10} = \frac{10}{2}(a + a_{10})$

$\Rightarrow \quad 125 = 5(a + a + 9d)$

$\Rightarrow \quad 2a + 9d = 25$

Solving equation (i) and equation (ii),we get

$d = -1$, $a = 17$

$\therefore \quad a_{10} = a + (10-1)d$

$= a + 9d$

$= 17 + 9(-1)$

$= 17 - 9$

$= 8$

$\therefore \quad d = -1$, $a_{10} = 8$.

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

We have, $S_9 = \frac{9}{2}(a + a_9)$

$\Rightarrow \quad 75 = \frac{9}{2}(a + a + 8d)$

$\Rightarrow \quad 75 = \frac{9}{2}(2a+8d)$

$\Rightarrow \quad 75 = 9(a+4\times 5)$

$\Rightarrow \quad 75 = 9a+180$

$\Rightarrow \quad 9a = -105$

$\Rightarrow \quad a = -\frac{35}{3}$

$\therefore \quad a_9 = a+8d$

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

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

$= \frac{85}{3}$

$\therefore \quad a = \frac{-35}{3}$ and $a_9 = \frac{85}{3}$

(vi) given $a = 2$, $d = 8$, $S_n = 90$, $n = ?$, $a_n = ?$

We have $\quad a_n = a+(n-1)d$

$= 2+(n-1)8$

$= 2+8n-8$

$= 8n-6$

and $\quad S_n = \frac{n}{2}[a+a_n]$

$\Rightarrow \quad 90 = \frac{n}{2}[a+8n-6]$

$\Rightarrow \quad 90 = \frac{n}{2}[2+8n-6]$

$\Rightarrow \quad 90 = \frac{n}{2}[8n-4]$

$\Rightarrow \quad 90 = 4n^2-2n$

$\Rightarrow \quad 4n^2-2n-90 = 0$

$\Rightarrow \quad 2n^2-n-45 = 0$

(which is quadratic equation)

$\Rightarrow \quad 2n^2-10n+9n-45 = 0$

(using factorization method)

$\Rightarrow \quad 2n(n-5)+9(n-5) = 0$

$\Rightarrow \quad (n-5)(2n+9) = 0$

$\Rightarrow \quad n = 5, n = \frac{-9}{2}$

The number of terms can not be negative

$\therefore \quad n = 5$

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

$\Rightarrow \quad a_5 = 2+(5-1)8$

$= 2+32$

$= 34.$

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

We have $\quad a_n = a+(n-1)d$

$\Rightarrow \quad 62 = 8+(n-1)d$

$\Rightarrow \quad (n-1)d = 54$

and $\quad S_n = \frac{n}{2}[a+a_n]$

$210 = \frac{n}{2}[8+62]$

$35n = 210$

$n = 6.$

Substituting the value of n in equation (i), we get

$(6-1)d = 54$

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

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

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

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

$\Rightarrow \quad 4 = a+2n-2$

$\Rightarrow \quad 6 = a+2n$

and $\quad S_n = \frac{n}{2}(a+a_n)$

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

$n = \frac{-28}{a+4}$

Substituting this value of n in equation (i), we get

$6 = a+\frac{2.(-28)}{a+4}$

or $\quad 6(a+4) = a^2+4a-56$

or $\quad a^2-2a-80 = 0$

or $\quad a^2-10a+8a-80 = 0$

or $\quad a(a-10)+8(a-10) = 0$

or $\quad (a+8)(a-10) = 0$

or $\quad a = -8, a = 10$

$\therefore \quad n = -\frac{28}{a+4}$

$= \frac{-28}{-8+4}$, (when $a = -8$) or $\frac{-28}{10+4}$, (when $a = 10$)

$= 7$ or $\frac{-28}{14}$

or -7 (it is not possible)

$\therefore$ a = –8, n = 7.

