ARITHMETIC PROGRESSION

(A) OBJECTIVE TYPE QUESTIONS

1 Mark Each

Stand Alone MCQs (1 Mark Each)

1. 30^{th} term of the A.P., : 10, 7, 4,………, is:

(A) 97 (B) 77

(C) –77 (D) –87 R

Ans. Option (C) is correct.

> *Explanation:* In the given A.P.,
> $a = 10$ and $d = 7 - 10 = -3$
> Thus, the 30^{th} term, $t_{30} = 10 + (30 - 1)(-3) = -77$

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

(A) 28 (B) 22

(C) –38 (D) $-48\frac{1}{2}$ R

Ans. Option (B) is correct.

> *Explanation:* In the given A.P.,
> $a = -3$ and $d = -\frac{1}{2} + 3 = \frac{5}{2}$
> Thus, the 11^{th} term, $t_{11} = -3 + (11-1)\left(\frac{5}{2}\right) = 22$

3. In an A.P., if $d = -4$, $n = 7$, $a_n = 4$, then a is;

(A) 6 (B) 7

(C) 20 (D) 28 R

Ans. Option (D) is correct.

> *Explanation:* In the given A.P.,
> $d = -4, n = 7, a_n = 4$
> $a_n = a + (n-1)d \Rightarrow 4 = a + (7-1)(-4) \Rightarrow a = 28$

4. In an A.P., if $a = 3.5$, $d = 0$, $n = 101$, then a_n will be

(A) 0 (B) 3.5

(C) 103.5 (D) 104.5 R

Ans. Option (B) is correct.

> *Explanation:* In the given A.P.,
> $a = 3.5, d = 0, n = 101$
> $a_n = a + (n-1)d \Rightarrow a_n = 3.5 + (101-1)0 \Rightarrow a_n = 3.5$

5. The list of numbers – 10, – 6, – 2, 2,…… is:

(A) an A.P., with $d = -16$

(B) an A.P., with $d = 4$

(C) an A.P., with $d = -4$

(D) not an A.P., U

Ans. Option (B) is correct.

> *Explanation:* In the given numbers
> – 10, – 6, – 2, 2,…
> $(-6) - (-10) = 4$
> $(-2) - (-6) = 4$
> $2 - (-2) = 4$
> Since, $(-6) - (-10) = (-2) - (-6) = 2 - (-2) = 4$,
> thus, the given numbers are in A.P. with $d = 4$.

6. The 11^{th} term of the A.P.,: $-5, \frac{-5}{2}, 0, \frac{5}{2}, \ldots$ is:

(A) –20 (B) 20

(C) –30 (D) 30 R

Ans. Option (B) is correct.

> *Explanation:* In the given A.P.,
> $a = -5, d = -\frac{5}{2} - (-5) = \frac{5}{2}, n = 11$
> $t_n = a + (n-1)d \Rightarrow t_{11} = -5 + (11-1)\left(\frac{5}{2}\right) \Rightarrow t_{11} = 20$

7. The first four terms of an A.P., whose first term is –2 and the common difference is –2, are:

(A) – 2, 0, 2, 4 (B) – 2, 4, – 8, 16

(C) – 2, – 4, – 6, – 8 (D) – 2, – 4, – 8, –16 U

Ans. Option (C) is correct.

> *Explanation:* In the given A.P., $a = -2, d = -2$,
> $t_n = a + (n-1)d$
> $t_1 = (-2) + (1-1)(-2) = -2$
> $t_2 = (-2) + (2-1)(-2) = -4$
> $t_3 = (-2) + (3-1)(-2) = -6$
> $t_4 = (-2) + (4-1)(-2) = -8$

8. The 21^{st} term of the A.P., whose first two terms are –3 and 4 is :

(A) 17 (B) 137

(C) 143 (D) –143 R

Ans. Option (B) is correct.

Explanation: In the given A.P.,
$t_1 = -3$ and $t_2 = 4$

$$\Rightarrow \quad d = t_2 - t_1 = 4 - (-3) = 7$$

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

$$\Rightarrow \quad t_{21} = (-3) + (21-1)(7) = 137$$

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

(A) Pythagoras (B) Newton
(C) Gauss (D) Euclid R

Ans. Option (C) is correct.

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

10. If the first term of an A.P. 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 R

Ans. Option (A) is correct.

Explanation: In the given A.P.,
$a = -5$ and $d = 2$

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

$$\Rightarrow \quad S_6 = \frac{6}{2}[2 \times (-5) + (6-1) \times 2]$$

$$= 0$$

11. The sum of first 16 terms of the A.P.,: 10, 6, 2,... is:

(A) –320 (B) 320
(C) –352 (D) –400 R

Ans. Option (A) is correct.

Explanation: In the given A.P.,
$a = 10$, $d = 6 - 10 = -4$
Thus,

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

$$\Rightarrow S_{16} = \frac{16}{2}[2 \times 10 + (16-1) \times (-4)]$$

$$= -320$$

12. In an A.P., if $a = 1$, $a_n = 20$ and $S_n = 399$, then n is:

(A) 19 (B) 21
(C) 38 (D) 42 R

Ans. Option (C) is correct.

Explanation: In the given A.P., $a = 1$, $a_n = 20$ and $S_n = 399$

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

$$\Rightarrow \quad 20 = 1 + (n-1)d$$

$$\Rightarrow \quad (n-1)d = 19$$

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

$$\Rightarrow \quad 399 = \frac{n}{2}[2 + 19]$$

$$\Rightarrow \quad n = 38$$

13. The sum of first five multiples of 3 is:

(A) 45 (B) 55
(C) 65 (D) 75 U

Ans. Option (A) is correct.

Explanation: In the given A.P.,
$a = 3$, $d = 3$ and $n = 5$

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

$$\Rightarrow \quad S_5 = \frac{5}{2}[2 \times 3 + (5-1) \times 3] = 45$$

14. The sum of first five positive integers divisible by 6 is:

(A) 180 (B) 90
(C) 45 (D) 30 R

Ans. Option (B) is correct.

Explanation: Positive integers divisible by 6 are 6, 12, 18, 24, 30
Since difference is same, its an A.P.
We need to find sum of first 5 integers
We can use formula

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

Here, $n = 5, d = 6, a = 6$

$$\therefore \quad S_5 = \frac{5}{2}[2 \times 6 + (5-1) \times 6]$$

$$S_5 = \frac{5}{2}[12 + 24]$$

$$S_5 = \frac{5}{2} \times 36$$

$$= 90.$$

Case-based MCQs (1 Mark Each)

Attempt any four sub-parts from each question. Each sub-part carries 1 mark.

I. Read the following text and answer the questions given below it:

Your friend Veer wants to participate in a 200 m race. He can currently run that distance in 51 seconds and with each day of practice it takes him 2 seconds less. He wants to do in 31 seconds. **[CBSE QB, 2021]**

1. Which of the following terms are in A.P. for the given situation

(A) 51, 53, 55…. (B) 51, 49, 47….

(C) – 51, – 53, – 55…. (D) 51, 55, 59…

Ans. Option (B) is correct.

Explanation:
$a = 51$
$d = -2$
A.P. $= 51, 49, 47$ ....

2. What is the minimum number of days he needs to practice till his goal is achieved ?

(A) 10 (B) 12

(C) 11 (D) 9

Ans. Option (C) is correct.

Explanation: Goal = 31 second

n = number of days

$\therefore \quad a_n = 31$

$a + (n - 1)d = 31$

$51 + (n - 1)(-2) = 31$

$51 - 2n + 2 = 31$

$-2n = 31 - 53$

$-2n = -22$

$n = 11$

3. Which of the following term is not in the A.P. for the above given situation

(A) 41 (B) 30

(C) 37 (D) 39

Ans. Option (B) is correct.

4. If n^{th} term of an A.P. is given by $a_n = 2n + 3$ then common difference of an A.P. is:

(A) 2 (B) 3

(C) 5 (D) 1

Ans. Option (A) is correct.

Explanation:

Here, $a_1 = 2(1) + 3 = 5$

$a_2 = 2(2) + 3 = 7$

$\therefore \quad d = a_2 - a_1$

$= 7 - 5 = 2$

5. The value of x, for which $2x, x + 10, 3x + 2$ are three consecutive terms of an A.P.

(A) 6 (B) – 6

(C) 18 (D) – 18

Ans. Option (A) is correct.

Explanation: Since, $2x, x + 10, 3x + 2$ are in A.P., then common difference will remain same.

$x + 10 - 2x = (3x + 2) - (x + 10)$

$10 - x = 2x - 8$

$3x = 18$

$x = 6$

AI II. Read the following text and answer the questions given below it:

Your elder brother wants to buy a car and plans to take loan from a bank for his car. He repays his total loan of ₹ 1,18,000 by paying every month starting with the first instalment of ₹ 1000. If he increases the instalment by ₹ 100 every month.

[CBSE QB, 2021]

1. The amount paid by him in 30^{th} instalment is:

(A) ₹ 3900 (B) ₹ 3500

(C) ₹ 3700 (D) ₹ 3600

Ans. Option (A) is correct.

Explanation:
$a = 1000$
$d = 100$
$a_{30} = a + (30 - 1)d$
$= 1000 + (30 - 1)100$
$= 1000 + 2900$
$=$ ₹ 3900

2. The amount paid by him in the 30 instalments is:

(A) ₹ 37000 (B) ₹ 73500

(C) ₹ 75300 (D) ₹ 75000

Ans. Option (B) is correct.

Explanation: Sum of 30 instalments

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

$$= \frac{30}{2}[2 \times 1000 + (30 - 1)100]$$

$$= 15[2000 + 2900]$$

$$= 15 \times 4900$$

$$= 73500$$

Total amount paid in 30 instalments = ₹ 73500

3. What amount does he still have to pay after 30^{th} instalment ?

(A) ₹ 45500 (B) ₹ 49000

(C) ₹ 44500 (D) ₹ 54000

Ans. Option (C) is correct.

