10 Arithmetic Progressions

Multiple Choice Questions (MCQs)

DIRECTIONS: *This section contains multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which only one is correct.*

1. In an A.P. if $a = 5$, $a_n = 81$ and $S_n = 860$, then n is

(a) 10 (b) 15 (c) 20 (d) 25

2. What is the value of k if $(k + 2)$, $(4k – 6)$ and $(3k – 2)$ are three consecutive terms of an A.P.?

(a) $k = –3$ (b) $k = 2$ (c) $k = –2$ (d) $k = 3$

3. The first term of an A.P. is 5 and its 100^{th} term is –292. The 50^{th} term of this A.P. will be

(a) 142 (b) –142 (c) 130 (d) –140

4. If a, b, c are in A.P., then the value of $(a + 2b – c)(2b + c – a)(c + a – b)$ will be

(a) $4abc$ (b) $2abc$

(c) abc (d) None of these

5. Sum of n terms of the series $\sqrt{2} + \sqrt{8} + \sqrt{18} + \sqrt{32} + ...$ is

(a) $\frac{n(n+1)}{2}$ (b) $2n((n + 1)$

(c) $\frac{n(n+1)}{\sqrt{2}}$ (d) 1

6. If eight times the 8^{th} term of an A.P. is equal to 12 times the 12^{th} term of the A.P. then its 20^{th} term will be

(a) –1 (b) 1 (c) 0 (d) 2

7. The 10^{th} term of an AP is 20 and the 19^{th} term is 101. Then, the third term is

(a) – 43 (b) – 61 (c) – 52 (d) 1

8. Given that the sum of the first 'n' terms of an arithmetic progression is $2n^2 + 3n$, find the 12^{th} term.

(a) 7^2 (b) 36 (c) $\sqrt{625}$ (d) 56

9. The common difference of the A.P. $\frac{1}{p}, \frac{1-p}{p}, \frac{1-2p}{p}$, ... is

(a) 1 (b) $\frac{1}{p}$ (c) –1 (d) $-\frac{1}{p}$

10. The n^{th} term of the A.P. a, $3a$, $5a$, ..., is

(a) na (b) $(2n – 1)a$

(c) $(2n + 1)a$ (d) $2na$

11. If the sum of the series 2 + 5 + 8 + 11 ..... is 60100, then the number of terms are

(a) 100 (b) 200

(c) 150 (d) 250

12. What is the common difference of four terms in A.P. such that the ratio of the product of the first and fourth term to that of the second and third term is 2 : 3 and the sum of all four terms is 20 ?

(a) 3 (b) 1 (c) 4 (d) 2

13. There are 60 terms in an A.P. of which the first term is 8 and the last term is 185. The 31^{st} term is

(a) 56 (b) 94 (c) 85 (d) 98

14. There are four arithmetic means between 2 and –18. The means are

(a) –4, –7, –10, –13 (b) 1, –4, –7, –10

(c) –2, –5, –9, –13 (d) –2, –6, –10, –14

15. If the first, second and the last terms of an A.P. are a, b, c respectively, then the sum is

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

(c) $\frac{(a+c)(b+c-2a)}{2(b-a)}$ (d) None of these

16. The sum of 11 terms of an A.P. whose middle term is 30, is

(a) 320 (b) 330

(c) 340 (d) 350

17. The first and last term of an A.P. are a and ℓ respectively. If S is the sum of all the terms of the A.P. and the common difference is $\frac{\ell^2 - a^2}{k-(\ell+a)}$, then k is equal to

(a) S (b) $2S$
(c) $3S$ (d) None of these

18. If four numbers in A.P. are such that their sum is 50 and the greatest number is 4 times the least, then the numbers are

(a) 5, 10, 15, 20 (b) 4, 10, 16, 22
(c) 3, 7, 11, 15 (d) None of these

19. Let T_r be the r^{th} term of an A.P. for r = 1, 2, 3, ... If for some positive integers m, n we have, $T_m = \frac{1}{n}$ and $T_n = \frac{1}{m}$, then T_{mn} equals

(a) $\frac{1}{mn}$ (b) $\frac{1}{m}+\frac{1}{n}$ (c) 1 (d) 0

20. If the sum of the first $2n$ terms of 2, 5, 8, ... is equal to the sum of the first n terms of 57, 59, 61....., then n is equal to