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

We have, $S = \frac{n}{2}[a + a_n]$

$192 = \frac{8}{2}[3 + a_8]$

$3 + a_8 = 48$

$a_8 = 45$

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

$\Rightarrow 45 = 3 + (8-1)d$

$\Rightarrow 45 = 3 + 7d$

$\Rightarrow 7d = 42$

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

$\Rightarrow d = 6.$

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

We have, $S = \frac{n}{2}[a + l]$

or $144 = \frac{9}{2}[a + 28]$

$\Rightarrow a + 28 = 32$

$\Rightarrow a = 4.$

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

Ans. Here, $a = 9$, $d = 17 - 9 = 8$, $S_n = 636 = 8$

Now, using the formula,

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

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

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

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

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

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

$\therefore n = \frac{-5 \pm \sqrt{(5)^2 - 4 \times 4 \times 9 - 636)}}{2 \times 4}$

(using quadratic formula)

$n = \frac{-5 \pm \sqrt{25 + 10176}}{8}$

$= \frac{-5 \pm \sqrt{10201}}{8}$

$= \frac{-5 \pm 101}{8}$

$= \frac{-5+101}{8}$ or $\frac{-5-101}{8}$

$\therefore n = \frac{96}{8}$; since negative value of n is not possible.

$\Rightarrow n = 12.$

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

Ans. Here, $a = 5$, $a_n = l = 45$, $S_n = 400$

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

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

$n = 16.$

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

$\Rightarrow 5 + (16-1)d = 45$

$\Rightarrow 5 + 15d = 45$

$\Rightarrow 15d = 40$

$\Rightarrow d = \frac{8}{3}$

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

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

Ans. Here $a = 17$, $l = a_n = 350$, $d = 9$

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

$\Rightarrow 17 + (n-1)\,9 = 350$

$\Rightarrow \quad (n-1)\,9 = 333$

$\Rightarrow \quad n-1 = 37$

$\Rightarrow \quad n = 38$

using $\quad S_n = \dfrac{n}{2}[2a+(n-1)d]$, we get

$$S_{38} = \frac{38}{2}[2\times 17+(38-1)\,9]$$
$$= 19\,[34+333]$$
$$= 19\times[367]$$
$$\therefore \quad S_{38} = 6973$$

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

Ans. Here, $n = 22$, $d = 7$, $a_{22} = 149$, $S_{22} = ?$

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

$\Rightarrow \quad a+(22-1)7 = 149$

$\Rightarrow \quad a+21\times 7 = 149$

$\Rightarrow \quad a+147 = 149$

$\Rightarrow \quad a = 2$

using $\quad S_n = \dfrac{n}{2}[a+a_n]$, we get

$$S_{22} = \frac{22}{2}[a+a_{22}]$$
$$= \frac{22}{2}[2+149]$$
$$\therefore \quad S_{22} = 1661.$$

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

Ans. Here, $n = 51$, $a_2 = 14$, $a_3 = 18$

$\therefore \quad d = a_3 - a_2$
$= 18 - 14$
$= 4$

Now, $\quad a_3 = a + 2d$

$\Rightarrow \quad 18 = a + 2\times 4$

$\Rightarrow \quad a = 10$

$$\therefore \quad S_{12} = \frac{51}{2}[2\times 10+(51-1)\,4]$$
$$= \frac{51}{2}[20+200]$$
$$= \frac{51}{2}\times 220$$
$$= 51\times 110$$
$$\Rightarrow \quad S_{51} = 5610.$$

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

Ans. Here, we have

$$S_7 = \frac{7}{2}[2a+(7-1)d]$$
$$\Rightarrow \quad 49 = \frac{7}{2}[2a+6d]$$
$$\Rightarrow \quad 49 = 7a+21d$$
$$\Rightarrow \quad a+3d = 7 \qquad \text{...(i)}$$

and $\quad S_{17} = \dfrac{17}{2}[2a+(17-1)\,d]$

$$\Rightarrow \quad \frac{17}{2}[2a+16d] = 289$$
$$\Rightarrow \quad a+8d = 17 \qquad \text{...(ii)}$$

On solving equations (i) and (ii), we get

$a = 1$, $d = 2$

$$\therefore \quad Sn = \frac{n}{2}[2a+(n–1)d]$$
$$= \frac{n}{2}[2\times 1+(n-1)\,2]$$
$$= \frac{n}{2}[2+2n-2] = n^2$$

Thus, $\quad S_n = n^2.$

Q.10. Show that $a_1, a_2, \ldots, a_n, \ldots$ form an AP where a_n is defined as below :

(i) $a_n = 3 + 4n$ (ii) $a_n = 9 - 5n$

Also find the sum of the first 15 terms in each case.