Explanation:

Remaining amount = ₹ 1,18,000 – ₹ 73,500

= ₹ 44,500

4. If total instalments are 40, then amount paid in the last instalment ?

(A) ₹ 4900 (B) ₹ 3900

(C) ₹ 5900 (D) ₹ 9400

Ans. Option (A) is correct.

> **Explanation:** Amount paid in 40th instalment,
> $$a_{40} = 1000 + (40 - 1)100$$
> $$= 1000 + 3900$$
> $$= ₹\ 4900$$

5. The ratio of the 1st instalment to the last instalment is:

(A) 1 : 49 (B) 10 : 49

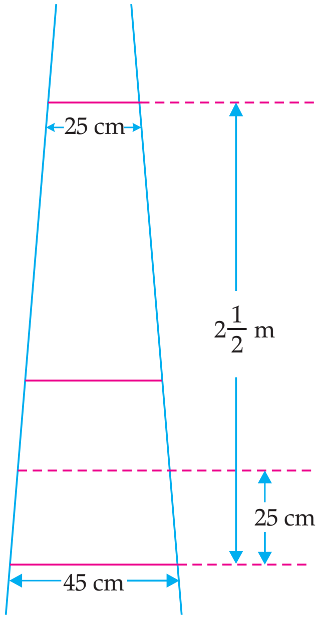
(C) 10 : 39 (D) 39 : 10

Ans. Option (B) is correct.

> **Explanation:** 1st instalment : last instalment
> = 1000 : 4900
> = 10 : 49

III. Read the following text and answer the questions given below it:

A ladder has rungs 25 cm apart. (see the fig. below).



The rungs decrease uniformly in length from 45 cm at the bottom to 25 cm at the top. The top and the bottom rungs are $2\frac{1}{2}$ m apart.

1. The top and bottom rungs are apart at a distance:

(A) 200 cm (B) 250 cm

(C) 300 cm (D) 150 cm

Ans. Option (B) is correct.

> ***Explanation:*** Since the top and the bottom rungs are apart by $2\frac{1}{2}$ m $= \frac{5}{2}$ m
> $$= \frac{5}{2} \times 100 \text{ cm}$$
> $$= 250 \text{ cm}$$

2. Total number of the rungs is:

(A) 20 (B) 25

(C) 11 (D) 15

Ans. Option (C) is correct.

> ***Explanation:*** The distance between the two rungs is 25 cm.
> Hence, the total number of rungs $= \frac{250}{25} + 1$
> = 11.

3. The given problem is based on A.P. find its first term.

(A) 25 (B) 45

(C) 11 (D) 13

Ans. Option (A) is correct.

> ***Explanation:*** The length of the rungs increases from 25 to 45 and total number of rungs is 11. Thus, this is in the form of an A.P., whose first term is 25.

4. What is the last term of A.P. ?

(A) 25 (B) 45

(C) 11 (D) 13

Ans. Option (B) is correct.

> ***Explanation:*** Total number of terms, $n = 11$ and the last term, $T_{11} = 45$.

5. What is the length of the wood required for the rungs ?

(A) 385 cm (B) 538 cm

(C) 532 cm (D) 382 cm

Ans. Option (A) is correct.

> ***Explanation:*** The required length of the wood,
> $$S_{11} = \frac{11}{2}[25 + 45]$$
> $$= \frac{11}{2} \times 70$$
> $$= 385 \text{ cm.}$$

(B) Subjective Questions

Very Short Answer Type Questions
(1 Mark Each)

AI **1. Which term of the following A.P. 27, 24, 21, ... is zero ?** A [CBSE SQP, 2020-21]

Sol. We know that $a_n = a + (n - 1)d$

Here, $a_n = 0$

$0 = 27 + (n - 1)(-3)$ ½

$30 = 3n$

$n = 10$ ½

10^{th} term of the given A.P. is zero.

[CBSE Marking Scheme, 2020-21]

Detailed Solution:

Given A.P. = 27, 24, 21, ...

Here, $a = 27$ and $d = 24 - 27 = -3$

and, $a_n = 0$

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

$\Rightarrow \quad 0 = 27 + (n-1)(-3)$

$\Rightarrow \quad -3n + 3 = -27$

$\Rightarrow \quad -3n = -27 - 3 = -30$

$\Rightarrow \quad n = 10$

AI 2. In an Arithmetic Progression, if $d = -4$, $n = 7$, $a_n = 4$, then find a. A **[CBSE SQP, 2020-21]**

Sol. We know that $a_n = a + (n-1)d$

$4 = a + 6 \times (-4)$ ½

$a = 28$ ½

[CBSE Marking Scheme, 2020-21]

Detailed Solution:

We have, $d = -4$, $n = 7$, and $a_n = 4$

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

$\Rightarrow \quad 4 = a + (7-1)(-4)$

$\Rightarrow \quad 4 = a + 6(-4)$

$= a - 24$

$\Rightarrow \quad a = 4 + 24$

$\Rightarrow \quad a = 28$

3. If the first term of an A.P. is p and the common difference is q, then find its 10^{th} term. R **[CBSE Delhi Set-I, 2020]**

Sol. We have, first term $(a) = p$,

Common difference $(d) = q$

and $n = 10$

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

$\Rightarrow \quad a_{10} = p + (10-1)q$

$\Rightarrow \quad a_{10} = p + 9q$

4. Find the common difference of the A.P. $\frac{1}{p}, \frac{1-p}{p}, \frac{1-2p}{p}$, ... R **[CBSE OD Set-I, 2020]**

Sol. Given A.P. $= \frac{1}{p}, \frac{1-p}{p}, \frac{1-2p}{p} \dots$

Here, let $a_1 = \frac{1}{p}$ and $a_2 = \frac{1-p}{p}$

$\therefore$ Common difference $= a_2 - a_1 = \frac{1-p}{p} - \frac{1}{p}$

$= \frac{1-p-1}{p}$

$= \frac{-p}{p}$

$= -1$

AI 5. Find the n^{th} term of the A.P. $a, 3a, 5a$, ... A **[CBSE SQP, 2020-21]**

Sol. Given A.P. $= a, 3a, 5a, \dots$

Here first term, $a = a$ and $d = 3a - a = 2a$

$\therefore \quad n^{th}$ term $= a + (n-1)d$

$= a + (n-1)2a$

$= a + 2na - 2a$

$= 2na - a$

$= (2n-1)a$

6. How many two digit numbers are divisible by 3 ? U **[CBSE Delhi Set-I, 2019]**

Sol. Numbers are 12, 15, 18, ..., 99 ½

$\therefore \quad 99 = 12 + (n-1) \times 3$

$\Rightarrow \quad n = 30$ ½

[CBSE Marking Scheme, 2019]

Detailed Solution:

Numbers divisible by 3 are 3, 6, 9, 12, 15, -------, 96, 99

Lowest two digit number divisible by 3 is 12 and highest two digit number divisible by 3 is 99.

Hence, the sequence start with 12 ends with 99 and common difference is 3.

So, the A.P. will be 12, 15, 18, ----, 96, 99

Here, $a = 12$, $d = 3$, $l = 99$

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

$\therefore \quad 99 = 12 + (n-1)3$

$\Rightarrow \quad 99 - 12 = 3(n-1)$

$\Rightarrow \quad n - 1 = \frac{87}{3}$

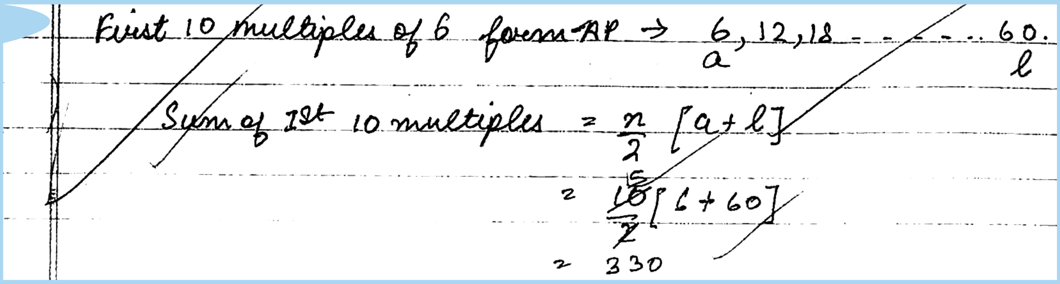
$\Rightarrow \quad n - 1 = 29$

$\Rightarrow \quad n = 30$

Therefore, there are 30, two digit numbers divisible by 3.

7. Find the sum of the first 10 multiples of 6. A **[CBSE Term, 2019]**

Topper Answer, 2019


First 10 multiples of 6 form AP → 6, 12, 18 - - - - - - 60.
a l
Sum of 1st 10 multiples = n/2 [a + l]
= 10/2 [6 + 60]
= 330

8. If n^{th} term of an A.P. is $(2n + 1)$, what is the sum of its first three terms ? [A] **[CBSE SQP, 2018]**

Sol. Since, $a_1 = 3$, $a_2 = 5$ and $a_3 = 7$ ½

$$S_3 = \frac{3}{2}(3 + 7) = 15 \quad ½$$

[CBSE Marking Scheme, 2018]

Detailed Solution:

$\because \quad a_n = (2n + 1)$

$\therefore \quad a_1 = 2 \times 1 + 1 = 3$

$l = a_3 = 2 \times 3 + 1 = 7$

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

Hence, $S_3 = \frac{3}{2}[3 + 7]$

$S_3 = 15$

9. Which term of the A.P. 8, 14, 20, 26, ... will be 72 more than its 41^{st} term. [A] **[CBSE OD Set-II, 2017]** **[CBSE Comptt. Set-III, 2017]**

Sol. Given $a = 8$ and $d = 6$.

Let n^{th} term be 72 more than its 41^{th} term.