(a) 10 (b) 12 (c) 11 (d) 13

21. The number of terms of the series 5, 7, 9, ... that must be taken in order to have the sum 1020 is

(a) 20 (b) 30 (c) 40 (d) 50

22. If the n^{th} term of an A.P. is $4n + 1$, then the common difference is :

(a) 3 (b) 4 (c) 5 (d) 6

23. If a, b, c, d, e, f are in A.P., then $e - c$ is equal to:

(a) $2(c - a)$ (b) $2(d - c)$
(c) $2(f - d)$ (d) $(d - c)$

24. The number of common terms of the two sequences 17, 21, 25, ..., 417 and 16, 21, 26, ..., 466 is

(a) 19 (b) 20 (c) 21 (d) 91

25. The number of two digit numbers which are divisible by 3 is

(a) 33 (b) 31 (c) 30 (d) 29

26. If the n^{th} term of an A.P. is given by $a_n = 5n - 3$, then the sum of first 10 terms is

(a) 225 (b) 245 (c) 255 (d) 270

27. If S_1, S_2, S_3, ..., S_r are the sum of first n terms of r arithmetic progressions respectively. Whose first terms are 1, 2, 3, ... and whose common differences are 1, 3, 5, ... respectively, then the value of $S_1 + S_2 + S_3 +$ ..... S_r is

(a) $\frac{(nr-1)(nr+1)}{2}$ (b) $\frac{(nr+1)nr}{2}$
(c) $\frac{(nr-1)nr}{2}$ (d) $\frac{n(nr+1)}{2}$

28. First term of an arithmetic progression is 2. If the sum of its first five terms is equal to one-fourth of the sum of the next five terms, then the sum of its first 30 terms is

(a) 2670 (b) 2610 (c) –2520 (d) –2550

29. The odd natural numbers have been divided in groups as (1, 3) ; (5,7, 9, 11) ; (13, 15, 17, 19, 21, 23), ...

Then the sum of numbers in the 10^{th} group is

(a) 4000 (b) 4003 (c) 4007 (d) 4008

30. Suppose the sum of the first m terms of an arithmetic progression is n and the sum of its first n terms is m, where $m \neq n$. Then, the sum of the first $(m + n)$ terms of the arithmetic progression is

(a) $1 - mn$ (b) $mn - 5$
(c) $-(m + n)$ (d) $m + n$

31. Let a_n, $n \geq 1$, be an arithmetic progression with first term 2 and common difference 4. Let M_n be the average of the first n terms.
Then the sum is $\sum_{n=1}^{10} M_n$

(a) 110 (b) 335 (c) 770 (d) 1100

32. Which of the following represents an A.P. ?

(a) 0.2, 0.4, 0.6, ... (b) 29, 58, 116....
(c) 15, 45, 135, 405... (d) 3, 3.5, 4.5, 8.5 ....

33. If $t_n = 6n + 5$, then t_{n+1} =

(a) $6(n + 1) + 17$ (b) $6(n - 1) + 11$
(c) 6n + 11 (d) $6n - 11$

34. Summation of n terms of an A.P. is

(a) $\frac{n}{2}(2a+l)$ (b) $\frac{n}{2}\left[2a+(n-1)d\right]$
(c) $\frac{a\left(r^n-1\right)}{(r-1)}$ (d) $\frac{a\left(1-r^n\right)}{(1-r)}$

35. $S_n = 54 + 51 + 48 +$ ..... n terms = 513. Least value of n is

(a) 18 (b) 19
(c) 15 (d) None of these

36. If the nth term of an A.P. be $(2n - 1)$, then the sum of its first n terms will be

(a) $n^2 - 1$ (b) $(n - 1)^2$
(c) $(n - 1)^2 - (2n - 1)$ (d) n^2

37. If $\frac{b+c-a}{a}, \frac{c+a-b}{b}, \frac{a+b-c}{c}$ are in A.P., then which of the following is in A.P.?

(a) a, b, c (b) a^2, b^2, c^2
(c) $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ (d) a^3, b^3, c^3

Case/Passage Based Questions

DIRECTIONS : *Study the given Case/Passage and answer the following questions.*

Case/Passage-I

India is competitive manufacturing location due to the low cost of manpower and strong technical and engineering capabilities contributing to higher quality production runs. The production of TV sets in a factory increases uniformly by a fixed number every year. It produced 16000 sets in 6^{th} year and 22600 in 9^{th} year.

[From CBSE Question Bank 2021]

Based on the above information, answer the following questions:

38. Find the production during first year.

39. Find the production during 8^{th} year.

40. Find the production during first 3 years.

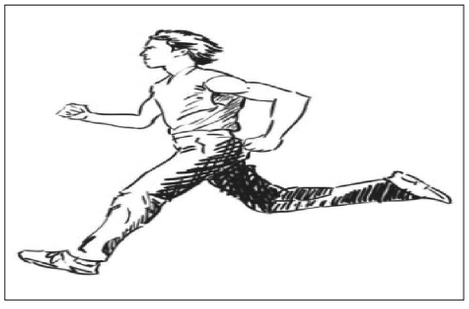
41. In which year, the production is Rs 29,200.