Ans. (i) Here, $a_n = 3+4n$

Put $n = 1, 2, 3, 4,\ldots$ successively ,we get

$a_1 = 3+4\times 1 = 3+4 = 7$

$a_2 = 3+4\times 2 = 3+8 = 11$

$a_3 = 3+4\times 3 = 3+12 = 15, \ldots$

$\therefore \quad a = 7$, $d = a_2 - a_1 = 11 - 7 = 4.$

Clearly, a_1, a_2, a_3, ... is an A.P. with common difference 4.

Now, $\quad S_{15} = \dfrac{15}{2}[2\times 7+(15-1)\,4]$

$$= \frac{15}{2}[14+56]$$
$$= \frac{15}{2}\times 70 = 525$$

(ii) Here, $a_n = 9 - 5n$

Put $n = 1, 2, 3, ...$ successively, we get

$\therefore \quad a_1 = 9 - 5 \times 1 = 9 - 5 = 4$

$a_2 = 9 - 5 \times 2 = -1,$

$a_3 = 9 - 5 \times 3 = -6, ...$

$\therefore \quad a = 4, d = -1 - 4 = -5.$

Clearly, $a_1, a_2, a_3, ...$ is an A.P. with common difference – 5.

Now, $S_{15} = \frac{15}{2}[2 \times 4 + (15-1)(-5)] = \frac{15}{2}[8-70]$

$= \frac{15}{2}[-62] = -465.$

Q.11. If the sum of the first *n* terms 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 10th and the *n*th terms.

Ans. Here, $S_n = 4n - n^2$, $\therefore S_1 = 4 \times 1 - (1)^2 = 4 - 1 = 3.$

First term is 3.

Now, $S_2 = 4 \times 2 - (2)^2 = 8 - 4 = 4$

Sum of two terms is 4.

2nd term = $S_2 - S_1 = 4 - 3 = 1$

Now, $S_3 = 4 \times 3 - (3)^2 = 12 - 9 = 3$

$\therefore$ 3rd term = $S_3 - S_2 = 3 - 4 = -1$

Now $S_9 = 4 \times 9 - (9)^2 = 36 - 81 = -45$

and $S_{10} = 4 \times 10 - (10^2 = 40 - 100 = -60$

$\therefore$ 10th term $= S_{10} - S_9 = -60 - (-45)$

$= -60 + 45 = -15$

Similarly,nth term $= S_n - S_{n-1}$

$= 4n - n^2 - 4(n-1) + (n-1)^2$

$= 4n - n^2 - 4n + 4 + n^2 + 1 - 2n$

$= 5 - 2n.$

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

Ans. The positive integers divisible by 6 are.

Here, a = 6, d = 12 – 6= 6, n = 40

$\therefore \quad S_{40} = \frac{40}{2}[2 \times 6 + (40-1)6]$

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

$= 20[12 + 234]$

$= 20 \times 246$

Thus, $S_{40} = 4920.$

Q.13. Find the sum of the first 15 multiples of 8.

Ans. The multiplesof 8 are,

8, 16, 24, 32, ...

Here, $a = 8, d = 16 - 8 = 8, n = 15$

$\therefore \quad S_{15} = \frac{15}{2}[2 \times 8 + (15-1)8]$

$= \frac{15}{2}[16 + 112]$

$= \frac{15}{2} \times 128$

$= 15 \times 64$

Thus, $S_{15} = 960.$

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

Ans. The odd numbers between 0 and 50 are

1, 3, 5, 7, 9, ... 49

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

Using the formula

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

$\Rightarrow \quad 1 + (n-1)2 = 49$

$\Rightarrow \quad (n-1)2 = 48$

$\Rightarrow \quad n - 1 = 24$

$\Rightarrow \quad n = 25$

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

$S_{25} = \frac{25}{2}[2 \times 1 + (25-1)2]$

$= \frac{25}{2}[2 + 48]$

$= \frac{25}{2} \times 50$

$= 25 \times 25$

Thus, $S_{25} = 625$

Q.15. A contract on construction job specifies a penalty for delay of completion beyond a certain date as follows: Rs 200 for the first day, Rs 250 for the second day, Rs 300 for the third day, etc., the penalty for each succeeding day being Rs 50 more than for the preceding day. How much money the contractor has to pay as penalty, if he has delayed the work by 30 days?

Ans. Here the series is :

200, 250, 300, ...