$\therefore \quad t_n - t_{41} = 72$

$8 + (n - 1)6 - (8 + 40 \times 6) = 72$

$8 + (n - 1)6 = 320$

$(n - 1)6 = 312$

$n - 1 = 52$

$n = 53$

[AI] **10. Write the n^{th} term of the A.P. $\frac{1}{m}, \frac{1+m}{m}, \frac{1+2m}{m}, ...$** [A] **[CBSE Delhi Comptt. Set-I, II, III, 2017]**

Sol. We have, $a = \frac{1}{m}$

$$d = \frac{1+m}{m} - \frac{1}{m} = 1$$

$\therefore \quad a_n = \frac{1}{m} + (n-1)1$

Hence, $a_n = \frac{1}{m} + n - 1$

$$= \frac{1 + (n-1)m}{m}$$

11. If the n^{th} term of the A.P. – 1, 4, 9, 14, ... is 129. Find the value of n. [A] **[CBSE Delhi Comptt. Set-I, II, III, 2017]**

Sol. Given, $a = -1$ and $d = 4 - (-1) = 5$

$a_n = -1 + (n - 1) \times 5 = 129$ ½

or, $(n - 1)5 = 130$

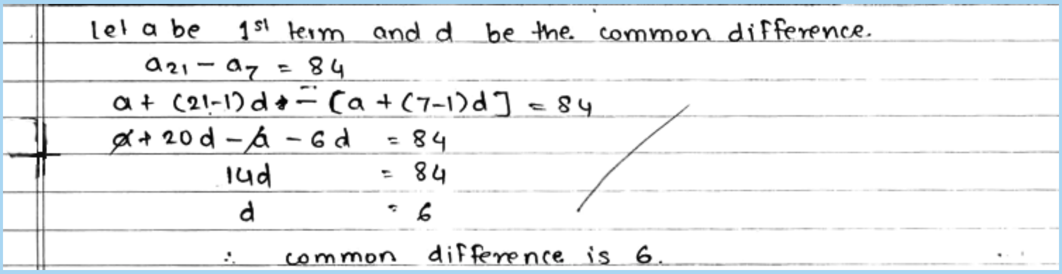
$(n - 1) = 26$

$n = 27$ ½

[CBSE Marking Scheme, 2017]

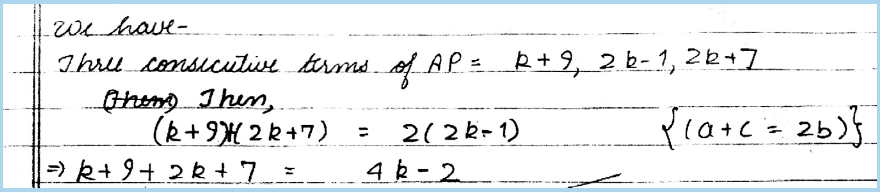
12. What is the common difference of an A.P. in which $a_{21} - a_7 = 84$? [A] **[CBSE OD Set-I, II, III, 2017]**

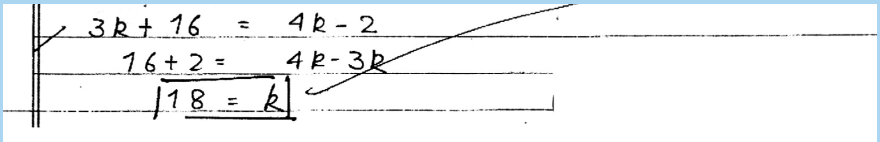
Topper Answer, 2017


let a be 1st term and d be the common difference.
a21 − a7 = 84
a + (21−1)d − [a + (7−1)d] = 84
a + 20d − a − 6d = 84
14d = 84
d = 6
∴ common difference is 6.

13. For what value of k will $k + 9$, $2k - 1$ and $2k + 7$ are the consecutive terms of an A.P. ? [C] + [A] **[CBSE OD Set-II, 2016]**

Topper Answer, 2016


We have-
Three consecutive terms of AP = k+9, 2k-1, 2k+7
~~(then)~~ Then,
(k+9)+(2k+7) = 2(2k-1) {(a+c = 2b)}
⇒ k+9+2k+7 = 4k-2



14. Find the tenth term of the sequence: $\sqrt{2}, \sqrt{8}, \sqrt{18}, \ldots$.

U **[CBSE SQP, 2016] [CBSE Foreign Set-I, II, III, 2015]**

Sol. Given sequence is an A.P.

$$\sqrt{2}, \sqrt{8}, \sqrt{18}, \ldots = \sqrt{2}, 2\sqrt{2}, 3\sqrt{2} \ldots$$

Hence, $a = \sqrt{2}$, $d = \sqrt{2}$ and $n = 10$

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

or, $a_{10} = \sqrt{2} + (10-1)\sqrt{2}$

$= \sqrt{2} + 9\sqrt{2}$

$= 10\sqrt{2}$

Hence, $a_{10} = \sqrt{200}$

15. Is series $\sqrt{3}, \sqrt{6}, \sqrt{9}, \sqrt{12}, \ldots$ an A.P. ? Give reason.

U **[CBSE Term-II, 2015]**

Sol. Common difference,

$d_1 = \sqrt{6} - \sqrt{3}$

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

Again, $d_2 = \sqrt{9} - \sqrt{6}$

$= 3 - \sqrt{6}$

$d_3 = \sqrt{12} - \sqrt{9}$

$= 2\sqrt{3} - 3$

As common differences are not equal.
Hence, the given series is not an A.P.

[CBSE Marking Scheme, 2015] 1

Short Answer Type Questions-I

(2 Marks Each)

AI **1. Find the number of natural numbers between 102 and 998 which are divisible by 2 and 5 both.**

A **[CBSE SQP, 2020]**

Sol. 110, 120, 130, ..., 990

$a_n = 990 \Rightarrow 110 + (n-1) \times 10 = 990$ **1**

$\therefore$ $n = 89$ **1**

[CBSE SQP Marking Scheme, 2020]

Detailed Solution:

The number which ends with 0 is divisible by 2 and 5 both.

$\therefore$ Such numbers between 102 and 998 are:

110, 120, 130, ..., 990.

Last term, $a_n = 990$

$a + (n+1)d = 990$

$110 + (n-1) \times 10 = 990$

$110 + 10n - 10 = 990$

$10n + 100 = 990$

$10n = 990 - 100$

$10n = 890$

$n = \frac{890}{10} = 89$

AI **2. Show that $(a-b)^2$, $(a^2 + b^2)$ and $(a+b)^2$ are in A.P.**

A **[CBSE Delhi Set-I, 2020]**

Sol. Given: $(a-b)^2$, $(a^2 + b^2)$ and $(a+b)^2$

Common difference,

$d_1 = (a^2 + b^2) - (a-b)^2$

$= a^2 + b^2 - (a^2 + b^2 - 2ab)$

$= a^2 + b^2 - a^2 - b^2 + 2ab$

$= 2ab$

and $d_2 = (a+b)^2 - (a^2 + b^2)$

$= a^2 + b^2 + 2ab - a^2 - b^2$

$= 2ab$

Since, $d_1 = d_2$

Hence, $(a-b)^2$, $(a^2 + b^2)$ and $(a+b)^2$ are in A.P.

Hence Proved.

AI **3. Find the sum of first 20 terms of the following A.P.: 1, 4, 7, 10, ...**

A **[CBSE Delhi Set-II, 2020]**

Sol. Given A.P.: 1, 4, 7, 10, ...

Here, $a = 1$, $d = 4 - 1 = 3$ and $n = 20$

$\therefore$ The sum of first 20 terms,

$S_{20} = \frac{n}{2}[2a + (n-1)d]$

$= \frac{20}{2}[2 \times 1 + (20-1)3]$

$= 10(2 + 57)$

$= 10 \times 59$

$= 590$

AI **4. The sum of the first 7 terms of an A.P. is 63 and that of its next 7 terms is 161. Find the A.P.**

A **[CBSE Delhi Set-III, 2020]**

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

Given, $S_7 = 63$

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

$= 63$

or, $2a + 6d = 18$ ...(i)

Now, sum of 14 terms is:

$$S_{14} = S_{\text{first 7 terms}} + S_{\text{next 7 terms}} = 63 + 161 = 224$$

$\therefore \quad \frac{14}{2}[2a + 13d] = 224$

$\Rightarrow \quad 2a + 13d = 32$ ...(ii)

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

$(2a + 13d) - (2a + 6d) = 32 - 18$

$\Rightarrow \quad 7d = 14$

$\Rightarrow \quad d = 2$

Putting the value of d in (i), we get

$a = 3$

Hence, the A.P. will be: 3, 5, 7, 9, ...

AI 5. If S_n, the sum of first n terms of an A.P. is given by $S_n = 3n^2 - 4n$. Find the n^{th} term.

A [CBSE Delhi Set-I, 2019]

Sol. $a_1 = S_1 = 3 - 4 = -1$ ½

$a_2 = S_2 - S_1$

$= [3(2)^2 - 4(2)] - (-1) = 5$ ½

$\therefore \quad d = a_2 - a_1 = 6$ ½

Hence $a_n = -1 + (n-1) \times 6 = 6n - 7$ ½

Alternate method:

$S_n = 3n^2 - 4n$

$\therefore \quad S_{n-1} = 3(n-1)^2 - 4(n-1)$

$= 3n^2 - 10n + 7$ **1**

Hence $a_n = S_n - S_{n-1}$ ½

$= (3n^2 - 4n) - (3n^2 - 10n + 7)$

$= 6n - 7$ ½

[CBSE Marking Scheme, 2019]

Detailed Solution:

Given, $S_n = 3n^2 - 4n$

Put $n = 1, S_1 = 3 \times 1^2 - 4 \times 1 = -1$

So, sum of first term of A.P. is – 1.

But sum of first term will be the first term,

$\therefore$ First term, $a_1 = -1$

Put $n = 2, \; S_2 = 3 \times 2^2 - 4 \times 2 = 4$

$\therefore$ Sum of first two terms is 4.

$\therefore$ First term + Second term = 4

$\therefore \quad -1 + a_2 = 4$

$\Rightarrow \quad a_2 = 5$

Hence, Common difference, $d = a_2 - a_1 = 5 - (-1) = 6$

$\therefore \quad n^{th}$ term, $a_n = a_1 + (n-1)d$

i.e., $a_n = -1 + (n-1)6$

$\Rightarrow \quad a_n = 6n - 7$

Therefore, n^{th} term is $6n - 7$.