So, $a = 200, d = 50, n = 30,$ (given)

$\therefore \quad S_{30} = \frac{30}{2}[2 \times 200 + (30-1)50]$

$= 15[400 + 29 \times 50]$

$= 15\,[400 + 1450]$
$= 15 \times 1850$
$= 27{,}750$

The penalty for the cost of construction is Rs. 27,750.

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

Ans. Here, $n = 7, S_n = 700, d = -20$

$$\therefore \quad S_n = \frac{n}{2}[2a + (n-1)d]$$

$$\Rightarrow \quad 700 = \frac{7}{2}[2a + (7-1)(-20)]$$

$$\Rightarrow \quad 200 = 2a + 6 \times (-20)$$

$$\Rightarrow \quad 200 = 2a - 120$$

$$\Rightarrow \quad 2a = 200 + 120$$

$$\Rightarrow \quad 2a = 320$$

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

$$\Rightarrow \quad a = 160$$

Ist Prize = Rs.160.
2nd Prize = 160 – 20 = Rs. 140
3rd Prize = 140 – 20 = Rs. 120
4th Prize = 120 – 20 = Rs. 100
5th Prize = 100 – 20 = Rs. 80
6th Prize = 80 – 20 = Rs. 60
7th Prize = 60 – 20 = Rs. 40.

Q.17. In a school, students thought of planting trees in and around the school to reduce air pollution. It was decided that the number of trees, that each section of each class will plant, will be the same as the class, in which they are studying, e.g., a section of Class I will plant 1 tree, a section of Class II will plant 2 trees and so on till Class XII. There are three sections of each class. How many trees will be planted by the students?

Ans. No. of trees that planted by all 3 sections of classes, I, II, III, ... XII are 3, 6, 9, ... 36 respectively.

Here, $d = 6 - 3 = 9 - 6 = ... = 3.$

Hence, it is an A.P.

Here, $a = 3, a_n = 36, n = 12.$

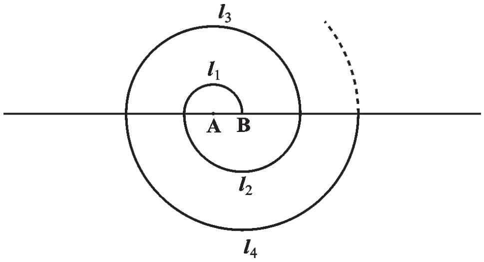
$$\text{Total no. of trees, } S_n = \frac{n}{2}[a + a_n]$$

$$= \frac{12}{2}[3 + 36]$$

$$= 6 \times 39$$

$$= 234.$$

Q.18. A spiral is made up of successive semicircles, with centres alternately at A and B, starting with centre at A, of radii 0.5 cm, 1.0 cm, 1.5 cm, 2.0 cm, . . . as shown in Fig.. What is the total length of such a spiral made up of thirteen consecutive semicircles? (Take π = 22/7)



[**Hint :** Length of successive semicircles is l_1, l_2, l_3, l_4, . . . with centres at A, B, A, B, . . ., respectively.]

Ans. Here,series is

$\pi r_1, \pi r_2, \pi r_3, ...$

or $\quad \pi \times 0.5, \pi \times 1.0, \pi \times 1.5, \pi \times 2.0, ...$

or $\quad \frac{\pi}{2}, \pi, \frac{3\pi}{2}, 2\pi \; ....$

Here, $a = \quad , d = \frac{3\pi}{2} - p = \frac{\pi}{2}, n = 13$

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

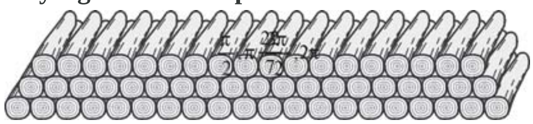
$$= \frac{13}{2}\left[2 \times \frac{\pi}{2}, + (13-1), \frac{\pi}{2}\right]$$

$$= \frac{13}{2}[\pi + 6\pi] \qquad [\pi = \frac{22}{7}]$$

$$= \frac{13}{2} \times 7\pi = \frac{13}{2} \times 7 \times \frac{22}{7} = 143$$

Total length = 143 cm.

Q.19. 200 logs are stacked in the following manner: 20 logs in the bottom row, 19 in the next row, 18 in the row next to it and so on (see Fig.). In how many rows are the 200 logs placed and how many logs are in the top row?



Ans. Clearly, logs stacked in each row form a sequence

20, 19, 18, 17, 16 15, ...

It is an A.P. with $a = 20$, $d = 19 - 20 = -1$

Let $S^n = 200$, then

$$\begin{aligned} \frac{n}{2}[2 \times 20 + (n-1)(-1)] &= 20 \\ \Rightarrow \quad n(40 - n + 1) &= 400 \\ \Rightarrow \quad 41n - n^2 &= 400 \\ \Rightarrow \quad n^2 - 41n + 400 &= 0 \\ \Rightarrow \quad (n-16)(n-25) &= 0 \\ \Rightarrow \quad n &= 16 \text{ or } 25 \end{aligned}$$

For $n = 25$, we have

$$\begin{aligned} a_{25} &= a + 24d \\ &= 20 + 24(-1) \end{aligned}$$

$\therefore$ Number of logs in 25th row is –4,which is not possible.

So, $n = 25$ is not possible.

$\therefore \quad n = 16$

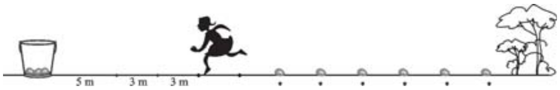
Thus, 200 logs are placed in 16 rows.

$\therefore$ Number of logs in the 16th row (top row) $= a_{16}$

$= a + 15d$

$= 20 + 15(-1) = 20 - 15 = 5.$

Q.20. In a potato race, a bucket is placed at the starting point, which is 5 m from the first potato, and the other potatoes are placed 3 m apart in a straight line. There are ten potatoes in the line (see Fig.).



A competitor starts from the bucket, picks up the nearest potato, runs back with it, drops it in the bucket, runs back to pick up the next potato, runs to the bucket to drop it in, and she continues in the same way until all the potatoes are in the bucket. What is the total distance the competitor has to run?

[**Hint :** To pick up the first potato and the second potato, the total distance (in metres) run by a competitor is $2 \times 5 + 2 \times (5 + 3)$]

Ans. Distance travelled to pick up 1 potato

$= 2 \times 5 = 10$ m

Distance travelled to pick up II potato

$= 2 \times (5 + 3) = 16$ m

Distance travelled to pick up III potato

$= 2 \times (5 + 3 + 3) = 22$ m etc.

The series is 10, 16, 22, ...

Here, $n = 10$, $a = 10$, $d = 16 - 10 = 6$

$$\therefore \quad S_n = \frac{n}{2}[2a + (n-1)d]$$

$$\begin{aligned} \Rightarrow \quad S_{10} &= \frac{10}{2}[2 \times 10 + (10-1)6] \\ &= 5[20 + 54] \\ &= 5 \times 74 = 370 \end{aligned}$$

Total distance travelled = 370 m

EXERCISE 5.4 (Optional)

Q.1. Which term of the AP : 121, 117, 113, . . ., is its first negative term?

[**Hint :** Find n for $a_n < 0$]

Ans. Here, $a = 121$, $d = 117 - 121 = -4$.

$$\begin{aligned} \therefore \text{ Using} \quad a_n &< 0 \\ \Rightarrow \quad a + (n-1)d &< 0 \\ \Rightarrow \quad 121 + (n-1)(-4) &< 0 \\ \Rightarrow \quad (n-1)(-4) &< -121 \\ \Rightarrow \quad -4n + 4 &< -121 \\ \Rightarrow \quad -4n &< -125 \\ \Rightarrow \quad 4n &> 125 \\ \Rightarrow \quad n &> \frac{125}{4} \\ \Rightarrow \quad n &> 31\frac{1}{4} \end{aligned}$$

$\therefore$ Its first negative term is 32nd.

Q.2. The sum of the third and the seventh term of an AP is 6 and their product is 8. Find the sum of first sixteen terms of the AP.