COMMONLY MADE ERROR

- Some students do not know the basic concepts of arithmetic progression. Many students try to solve with wrong method.

ANSWERING TIP

- Learn the concept of Arithmetic progression with different examples.

6. Which term of the A.P. 3, 15, 27, 39,... will be 120 more than its 21^{st} term ?

A [CBSE Delhi Set-I, 2019]

Sol. $a_n = a_{21} + 120$

$= (3 + 20 \times 12) + 120$

$= 363$ **1**

$\therefore \quad 363 = 3 + (n-1) \times 12$

$\Rightarrow \quad n = 31$ **1**

Thus, 31^{st} term is 120 more than a_{21}.

[CBSE Marking Scheme, 2019]

Detailed Solution:

Given A.P. is: 3, 15, 27, 39

Here, first term, $a = 3$ and common difference, $d = 12$

Now, 21^{st} term of A.P. is

$t_{21} = a + (21-1)d$

$[\because t_n = a + (n-1)d]$

$\therefore \quad t_{21} = 3 + 20 \times 12 = 243$

Therefore, 21^{st} term is 243

We need to calculate term which is 120 more than 21^{st} term

i.e., it should be 243 +120 = 363

Therefore, $t_n = 363$

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

$\Rightarrow \quad 363 = 3 + (n-1)12$

$\Rightarrow \quad 360 = 12(n-1)$

$\Rightarrow \quad n - 1 = 30$

$\Rightarrow \quad n = 31$

So, 31^{st} term is 120 more than 21^{st} term.

7. Find the sum of first 8 multiples of 3.

A [CBSE Delhi/OD 2018] [Delhi Comptt. Set-I, 2017]

Sol. Here, $S = 3 + 6 + 9 + 12 + ... + 24$

$= 3(1 + 2 + 3 + ... + 8)$ **1**

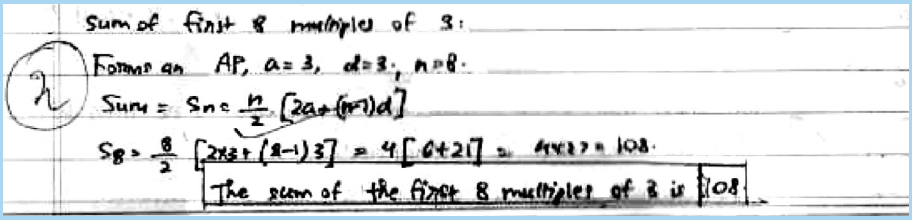
$= 3 \times \frac{8 \times 9}{2}$

$= 108$ **1**

[CBSE Marking Scheme, 2018]

Detailed Solution:

Topper Answer, 2019


Sum of first 8 multiples of 3:
Forms an AP, a = 3, d = 3, n = 8.
Sum = $S_n = \frac{n}{2}[2a+(n-1)d]$
$S_8 = \frac{8}{2}[2\times3+(8-1)3] = 4[6+21] = 4\times27 = 108$.
The sum of the first 8 multiples of 3 is 108.

8. Find the 20th term from the last term of the A.P.: 3, 8, 13, ... 253. A **[CBSE SQP, 2018]**

Sol. 20th term from the end $= l-(n-1)d$ ½
$= 253 - 19 \times 5$ 1
$= 158$ ½
[CBSE Marking Scheme, 2018]

Detailed Solution:

Given A.P.: 3, 8, 13, ... 253

Here, first term $(a) = 3$, common difference $(d) = 8-3 = 5$ and last term $(l) = 253$

Then, 20th term from the end of the A.P.

$$= l-(n-1)d$$
$$= 253 + (20-1)5$$
$$= 253 - 95$$
$$= 158$$

9. Find how many integers between 200 and 500 are divisible by 8. A **[CBSE Delhi Comptt. Set-I, II, III, 2017]**

Sol. Integers divisible by 8 are 208, 216, 224, ..., 496.

Which is an A.P.

Here, $a = 208$, $d = 8$ and $l = 496$

Let the number of terms in A.P. be n.

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

$\therefore$ $208 + (n-1)d = 496$

$(n-1)8 = 496 - 208$

$n - 1 = \frac{288}{8}$

$= 36$

$n = 36 + 1 = 37$

Hence, no. of required integers divisible by 8 = 37

10. The fifth term of an A.P. is 26 and its 10th term is 51. Find the A.P. A **[CBSE OD Comptt. Set-II, 2017]**

Sol. Here, $a_5 = a + 4d = 26$ ...(i) ½

and $a_{10} = a + 9d = 51$ ...(ii) ½

Solving Eqns. (i) and (ii), we get

or, $5d = 25$

$d = 5$ ½

and $a = 6$

Hence, the A.P. is 6, 11, 16 .... ½

[CBSE Marking Scheme, 2017]

11. How many terms of the A.P. $-6, \frac{-11}{2}, -5, -\frac{9}{2}$..... are needed to give their sum zero. A **[CBSE Delhi Comptt. Set-III, 2017]** **[CBSE Delhi Set-III, 2016]**

Sol. Given $a = -6$ and $d = -\frac{11}{2}-(-6) = \frac{1}{2}$

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

Let sum of n terms be zero.

$\therefore$ $S_n = 0$

or, $\frac{n}{2}\left[2\times-6+(n-1)\frac{1}{2}\right] = 0$

or, $\frac{n}{2}\left[-12+\frac{n}{2}-\frac{1}{2}\right] = 0$

or, $\frac{n}{2}\left[\frac{n}{2}-\frac{25}{2}\right] = 0$

or, $n^2 - 25n = 0$

$n(n-25) = 0$

$n = 25$ as $n \neq 0$

Hence, required terms are 25.

12. In an A.P. of 50 terms, the sum of the first 10 terms is 210 and the sum of its last 15 terms is 2565. Find the A.P. A **[CBSE Foreign Set-III, 2017]**

Sol. Given, $S_{10} = 210$

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

or, $\frac{10}{2}(2a+9d) = 210$ ½

or, $2a + 9d = 42$ ...(i)

Since, $a_{36} = a + 35d$

and $a_{50} = a + 49d$

Hence,

Sum of last 15 terms $= \frac{15}{2}(a+35d+a+49d)$

or, $\frac{15}{2}(2a+84d) = 2565$ ½

or, $a + 42d = 171$ ...(ii) ½

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

$a = 3$ and $d = 4$ ½

Hence, given A.P. is 3, 7, 11 ....

[CBSE Marking Scheme, 2017]

13. How many two digit numbers are divisible by 7 ?

A [CBSE SQP, 2016]

Sol. Two digit numbers which are divisible by 7 are: 14, 21, 28, ..., 98. ½

It forms an A.P.

Here, $a = 14, d = 7$ and $a_n = 98$ ½

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

$98 = 14 + (n - 1)7$ ½

$98 - 14 = 7n - 7$

$84 + 7 = 7n$

or, $7n = 91$

or, $n = 13$ ½

[CBSE Marking Scheme, 2016]

AI **14. In a certain A.P. 32nd term is twice the 12th term. Prove that 70th term is twice the 31st term.**

A [CBSE Term-II, 2015]

Sol. Let the 1st term be a and common difference be d.

According to the question, $a_{32} = 2a_{12}$

$\therefore$ $a + 31d = 2(a + 11d)$

$a + 31d = 2a + 22d$

$a = 9d$ 1

Again, $a_{70} = a + 69d$

$= 9d + 69d = 78d$

$\because$ $a_{31} = a + 30d$

$= 9d + 30d = 39d$

Hence, $a_{70} = 2a_{31}$ **Hence Proved.** 1

[CBSE Marking Scheme, 2015]

AI **15. The 8th term of an A.P. is zero. Prove that its 38th term is triple of its 18th term.**

A [CBSE Term-II, 2015]

Sol. Given, $a_8 = 0$ or, $a + 7d = 0$ or, $a = -7d$ ½

or, $a_{38} = a + 37d$

or, $a_{38} = -7d + 37d = 30d$ ½

And, $a_{18} = a + 17d$

$= -7d + 17d = 10d$ ½

or, $a_{38} = 30d = 3 \times 10d = 3 \times a_{18}$

$\therefore$ $a_{38} = 3a_{18}$. **Hence Proved.** ½

[CBSE Marking Scheme, 2015]

16. The fifth term of an A.P. is 20 and the sum of its seventh and eleventh terms is 64. Find the common difference. A [CBSE Foreign Set II, 2015]

[CBSE Term-II, 2015]

Sol. Let the first term be a and common difference be d.

Then, $a + 4d = 20$ ...(i) ½

and $a + 6d + a + 10d = 64$

$a + 8d = 32$ ...(ii) 1

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

$d = 3$

Hence, common difference, $d = 3$ ½

[CBSE Marking Scheme, 2015]

17. Find the middle term of the A.P. 213, 205, 197, ... 37. A [CBSE Delhi Term, 2015]

Sol. Here, $a = 213$, $d = 205 - 213 = -8$ and $l = 37$

Let the number of terms be n.

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

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

or, $37 - 213 = -8(n - 1)$

or, $n - 1 = \dfrac{-176}{-8} = 22$ ½

or, $n = 22 + 1 = 23$ ½

The middle term will be $= \dfrac{23+1}{2} = 12^{th}$ ½

$\therefore$ $a_{12} = a + (n - 1)d$

$= 213 + (12 - 1)(-8)$

$= 213 - 88$

$= 125$

Thus, the middle term will be 125. ½

[CBSE Marking Scheme, 2015]

18. In an A.P., if $S_5 + S_7 = 167$ and $S_{10} = 235$, then find the A.P., where S_n denotes the sum of first n terms.

A [CBSE Term-II, 2015]

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

Given, $S_5 + S_7 = 167$

Hence, $\dfrac{5}{2}(2a+4d) + \dfrac{7}{2}(2a+6d) = 167$

or, $24a + 62d = 334$

or $12a + 31d = 167$ ....(i) ½

Given, $S_{10} = 235$

or, $5(2a + 9d) = 235$

or $2a + 9d = 47$ ...(ii) ½

Solving (i) and (ii), wet get

$a = 1$ and $d = 5$ ½

Hence A.P. $= 1, 6, 11, ...$ ½

[CBSE Marking Scheme, 2015]

Short Answer Type Questions-II

(3 Marks Each)

AI **1. Which term of the A.P. $20, 19\frac{1}{4}, 18\frac{1}{2}, 17\frac{3}{4}$, ... is the first negative term.**

A [CBSE OD Set-III, 2020]

Sol. Here, First term, $a = 20$

and Common difference, $d = \dfrac{77}{4} - 20 = -\dfrac{3}{4}$

Let $t_n < 0$

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

$\therefore$ $20 + (n-1)\left(-\dfrac{3}{4}\right) < 0$

$\Rightarrow$ $80 - 3n + 3 < 0$

$\Rightarrow$ $83 - 3n < 0$

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

$\Rightarrow$ $n > 27.6$

$\Rightarrow$ $n = 28$

Hence, 28th term will be the first negative term.