Ans. Given, $a_3 + a_7 = 6$

$$\begin{aligned} \Rightarrow \quad a + (3-1)d + a + (7-1)d &= 6 \\ & [a_n = a + (n+1)d] \\ \Rightarrow \quad a + 2d + a + 6d &= 6 \\ \Rightarrow \quad 2a + 8d &= 6 \\ \Rightarrow \quad a + 4d &= 3 \\ \text{and} \quad a_3 a_7 &= 8 \\ (a + 2d)(a + 6d) &= 8 \\ \Rightarrow \quad (3 - 4d + 2d)(3 - 4d + 6d) &= 8 \\ \Rightarrow \quad (3 - 2d)(3 + 2d) &= 8 \\ \Rightarrow \quad 9 - 4d^2 &= 8 \\ \Rightarrow \quad -4d^2 &= 8 - 9 \\ \Rightarrow \quad -4d^2 &= -1 \end{aligned}$$

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

$$\Rightarrow \quad d = + \frac{1}{2}$$

When $d = \frac{1}{2}$

$$\therefore \quad a + 4 \times \frac{1}{2} = 3$$

$$\Rightarrow \quad a + 2 = 3$$

$$\Rightarrow \quad a = 3 - 2$$

$$\Rightarrow \quad a = 1$$

When $d = -\frac{1}{2}$

$$\therefore \quad a + 4\left(-\frac{1}{2}\right) = 3$$

$$\Rightarrow \quad a - 2 = 3$$

$$\Rightarrow \quad a = 3 + 2$$

$$\Rightarrow \quad a = 5$$

$$\therefore \quad S_{16} = \frac{16}{2}\left[2\times1+(16-1)\left(\frac{1}{2}\right)\right]$$

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

$$= 8\left[2+\frac{15}{2}\right]$$

$$= 4 \times 19$$

$$= 76$$

Also $$S_{16} = \frac{16}{2}\left[2\times5+(16-1)\left(\frac{1}{2}\right)\right]$$

when $a = 5, d = \frac{-1}{2}$

$$= 8\left[10-\frac{15}{2}\right]$$

$$= 4[20-15]$$

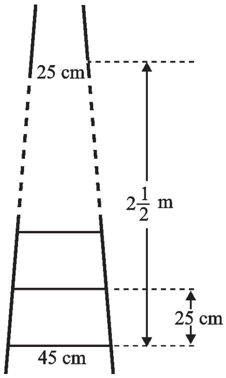
$$= 4 \times 5$$

$$= 20$$

$\therefore$ The sum of first 16 terms of A.P. is 76 or 20.

Q.3. A ladder has rungs 25 cm apart. (see Fig.). The rungs decrease uniformly in length from 45 cm at the bottom to 25 cm at the top. If the top and the bottom rungs are $2\frac{1}{2}$ m apart, what is the length of the wood required for the rungs?

[Hint : Number of rungs = $\frac{250}{25}+1$]



Ans. Distance between top and bottom rungs

$$= 2\frac{1}{2}\text{ m} = 2.5 \times 100 \text{ cm}$$

$$= 250 \text{ cm}$$

Number of rungs $= \frac{250}{25} = 10$

$\therefore$ a = 25, $l = a_n = 45$, n = 10.

The length of the wood required for the rungs

= sum of 10 rungs

$$= \frac{10}{2}[25+45]$$

$$= 5 \times 70 = 350 \text{ cm}$$

Q.4. The houses of a row are numbered consecutively from 1 to 49. Show that there is a value of *x* such that the sum of the numbers of the houses preceding the house numbered *x* is equal to the sum of the numbers of the houses following it. Find this value of *x*.

[Hint : $S_{x-1} = S_{49} - S_x$]

Ans. According to question

$S_{x-1} = S_{49} - S_x$

$$\Rightarrow \quad \frac{x-1}{2}[2 \times 1 + (x-1-1).1]$$

$$= \frac{49}{2}[2 \times 1 + (49-1)(1)] - \frac{x}{2}[2\times1+(x-1)1]$$

$\Rightarrow \quad \dfrac{x-1}{2}[2x+x-2] = \dfrac{49}{2}[2+48] - \dfrac{x}{2}[2+x-1]$

$\Rightarrow \quad \dfrac{x(x-1)}{2} = 25 \times 49 - \dfrac{x(x+1)}{2}$

$\Rightarrow \quad x^2 - x = 2450 - x2 - x$

$\Rightarrow \quad 2x^2 = 2450$

$\Rightarrow \quad x^{2} = 1225$

$\Rightarrow \quad x = +35.$

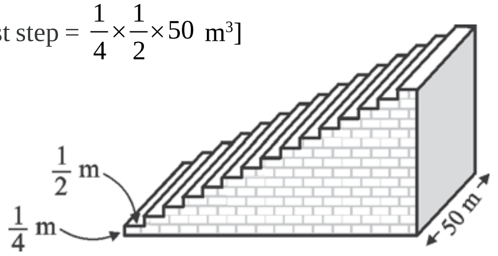
Since x is a counting number, so $x \neq -35$.