AI 2. Find the middle term of the A.P. 7, 13, 19, ..., 247.

U **[CBSE OD Set-III, 2020]**

Sol. In this A.P., $a = 7, d = 13 - 7 = 6$

and $t_n = 247$

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

$\therefore$ $247 = 7 + (n-1)6$

$\Rightarrow$ $6(n-1) = 240$

$\Rightarrow$ $n - 1 = 40$

$\Rightarrow$ $n = 41$

Hence,

$$\text{the middle term} = \frac{n+1}{2} = \frac{41+1}{2} = \frac{42}{2} = 21.$$

Hence, 21st term will be the middle term.

$\therefore$ $t_{21} = a + 20d = 7 + 20 \times 6 = 7 + 120 = 127$

AI 3. Show that the sum of all terms of an A.P. whose first term is a, the second term is b and the last term is c is equal to $\frac{(a+c)(b+c-2a)}{2(b-a)}$.

A **[CBSE OD Set-I, 2020]**

Sol. Given, first term, $A = a$

and second term $= b$

$\Rightarrow$ common difference, $d = b - a$

Last term, $l = c$

$\Rightarrow$ $A + (n-1)d = c$ [By using, $l = a + (n-1)d$]

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

$a + (n-1)(b-a) = c$

$\Rightarrow$ $(b-a)(n-1) = c - a$

$\Rightarrow$ $n - 1 = \frac{c-a}{b-a}$

$\Rightarrow$ $n = \frac{c-a}{b-a} + 1 = \frac{c-a+b-a}{b-a}$

$\Rightarrow$ $n = \frac{b+c-2a}{b-a}$

Now sum $= \frac{n}{2}[A + l]$

$$= \frac{(b+c-2a)}{2(b-a)}[a+c] = \frac{(a+c)(b+c-2a)}{2(b-a)}$$

Hence Proved.

AI 4. Solve the equation: $1 + 4 + 7 + 10 + ... + x = 287$.

A **[CBSE Delhi & OD Set-I, 2020]**

Sol. Given, $a = 1$ and $d = 4 - 1 = 3$

Let number of terms is the series be n, then

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

$\Rightarrow$ $\frac{n}{2}[2 \times 1 + (n-1)3] = 287$

$\Rightarrow$ $\frac{n}{2}[2 + 3n - 3] = 287$

$\Rightarrow$ $3n^2 - n - 574 = 0$

$\Rightarrow$ $3n^2 - 42n + 41n - 574 = 0$

$\Rightarrow$ $3n(n-14) + 41(n-14) = 0$

$\Rightarrow$ $(n-14)(3n+41) = 0$

Either $n = 14$ or $n = -\frac{41}{3}$, it is not possible.

Thus 14th term

$a_{14} = a + (14-1)d$

$\Rightarrow$ $= 1 + 13 \times 3$

$= 40.$

AI 5. If in an A.P., the sum of first m terms is n and the sum of its first n terms is m, then prove that the sum of its first $(m + n)$ terms is $-(m + n)$.

A **[CBSE OD Set-II, 2020]**

Sol. Let 1st term of series be a and common difference be d, then

$S_m = n$ [given]

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

$\Rightarrow$ $m[2a + (m-1)d] = 2n$ ...(i)

and $S_n = m$ [given]

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

$\Rightarrow$ $n[2a + (n-1)d] = 2m$ ...(ii)

On subtracting eq. (ii) from eq. (i)

$2(n-m) = 2a(m-n) + d[m^2 - n^2 - (m-n)]$

$\Rightarrow$ $2(n-m) = 2a(m-n) + d[(m-n)(m+n) - (m-n)]$

$\Rightarrow$ $2(n-m) = (m-n)[2a + d(m+n-1)]$

$\Rightarrow$ $-2 = 2a + d(m+n-1)$ ...(iii)

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

$= \frac{m+n}{2}(-2)$ [from (iii)]

$= -(m+n)$ **Hence Proved.**

6. Find the sum of all 11 terms of an A.P. whose middle term is 30. A **[CBSE OD Set-II, 2020]**

Sol. In an A.P. with 11 terms,

$$\text{middle term} = \frac{11+1}{2}\text{ term} = 6^{th}\text{ term}$$

Now, sixth term *i.e.*, $a_6 = a + (6-1)d$

i.e., $a + 5d = 30$ ...(i)

[$\because$ middle term *i.e.*, $a_6 = 30$ (given)]

Now, the sum of 11 terms,

$$S_{11} = \frac{11}{2}[2a + (11-1)d]$$
$$= \frac{11}{2}[2a + 10d]$$
$$= \frac{11}{2} \times 2[a + 5d]$$
$$= 11 \times 30 \quad \text{[from (i)]}$$
$$= 330$$

7. If the sum of first m terms of an A.P. is the same as the sum of its first n terms, show that the sum of its first $(m + n)$ terms is zero. A [CBSE SQP, 2020]

Sol. $S_m = S_n$

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

$\Rightarrow 2a(m-n) + d(m^2 - m - n^2 + n) = 0$ **1**

$\Rightarrow (m-n)[2a + (m + n - 1)d] = 0$ **1**

or $S_{m+n} = 0$

[CBSE SQP Marking Scheme, 2020]

Detailed Solution:

Sum of first m terms = Sum of first n terms

$\Rightarrow S_m = S_n$

$$\frac{m}{2}[2a + (m-1)d] = \frac{n}{2}[2a + (n-1)d]$$
$$m[2a + (m-1)d] = n[2a + (n-1)d]$$
$$m[2a + (m-1)d] - n[2a + (n-1)d] = 0$$
$$2a(m-n) + [m(m-1) - n(n-1)]d = 0$$
$$2a(m-n) + [m^2 - m - n^2 + n]d = 0$$
$$2a(m-n) + [(m-n)(m+n) - (m-n)]d = 0$$
$$(m-n)[2a + (m+n-1)d] = 0$$

Here, $(m - n)$ is not equal to zero.

So, $[2a + (m + n - 1)d] = 0$

Hence, $S_{m+n} = 0$

8. If the sum of first four terms of an A.P. is 40 and that of first 14 terms is 280. Find the sum of its first n terms. A [CBSE Delhi Set-I, 2019]

Sol. $S_4 = 40 \Rightarrow 2(2a + 3d) = 40 \Rightarrow 2a + 3d = 20$ ½

$S_{14} = 280 \Rightarrow 7(2a + 13d) = 280 \Rightarrow 2a + 13d = 40$ ½

Solving to get $d = 2$ ½

and $a = 7$ ½

$\therefore S_n = \frac{n}{2}[14 + (n-1)2]$ ½

$= n(n + 6)$ or $(n^2 + 6n)$ ½

[CBSE Marking Scheme, 2019]

Detailed Solution:

Since,

Sum of n terms of an A.P.,

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

[a be the first term and d be the common difference]

According to question, $S_4 = 40$

$\Rightarrow \frac{4}{2}[2a + (4-1)d] = 40$

$\Rightarrow 2[2a+3d] = 40$

$\Rightarrow 2a + 3d = 20$ ...(i)

and $S_{14} = 280$

$\Rightarrow \frac{14}{2}[2a + (14-1)d] = 280$

$\Rightarrow 7(2a + 13d) = 280$

$\Rightarrow 2a + 13d = 40$ ...(ii)

Solving eq. (i) and (ii), we get

$a = 7$ and $d = 2$

$\therefore S_n = \frac{n}{2}[2 \times 7 + (n-1)2]$

$= \frac{n}{2}[14 + 2n - 2]$

$= \frac{n}{2}(12 + 2n)$

$= 6n + n^2$

Hence, Sum of n terms $= 6n + n^2$

9. For what value of n, are the n^{th} terms of two A.P.s 63, 65, 67,.... and 3, 10, 17,.... equal ? C + A [CBSE OD Set-III, 2017]

Sol. Let a, d and A, D be the 1st term and common different of the 2 A.P.s respectively.

Here, $a = 63, d = 2$

$A = 3, D = 7$

Given, $a_n = A_n$

$\Rightarrow a + (n-1)d = A + (n-1)D$

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

$\Rightarrow 63 + 2n - 2 = 3 + 7n - 7$

$\Rightarrow 61 + 2n = 7n - 4$

$\Rightarrow 5n = 65$

$\Rightarrow n = 13$

$\therefore$ When n is 13, the n^{th} terms are equal

i.e., $a_{13} = A_{13}$

10. If the 10th term of an A.P. is 52 and the 17th term is 20 more than the 13th term, find A.P. A [CBSE, OD Set-I 2017]

Sol. $a_{10} = 52$

or, $a + 9d = 52$ ...(i) **1**

Also $a_{17} - a_{13} = 20$

$a + 16d - (a + 12d) = 20$ ½

$4d = 20$

$d = 5$

Substituting, the value of d in (i), we get

$a = 7$ **1**

Hence, A.P. = 7, 12, 17, 22 ..... ½

[CBSE Marking Scheme, 2017]

11. How many terms of an A.P. 9, 17, 25, ... must be taken to give a sum of 636 ? A [CBSE OD Set-III, 2017]

Topper Answer, 2017

$a = 9$, $d = 8$, $S_n = 636$.

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

$636 = \frac{n}{2}[18 + (n-1)8]$

$636 = n[9 + (n-1)4]$

$636 = n(9 + 4n - 4)$

$636 = n(5 + 4n)$

$636 = 5n + 4n^2$

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

$4n^2 + 53n - 48n - 636 = 0$

~~$n(4n+5)$~~

$4n^2 - 48n + 53n - 636 = 0$.

$4n(n-12) + 53(n-12) = 0$

$(4n+53)(n-12) = 0$

$\therefore n = \frac{-53}{4}$ or 12.

as n is a natural number, $\boxed{n = 12}$

$\therefore$ 12 terms are required to give sum 636.

AI 12. Find the sum of n terms of the series

$$\left(4-\frac{1}{n}\right)+\left(4-\frac{2}{n}\right)+\left(4-\frac{3}{n}\right)+\ldots\ldots$$

A [CBSE Delhi Set-I, II, III, 2017]

Sol. Let sum of n term be S_n.

$$\therefore S_n = \left[4-\frac{1}{n}\right]+\left[4-\frac{2}{n}\right]+\left[4-\frac{3}{n}\right]+\ldots\ldots$$

up to n terms **1**

or, $(4 + 4 + 4 + \ldots\ldots$ up to n terms$)$

$$-\left(\frac{1}{n}+\frac{2}{n}+\frac{3}{n}+\ldots\ldots\text{ up to } n \text{ terms}\right)$$

or, $(4 + 4 + 4 + \ldots\ldots$ up to n terms$)$

$$-\frac{1}{n}(1 + 2 + 3 + \ldots\ldots \text{ up to } n \text{ terms})$$

or, $(4 + 4 + 4 + \ldots\ldots$ up to n terms$)$

$$-\frac{1}{n}(1 + 2 + 3 + \ldots\ldots \text{ up to } n \text{ terms})$$

or, $4n - \frac{1}{n}\times\frac{n(n+1)}{2}$ **1½**

or, $4n - \frac{n+1}{2} = \frac{7n-1}{2}$

Hence, sum of n terms $= \frac{7n-1}{2}$ **½**

[CBSE Marking Scheme, 2017]

13. If the sum of the first 14 terms of an A.P. is 1050 and its first term is 10, find its 20th term. A [CBSE OD Comptt. Set-III, 2017]

Sol. Given, $a = 10$, and $S_{14} = 1050$

Let the common difference of the A.P. be d. **½**

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

$\therefore$ $S_{14} = \frac{14}{2}[2\times10 + (14-1)d]$

$= 1050$ **½**

$20 + 13d = \frac{1050}{7} = 150$

$13d = 130$

$d = \frac{130}{13} = 10$ **1**

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

$a_{20} = 10 + 19 \times 10 = 200$ **1**

Hence, $a_{20} = 200$

[CBSE Marking Scheme, 2017]

14. Find the sum of all odd numbers between 0 and 50. A [Delhi Comptt. Set-III, 2017]

Sol. Given, $1 + 3 + 5 + 7 + \ldots\ldots + 49$

Let total odd number of terms be n. **1**

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

$(n-1) \times 2 = 49 - 1 = 48$

$$n - 1 = 24$$
$$n = 24 + 1 = 25 \quad \mathbf{1}$$
$$S_{25} = \frac{25}{2}(1+49)$$
$$= 25 \times 25$$
$$= 625$$

Hence, sum of odd numbers between 0 and 50 = 625 **1**

[CBSE Marking Scheme, 2017]

AI 15. If m^{th} term of A.P. is $\frac{1}{n}$ and n^{th} term is $\frac{1}{m}$, find the sum of first mn terms. A **[CBSE Set-I, II, 2017]**

Sol. Let first term of given A.P. be a and common difference be d.

$$\therefore \quad a_m = a + (m-1)d = \frac{1}{n} \quad \text{...(i) ½}$$

$$\text{and} \quad a_n = a + (n-1)d = \frac{1}{m} \quad \text{...(ii) ½}$$

On subtracting (ii) from (i) we get

$$(m-n)d = \frac{1}{n} - \frac{1}{m} = \frac{m-n}{mn} \quad \mathbf{1}$$

or, $$d = \frac{1}{mn}$$

and $$a = \frac{1}{mn} \quad \text{[from (i)]}$$

Now $$S_{mn} = \frac{mn}{2}\left(2\cdot\frac{1}{mn} + (mn-1)\frac{1}{mn}\right)$$
$$= \frac{mn}{2}\left(\frac{2}{mn} + \frac{mn}{mn} - \frac{1}{mn}\right)$$
$$S_{mn} = \frac{mn}{2}\left[\frac{1}{mn} + 1\right]$$
$$= \frac{1}{2}[mn+1]$$

Hence, the sum of first mn terms $= \frac{1}{2}[mn+1]$. **1**

[CBSE Marking Scheme, 2017]

16. Find the sum of all two digit natural numbers which are divisible by 4. A **[Delhi Comptt. Set-II, 2017]**

Sol. First two digit multiple of 4 is 12 and last is 96

So, $a = 12$, $d = 4$ and $l = 96$

Let n^{th} term be last term = 96 **1**

$$\therefore \quad a_n = a + (n-1)d = l$$
$$12 + (n-1)4 = 96$$
$$n - 1 = 21$$
$$n = 21 + 1 = 22 \quad \mathbf{1}$$

Now, $$S_{22} = \frac{22}{2}[12+96]$$
$$= 11 \times 108$$
$$= 1188 \quad \mathbf{1}$$

[CBSE Marking Scheme, 2017]

17. Find the sum of the following series:
5 + (– 41) + 9 + (– 39) + 13 + (– 37) + 17 + ... + (– 5) + 81 + (– 3) A **[CBSE Foreign Set-I, 2017]**

Sol. The series can be written as

(5 + 9 + 13 + ... + 81)
+ [(– 41) + (– 39) + (– 37) + (– 35) ... (– 5) + (– 3)]

For the series (5 + 9 + 13 + ... + 81) ½

$$a = 5$$
$$d = 4$$

and $$a_n = 81$$

Then, $$a_n = 5 + (n-1)4$$
$$= 81$$

or, $$(n-1)4 = 76 \quad \text{½}$$
$$n = 20$$
$$S_n = \frac{20}{2}(5+81)$$
$$= 860$$

For series (– 41) + (– 39) + (– 37) + ... + (– 5) + (– 3)

$$a_n = -3 \quad \text{½}$$
$$a = -41$$
$$d = 2$$

Then, $$a_n = -41 + (n-1)(2)$$

$\therefore$ $$n = 20$$
$$S_n = \frac{20}{2}[-41+(-3)]$$
$$= -440 \quad \text{½}$$

Hence, the sum of the series = 860 – 440
= 420 **1**

[CBSE Marking Scheme, 2017]

18. The ninth term of an A.P. is equal to seven times the second term and twelfth term exceeds five times the third term by 2. Find the first term and the common difference. A **[CBSE SQP, 2016]**

Sol. Let the first term of A.P. be a and common difference be d.

Given, $$a_9 = 7a_2$$

or, $$a + 8d = 7(a+d) \quad \text{...(i) ½}$$

and $$a_{12} = 5a_3 + 2$$

Again, $$a + 11d = 5(a+2d) + 2 \quad \text{...(ii) } \mathbf{1}$$

From (i), $$a + 8d = 7a + 7d$$
$$-6a + d = 0 \quad \text{...(iii)}$$

From (ii), $$a + 11d = 5a + 10d + 2$$
$$-4a + d = 2 \quad \text{...(iv)}$$

Subtracting (iv) from (iii), we get

$$-2a = -2$$

or, $$a = 1 \quad \mathbf{1}$$

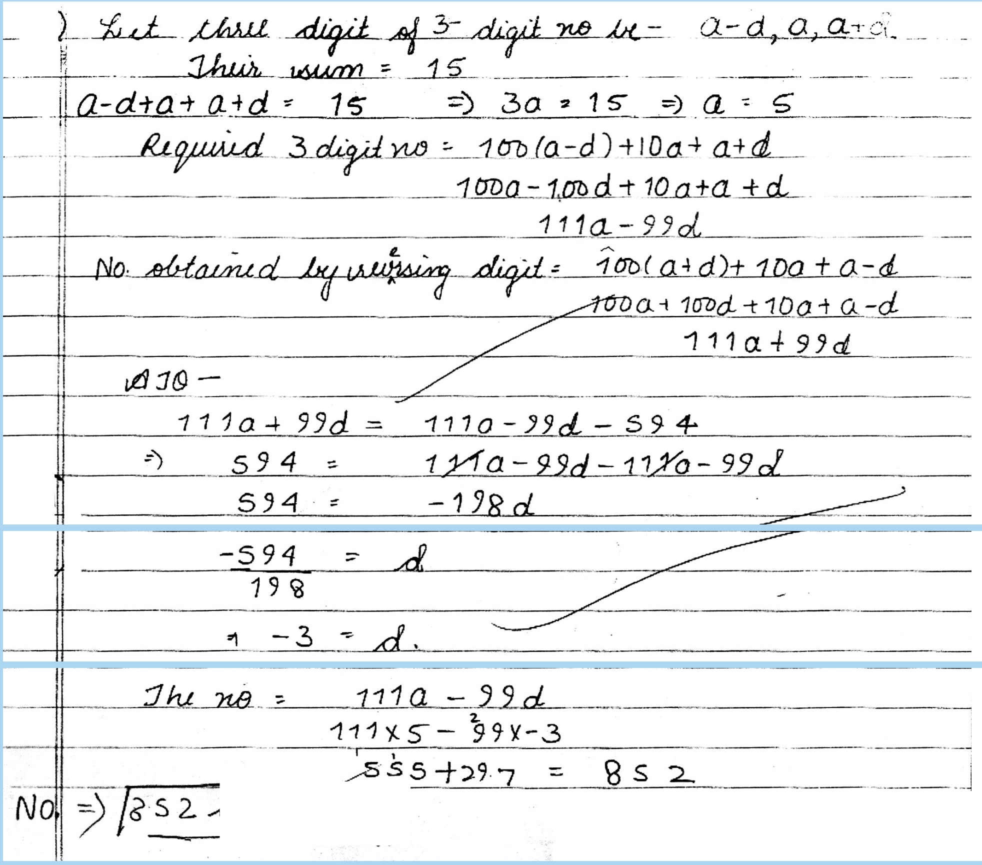
From (iii),
$$-6 + d = 0$$
$$d = 6 \quad \text{½}$$

Hence, first term = 1 and common difference = 6

[CBSE Marking Scheme, 2016]

19. The digits of a positive number of three digits are in A.P. and their sum is 15. The number obtained by reversing the digits is 594 less than the original number. Find the number. A **[CBSE Delhi Set-II, 2016]**

Topper Answer, 2016


Let three digit of 3-digit no be – a–d, a, a+d

Their sum = 15

a–d+a+a+d = 15 ⇒ 3a = 15 ⇒ a = 5

Required 3 digit no = 100(a–d)+10a+a+d

100a–100d+10a+a+d

111a–99d

No. obtained by reversing digit = 100(a+d)+10a+a–d

100a+100d+10a+a–d

111a+99d

A.T.Q. –

111a+99d = 111a–99d–594

⇒ 594 = 111a–99d–111a–99d

594 = –198d

$\frac{-594}{198}$ = d

⇒ –3 = d.