$\therefore \quad x = 35.$

Q.5. A small terrace at a football ground comprises of 15 steps each of which is 50 m long and built of solid concrete.

Each step has a rise of $\frac{1}{4}$ m and a tread of $\frac{1}{2}$ m. (see Fig.). Calculate the total volume of concrete required to build the terrace.

[**Hint :** Volume of concrete required to build the first step = $\frac{1}{4} \times \frac{1}{2} \times 50$ m^3]



Ans. Volumes of concrete required to build :

First step = $\frac{1}{4} \times \frac{1}{2} \times 50 = \frac{25}{4}$ m^3

Second step = $\left(2 \times \frac{1}{4}\right) \times \frac{1}{2} \times 50 = \frac{50}{4}$ m^3

Third step = $\left(3 \times \frac{1}{4}\right) \times \frac{1}{2} \times 50 = \frac{75}{4}$ m^3

Here, n = no. of steps = 15, (Given)\

$= \frac{25}{4} + \frac{50}{4} + \frac{75}{4} + ...$

$= \frac{25}{4}[1 + 2 + 3 + ... + 15] \qquad [n = 15]$

$= \frac{25}{4} \times \frac{15}{2}[2 \times 1 + (15 - 1) \times 1]$

$= \frac{25}{4} \times \frac{15}{2} \times 16 = 750$ m^3

Additional Questions

Q.1. Is 0 a term of the AP : 31, 28,25 ...? Justify your answer.

Ans. $a_n = 0$

$a = 31, d = 28 - 31 = -3$

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

$0 = 31 + (n - 1)(-3)$

$\Rightarrow \quad 3n - 3 = +31$

$\Rightarrow \quad 3n = 28$

$\Rightarrow \quad n = \frac{28}{3}$ which is not a natural number.

Hence 0 is not a term of the given A.P.

Q.2. The taxi fare after each kilometer, when the fare is Rs.15 for the first km and Rs. 8 for each additional km, does not form an AP as the total fare (in Rs.) after each km is 15, 8, 8, 8, ...

Is the statement true ? Give reasons.

Ans. Fare after 1 km = Rs. 15

Fare after 2 km = Rs.23

Fare after 3 km = Rs. 31

Fare after 4 km = Rs.39

Now the series is 13, 23, 31, 39, ...

$a_2 - a_1 = 23 - 15 = 8$

$a_3 - a_2 = 31 - 23 = 8$

$a_4 - a_3 = 39 - 31 = 8$

Now, $d = 8$ and = 15.

$\therefore$ the given series is an A.P.

Hence the given statement is true.

Q.3. For the A.P. : –3, –7, –11, ... can we find directly $a_{30} - a_{20}$ without actually finding a_{30} and a_{20}? Given reason for your answers.

Ans. $a_{30} - a_{20} = [a + (30 + 1)d] - [a + (20 - 1)d]$

$= 29d - 19d = 10d$

As $d = -7(-3) = -7 + 3 = -4$

$\therefore \quad a_{30} - a_{20} = 10 \times (-4) = -40.$

Q.4. Find a, b and c such that the following numbers are in AP :

a, 7, b, 23, c.

Ans. As the numbers are in AP,

$\therefore \quad 7 - a = b - 7 = 23 - b = c - 23$

$\Rightarrow \quad b - 7 = 23 - b \Rightarrow 2b = 30 \Rightarrow b = 15$

$\therefore \quad 7 - a = b - 7 \Rightarrow 7 - a = 15 - 7 \Rightarrow a = -1$

Again $b - 7 = c - 23 \Rightarrow 15 - 7 = c - 23$

$\Rightarrow c = 31$

Hence $a = -1$, $b = 15$, $c = 31$.

Q.5. The 9th term of an AP is zero, prove that 29th term is twice the 19th term.

Ans. Let for the AP first term = a

and common difference = d

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

$\therefore \quad a_n = a + 8d = 0 \Rightarrow a = -8d$

Now $a_{29} = a + 28d = -8d + 28d = 20d$

and $a_{19} = a + 18d = -8d + 18d = 10d$

Hence $a_{29} = 2a_{19}.$

Q.6. Determine k so that $k^2 + 4k + 8$, $2k^2 + 3k + 6$, $3k^2 + 4k + 4$ are three consecutive terms of an A.P.