The no = 111a – 99d

111×5 – 99×–3

555+297 = 852

No ⇒ 852

20. Divide 56 in four parts in A.P. such that the ratio of the product of their extremes (1^{st} and 4^{th}) to the product of middle (2^{nd} and 3^{rd}) is 5 : 6. U **[CBSE Foreign Set-I, 2016]**

Sol. Let the four parts be

$a - 3d, a - d, a + d$ and $a + 3d$.

$\therefore a - 3d + a - d + a + d + a + 3d = 56$

or, $4a = 56$

$a = 14$

Hence, four parts are $14 - 3d$, $14 - d$, $14 + d$ and $14 + 3d$.

Now, according to question,

$$\frac{(14-3d)(14+3d)}{(14-d)(14+d)} = \frac{5}{6}$$

or, $$\frac{196-9d^2}{196-d^2} = \frac{5}{6}$$

or, $6(196 - 9d^2) = 5(196 - d^2)$

or, $6 \times 196 - 54d^2 = 5 \times 196 - 5d^2$

or, $6 \times 196 - 5 \times 196 = 54d^2 - 5d^2$

or, $(6 - 5) \times 196 = 49d^2$

or, $$d^2 = \frac{196}{49} = 4$$

or, $d = \pm 2$

$\therefore$ The four parts are

$\{14 - 3(\pm 2)\}, \{14 - (\pm 2)\}$

Hence, first possible division will be 8, 12, 16 and 20. and second possible division will be 20, 16, 12 and 8.

21. The p^{th}, q^{th} and r^{th} terms of an A.P. are a, b and c respectively. Show that $a(q - r) + b(r - p) + c(p - q) = 0$. U **[CBSE Foreign Set-II, 2016]**

Sol. Let the first term be a' and the common difference be d.

$a = a' + (p - 1)d$, $b = a' + (q - 1)d$ and

$c = a' + (r - 1)d$ 1½

$a(q - r) = [a' + (p - 1)d](q - r)$

$b(r - p) = [a' + (q - 1)d](r - p)$

and $c(p - q) = [a' + (r - 1)d](p - q)$ ½

$\therefore a(q - r) + b(r - p) + c(p - q) = a'[q - r + r - p + p - q] + d[(p - 1)(q - r) + (q - 1)(r - p) + (r - 1)(p - q)]$

½

$= a' \times 0 + d[pq - pr + qr - pq + pr - qr + (-q + r - r + p - p + q)] = 0$ **Hence Proved.** ½

[CBSE Marking Scheme, 2016]

22. The sum of first n terms of three arithmetic progressions are S_1, S_2 and S_3 respectively. The first term of each A.P. is 1 and common differences are 1, 2 and 3 respectively. Prove that $S_1 + S_3 = 2S_2$. A **[CBSE OD Set-III, 2016]**

Sol. Since, $S_1 = 1 + 2 + 3 + ... + n.$

$S_2 = 1 + 3 + 5 + ...\text{upto } n \text{ terms}$

and $S_3 = 1 + 4 + 7 + ...\text{upto } n \text{ terms}$

or, $S_1 = \dfrac{n(n+1)}{2}$ ½

Also, $S_2 = \dfrac{n}{2}[2 \times 1 + (n-1)2]$

$= \dfrac{n}{2}[2n] = n^2$ ½

and $S_3 = \dfrac{n}{2}[2 \times 1 + (n-1)3]$

$= \dfrac{n(3n-1)}{2}$ ½

Now, $S_1 + S_3 = \dfrac{n(n+1)}{2} + \dfrac{n(3n-1)}{2}$ ½

$= \dfrac{n[n+1+3n-1]}{2}$

$= \dfrac{n[4n]}{2}$

$= 2n^2$

$= 2S_2$ **Hence Proved. 1**

[CBSE Marking Scheme, 2016]

23. If the sum of the first n terms of an A.P. is $\frac{1}{2}[3n^2 + 7n]$, then find its n^{th} term. Hence write its 20^{th} term. A **[CBSE Term-II, Set-II, 2015]**

[CBSE SQP, 2016]

Sol. $S_n = \dfrac{1}{2}[3n^2 + 7n]$

$S_1 = \dfrac{1}{2}[3 \times (1)^2 + 7(1)]$

$= \dfrac{1}{2}[3 + 7]$

$= \dfrac{1}{2} \times 10 = 5$ ½

$S_2 = \dfrac{1}{2}[3\,(2)^2 + 7 \times 2]$

$= \dfrac{1}{2}[12 + 14]$

$= \dfrac{1}{2} \times 26$

$= 13$ ½

$a_1 = S_1 = 5$ ½

$a_2 = S_2 - S_1 = 13 - 5 = 8$ ½

$d = a_2 - a_1 = 8 - 5 = 3$ ½

Now, A.P. is 5, 8, 11, ...

n^{th} term, $a_n = a + (n-1)d$

$= 5 + (n-1)3$

$= 3n + 2$

Hence, $a_{20} = 3 \times 20 + 2$

$a_{20} = 62$ ½

[CBSE Marking Scheme, 2015]

24. Prove that the n^{th} term of an A.P. can not be $n^2 + 1$. Justify your answer. **[CBSE Term-II, 2015]**

Sol. Let n^{th} term of A.P.,

$a_n = n^2 + 1$

Putting the values of $n = 1, 2, 3, ...$, we get

$a_1 = 1^2 + 1 = 2$

$a_2 = 2^2 + 1 = 5$

$a_3 = 3^2 + 1 = 10$ **1**

The obtained sequence

$= 2, 5, 10, 17, ...$

Their common difference

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

or, $5 - 2 \neq 10 - 5 \neq 17 - 10$

$\therefore$ $3 \neq 5 \neq 7$ **1**

Since the common difference are not equal.

Hence, $n^2 + 1$ is not a form of n^{th} term of an A.P. **1**

[CBSE Marking Scheme, 2015]

25. If S_n denotes, the sum of the first n terms of an A.P. prove that $S_{12} = 3(S_8 - S_4)$.

A **[CBSE Delhi, Set-I, 2015]**

Sol. Let a be the first term and d be the common difference.

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

$S_{12} = 6[2a + 11d]$

$= 12a + 66d$ ...(i) **1**

$S_8 = 4[2a + 7d]$

$= 8a + 28d$ ½

and $S_4 = 2[2a + 3d]$

$= 4a + 6d$ ½

Then, $3(S_8 - S_4) = 3[(8a + 28d) - (4a + 6d)]$

$= 3[4a + 22d]$

$= 12a + 66d$

From equation (i) and (ii),

$S_{12} = 3(S_8 - S_9)$ **1**

[CBSE Marking Scheme, 2015]

26. The 14^{th} term of an A.P. is twice its 8^{th} term. If the 6^{th} term is – 8, then find the sum of its first 20 terms. A **[CBSE OD Set-I, 2015]**

[CBSE Foreign Set-I, II, 2015]

Sol. Let first term be a and common difference be d.

Here, $a_{14} = 2a_8$

or, $a + 13d = 2(a + 7d)$

$$a + 13d = 2a + 14d$$
$$a = -d \quad \text{...(i) ½}$$
Again, $a_6 = -8$
or, $a + 5d = -8$ ...(ii) ½

Solving (i) and (ii), we get
$$a = 2, d = -2 \quad ½$$
$$S_{20} = \frac{20}{2}[2\times2+(20-1)(-2)] \quad ½$$
$$= 10[4 + 19 \times (-2)]$$
$$= 10(4 - 38)$$
$$= 10 \times (-34) = -340 \quad \mathbf{1}$$

[CBSE Marking Scheme, 2015]

Long Answer Type Questions

(5 Marks Each)

AI **1.** The sum of four consecutive numbers in A.P. is 32 and the ratio of the product of the first and last term to the product of two middle terms is 7 : 15. Find the numbers. U **[CBSE Delhi Set-I, 2020]** **[CBSE Delhi & OD 2018]**

Sol. Let the four consecutive terms of A.P. be $(a - 3d)$, $(a - d)$, $(a + d)$ and $(a + 3d)$. **1**

By given conditions
$$a - 3d + a - d + d + a + 3d = 32$$
$$\Rightarrow \quad 4a = 32$$
$$\Rightarrow \quad a = 8 \quad \mathbf{1}$$
And
$$\frac{(a-3d)(a+3d)}{(a-d)(a+d)} = \frac{7}{15} \quad \mathbf{1}$$
$$\frac{a^2-9d^2}{a^2-d^2} = \frac{7}{15}$$
$$d^2 = 4$$
$$d = \pm 2 \quad \mathbf{1}$$
Hence, the numbers are 2, 6, 10 and 14 or 14, 10, 6 and 2. **1**

[CBSE Marking Scheme, 2018]

2. If m times the m^{th} term of an Arithmetic Progression is equal to n times its n^{th} term and $m \neq n$, show that the $(m + n)^{th}$ term of the A.P. is zero. **[CBSE Term-I, II, III, 2019]**

Topper Answer, 2019

27. Let the first term of given A.P. be 'a'
And, the common difference be 'd'.
and a_p dentotes p^{th} term.

given: $m(a_m) = n(a_n)$ $[m \neq n]$.