Ans. Clearly

$2(2k^2 + 3k + 6) = (k^2 + 4k + 8) + 3k^2 + 4k + 4)$

$\Rightarrow \quad 4k^2 + 6k + 12 = 4k^2 + 8k + 12$

$\Rightarrow \quad 6k - 8k = 0 \Rightarrow k = 0.$

Q.7. Find whether 55 is a term of the AP : 7, 10, 13, ... or not. If yes, find which term it is .

Ans. $a = 7$, $d = 10 - 3 = 3$

Let $a_n = 55$

$\therefore \quad a + (n - 1)d = 55$

$\Rightarrow \quad 7 + (n - 1) \times 3 = 55$

$\Rightarrow \quad (n - 1) \times 3 = 55$

$\Rightarrow \quad (n - 1) = 16 \Rightarrow n = 17$

Yes, 17th term = 55.

Q.8. Find the sum of last 10 terms of the A.P. : 8, 10, 12, ..., 126.

Ans. Writing the AP in reverse order

126, 124, ... 12, 10, 8

a = 126, d = 124 – 126 = – 2

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

$S_{10} = \frac{10}{2}[2a + 9d]$

$= 5[2 \times 126 + 9 \times (-2)]$

$= 5[252 - 18]$

$= 5 \times 234 = 1170.$

Q.9. Find the sum of first seven numbers which are muiltiples of 2 as well as of 9.

Ans. Let $S_7 = 18 + 36 + 54 + ...7$ terms

$a = 18$, $d = 18$, $n = 7$

$S_7 = \frac{7}{2}[2a + 6d]$

$= \frac{7}{2}[2 \times 18 + 6 \times 18]$

$= \frac{7}{2}[36 + 108]$

$= \frac{7}{2} \times 144 = 7 \times 72 = 504.$

Q.10. Kanishka was given her pocket money on Jan. 1st, 2012. She puts Re. 1 on Day 1, Rs. 2 on Day 2, Rs. 3 on Day 3 and continued doing so till the end of the month, into her piggy bank. She also spent Rs. 204 of her pocket money, and found that at the end of the month she still had Rs. 100 with her. How much was her pocket money for the month ?

Ans. $S_n = 1 + 2 + 3 + ... + 31$

$a = 1$, $d = 1$, $a_n = 31$, $n = 31$

$S_{31} = \frac{31}{2}[1 + 31]$

$= 31 \times 16 = 496$

Money in the piggy Bank = Rs. 496.

Money spend = Rs. 204.

Money with her = Rs. 100

Total pocket money = 496 + 204 + 100

= Rs. 800.

Multiple Choice Questions

Q.1. If the sum of n terms of an A.P. is $2n^2 + 5n$, then its 2nd terms is :

(a) 18 (b) 7

(c) 11 (d) 13

Ans. (c)

Q.2. If 18, a, b, –3 are in A.P. then a + b = ?

(a) 19 (b) 7

(c) 11 (c) 15

Ans. (d)

Q.3. The sum of first five positive integers divisible by 6 :

(a) 180 (b) 90
(c) 45 (d) 30

Ans. (b)

Q.4. The sum of first 16 terms of the AP : 10, 6, 2, ... is :

(a) – 320 (b) 320
(c) – 352 (d) – 400

Ans. (a)

Q.5. What is the common difference of an A.P. in which $a_{24} - a_{17} = -28$?

(a) 8 (b) –8
(c) –4 (c) 4

Ans. (c)

Q.6. The sum of first 10 multiples of 2 is :

(a) 100 (b) 110
(c) 130 (d) 120

Ans. (b)

Q.7. If the first term of an AP is –5 and the common difference is 2, then the sum of the first 6 terms is :

(a) 0 (b) 5
(c) 6 (d) 15

Ans. (a)

Q.8. The famous mathematician associated with finding the sum of the first 100 natural numbers is :

(a) Pythagoras (b) Newton
(c) Gauss (d) Euclid

Ans. (c)

Q.9. The sum of first five multiples of 3 is :

(a) 45 (b) 55
(c) 65 (d) 75

Ans. (a)

Q.10. Which term of the AP: 21, 42, 63, 84, ... is 210?

(a) 9th (b) 10th
(c) 11th (d) 12th

Ans. (b)