To show: $a_{(m+n)} = 0$

$m(a_m) = n(a_n)$
$\Rightarrow m[a + (m-1)d] = n[a+(n-1)d]$
$\Rightarrow am + md(m-1) = an + nd(n-1)$
$\Rightarrow am - an = nd(n-1) - md(m-1)$
$\Rightarrow a(m-n) = d[n(n-1) - m(m-1)]$
$\Rightarrow a(m-n) = d[n^2 - n - m^2 + m]$
$\Rightarrow a(m-n) = d[n^2 - m^2 + m - n]$
$\Rightarrow a(m-n) = d[(m+n)(n-m) + (m-n)]$
$\Rightarrow a(m-n) = d(m-n)[-(m+n) + 1]$

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

$\Rightarrow \quad \boxed{a + (m+n-1)d = 0}$

$\Rightarrow \quad \boxed{a_{m+n} = 0}$

$\therefore \quad a_{m+n} = 0$

Hence, proved !

AI 3. The first term of an A.P. is 3, the last term is 83 and the sum of all its terms is 903. Find the number of terms and the common difference of the A.P.

[CBSE Delhi Set-II, 2019]

Sol. Here $a = 3$, $a_n = 83$ and $S_n = 903$ **1**

Therefore $83 = 3 + (n-1)d$

$\Rightarrow \quad (n-1)d = 80$ ...(i) **1**

Also $903 = \frac{n}{2}[2a + (n-1)d]$

$= \frac{n}{2}(6 + 80)$ (using (i))

$= 43n$ **1+½**

$\Rightarrow \quad n = 21$

and from eq. (i) $d = 4$ **1+½**

[CBSE Marking Scheme, 2019]

Detailed Solution:

Given:

First term, $a = 3$

Last term, $a_n = 83$

Sum of n terms, $S_n = 903$

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

$\Rightarrow \quad 903 = \frac{n}{2}(3 + 83)$

$\Rightarrow \quad 903 = 43n$

$\Rightarrow \quad n = \frac{903}{43}$

$\Rightarrow \quad n = 21$

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

$\Rightarrow \quad 903 = \frac{21}{2}[2 \times 3 + (21-1)d]$

$\Rightarrow \quad 903 = 21(3 + 10d)$

$\Rightarrow \quad 3 + 10d = 43$

$\Rightarrow \quad 10d = 40$

$\Rightarrow \quad d = 4$

Hence, the common difference is 4.

COMMONLY MADE ERROR

- Some students fail to find the value of n as they get confused between the n^{th} term and last term.

ANSWERING TIP

- Understand the formulae related to given condition and use them to solve the problems.

4. An A.P. consists of 50 terms of which 3rd term is 12 and last term is 106. Find the 29th term.

U [CBSE SQP, 2018]

Sol. Given, $n = 50$, $a_3 = 12$ and $a_{50} = 106$

Then $a + 2d = 12$ **1**

and $a + 49d = 106$ **1**

On solving, we get $d = 2$ and $a = 8$ **1+1**

Now, $a_{29} = a + 28d$

$= 8 + 28 \times 2$

$= 64$ **1**

[CBSE Marking Scheme, 2018]

AI 5. If the ratio of the sum of the first n terms of two A.Ps is $(7n + 1) : (4n + 27)$, then find the ratio of their 9th terms.

A [CBSE OD Set-III, 2017] [CBSE OD Set-I, 2016]

Topper Answer, 2017

Let a, d and A, D be the 1st term and common difference of the 2 APs respectively.

Then,

$$\frac{\frac{n}{2}[2a + (n-1)d]}{\frac{n}{2}[2A + (n-1)D]} = \frac{7n+1}{4n+27}$$

$$\frac{2a+(n-1)d}{2A+(n-1)D} = \frac{7n+1}{4n+27}$$

Replacing n by 17 in both LHS and RHS,

$$\frac{2a+(17-1)d}{2A+(17-1)D} = \frac{7(17)+1}{4(17)+27}$$

$$\frac{2a+16d}{2A+16D} = \frac{119+1}{68+27}$$

$$\frac{2(a+8d)}{2(A+8D)} = \frac{120}{95}$$

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

$$\frac{a_9}{A_9} = \frac{24}{19}$$

∴ ratio of 9th terms is 24 : 19

6. The ratio of the sums of first m and first n terms of an A.P. is $m^2 : n^2$. Show that the ratio of its m^{th} and n^{th} terms is $(2m-1) : (2n-1)$.

[CBSE Delhi Set-I, 2017]

Sol. Let first term of given A.P. be a and common difference be d also sum of first m and first n terms be S_m and S_n respectively.

$$\therefore \quad \frac{S_m}{S_n} = \frac{m^2}{n^2} \qquad \mathbf{1}$$

$$\text{or,} \quad \frac{\frac{m}{2}[2a+(m-1)d]}{\frac{n}{2}[2a+(n-1)d]} = \frac{m^2}{n^2} \qquad \mathbf{1}$$

$$\Rightarrow \quad \frac{2a+(m-1)d}{2a+(n-1)d} = \frac{m^2}{n^2}\times\frac{n}{m} = \frac{m}{n}$$

$$\Rightarrow \quad m(2a+(n-1)d) = n[2a+(m-1)d] \qquad \mathbf{1}$$

$$\Rightarrow \quad 2am+nmd-md = 2an+nmd-nd$$

$$\Rightarrow \quad (n-m)d = 2a(n-m)$$

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

$$\text{Now} \quad \frac{a_m}{a_n} = \frac{a+(m-1)d}{a+(n-1)d}$$

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

$$\text{or,} \quad \frac{a+2ma-2a}{a+2na-2a} = \frac{2ma-a}{2na-a}$$

$$= \frac{a(2m-1)}{a(2n-1)}$$

$$= (2m-1) : (2n-1) \qquad \mathbf{2}$$

Hence Proved.

AI 7. If the p^{th} term of an A.P. is $\frac{1}{q}$ and q^{th} term is $\frac{1}{p}$. Prove that the sum of first pq term of the A.P. is $\left[\frac{pq+1}{2}\right]$.

[CBSE Delhi Set-III, 2017]

Sol. Try yourself similar to Q.No. 15 of SATQ-II.

8. If the ratio of the 11^{th} term of an A.P. to its 18^{th} term is 2 : 3, find the ratio of the sum of the first five term to the sum of its first 10 terms.

[Delhi Comptt. Set-I, II, III, 2017]

Sol. Since, $\frac{a_{11}}{a_{18}} = \frac{a+10d}{a+17d} = \frac{2}{3}$

$$\text{or,} \quad 2(a+17d) = 3(a+10d)$$

$$a = 4d \qquad \text{...(i)}$$

$$\text{Now,} \quad \frac{S_5}{S_{10}} = \frac{\frac{5}{2}(2a+4d)}{\frac{10}{2}[2a+9d]}$$

Putting the value of $a = 4d$, we get

$$\text{or,} \quad \frac{S_5}{S_{10}} = \frac{\frac{5}{2}(8d+4d)}{5(8d+9d)}$$

$$\frac{12d}{34d} = \frac{6}{17}$$

Hence, $S_5 : S_{10} = 6 : 17$

9. An A.P. consists of 37 terms. The sum of the three middle most terms is 225 and the sum of the last three terms is 429. Find the A.P. [CBSE SQP, 2017]

Sol. Let the middle most terms of the A.P. be $(a-d)$, a and $(a+d)$.

Given, $a-d+a+a+d = 225$

or, $3a = 225$

or, $a = 75$

and the middle term $= \frac{37+1}{2} = 19^{th}$ term

∴ A.P. is

$(a-18d), \ldots, (a-2d), (a-d), a, (a+d), (a+2d), \ldots, (a+18d)$

Sum of last three terms

$(a+18d)+(a+17d)+(a+16d) = 429$

or, $3a + 51d = 429$

or, $225 + 51d = 429$ or, $d = 4$

First term, $a_1 = a - 18d = 75 - 18 \times 4 = 3.$

$a_2 = 3 + 4 = 7$

Hence, A.P. = 3, 7, 11, ... , 147. **1**

10. The sum of three numbers in A.P. is 12 and sum of their cubes is 288. Find the numbers.

A **[Delhi Set-III, 2016]**

Sol. Let the three numbers in A.P. be $a - d$, a and $a + d$.

Then, their sum *i.e.*, $3a = 12$ **1**

or, $a = 4$

Also, $(4 - d)^3 + 4^3 + (4 + d)^3 = 288$ **1**

or, $64 - 48d + 12d^2 - d^3 + 64 + 64 + 48d + 12d^2 + d^3 = 288$

or, $24d^2 + 192 = 288$ **1**

or, $d^2 = 4$

$\therefore$ $d = \pm 2$ **1**

Hence, the numbers are 2, 4 and 6, or 6, 4 and 2. **1**

[CBSE Marking Scheme, 2016]

AI **11. Find the value of a, b and c such that the numbers a, 7, b, 23 and c are in A.P.**

U **[CBSE Term-II, 2015]**

Sol. Since, a, 7, b, 23 and c are in A.P.

Let the common difference be d

$\therefore$ $a + d = 7$ ...(i) ½

and $a + 3d = 23$ ...(ii) ½

From (i) and (ii), we get

$a = -1$ and $d = 8$ **1**

Again, $b = a + 2d$

$b = -1 + 2 \times 8$

or, $b = -1 + 16$

or, $b = 15$ **1**

$\therefore$ $c = a + 4d$

$= -1 + 4 \times 8$

$= -1 + 32$

$c = 31$ **1**

$\therefore a = -1, b = 15$ and $c = 31$ **1**

[CBSE Marking Scheme, 2015]