42. Find the difference of the production during 7^{th} year and 4^{th} year.

Case/Passage-II

Your friend Veer wants to participate in a 200m 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 .

[From CBSE Question Bank 2021]



43. Which of the following terms are in AP for the given situation

(a) 51,53,55…. (b) 51, 49, 47….

(c) –51, –53, –55…. (d) 51, 55, 59…

44. What is the minimum number of days he needs to practice till his goal isachieved

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

45. Which of the following term is not in the AP of the above given situation

(a) 41 (b) 30 (c) 37 (d) 39

46. If n^{th} term of an AP is given by $a_n = 2n + 3$ then common difference of an AP is

(a) 2 (b) 3 (c) 5 (d) 1

47. The value of x, for which 2x, x+ 10, 3x + 2 are three consecutive terms of an AP

(a) 6 (b) –6 (c) 18 (d) –18

Assertion & Reason

DIRECTIONS : *Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.*

(a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.

(b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.

(c) If **Assertion** is **correct** but **Reason** is **incorrect**.

(d) If **Assertion** is **incorrect** but **Reason** is **correct**.

48. **Assertion :** Let the positive numbers a, b, c be in A.P., then $\frac{1}{bc}, \frac{1}{ac}, \frac{1}{ab}$ are also in A.P.

Reason : If each term of an A.P. is divided by abc, then the resulting sequence is also in A.P.

49. **Assertion :** The sum of the series with the nth term, $t_n = (9 - 5n)$ is (465), when no. of terms $n = 15$.

Reason : Given series is in A.P. and sum of n terms of an A.P. is $S_n = \frac{n}{2}\left[2a + (n-1)d\right]$.

50. **Assertion :** Sum of first 10 terms of the arithmetic progression – 0.5, – 1.0, – 1.5, ... is 27.5.

Reason : Sum of n terms of an A.P. is given as $S_n = \frac{n}{2}[2a + (n-1)d]$ where a = first term, d = common difference.

51. **Assertion :** Sum of first hundred even natural numbers divisible by 5 is 500.

Reason : Sum of first n-terms of an A.P. is given by $S_n = \frac{n}{2}[a + \ell]$ where ℓ = last term.

52. **Assertion :** If n^{th} term of an A.P. is $7 - 4n$, then its common difference is –4.

Reason : Common difference of an A.P. is given by $d = a_{n+1} - a_n$.

53. **Assertion :** If S_n is the sum of the first n terms of an A.P., then its n^{th} term a_n is given by $a_n = S_n - S_{n-1}$.

Reason : The 10^{th} term of the A.P. 5, 8, 11, 14, ... is 35.

54. **Assertion :** Arithmetic between 8 and 12 is 10.
Reason : Arithmetic between two numbers 'a' and 'b' is given as $\frac{a+b}{2}$.

Match the Following

DIRECTIONS : *Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column-I have to be matched with statements (p, q, r, s) in column-II.*

55.

	Column -I (A.P.)		**Column-II (Common Difference)**
(A)	$1, \frac{3}{2}, 2, \frac{5}{2}, \ldots\ldots$	(p)	-4
(B)	$\frac{1}{3}, \frac{5}{3}, \frac{9}{3}, \frac{13}{3}, \ldots\ldots$	(q)	0.2
(C)	1.8, 2.0, 2.2, 2.4	(r)	4/3
(D)	$0, -4, -8, -12$	(s)	1/2

56.

	Column-I (A.P.)	**Column-II (n^{th} term)**
(A)	119, 136, 153, 170	(p) $13 - 3n$
(B)	7, 11, 15, 19, ...	(q) $9 - 5n$
(C)	$4, -1, -6, -11$, ...	(r) $3 + 4n$
(D)	10, 7, 4, 3, ...	(s) $17n + 102$

Fill in the Blanks

DIRECTIONS : *Complete the following statements with an appropriate word / term to be filled in the blank space(s).*

57. 4, 10, 16, 22, ..., ...

58. 1, –1, –3, – 5, ... , ...

59. 11^{th} term from last term of an A.P. 10, 7, 4..... , – 62, is ..... .

60. In a flower bed, there are 23 rose plants in the first row, 21 in the second, 19 in the third, and so on. There are 5 rose plants in the last row. Number of rows in the flower bed is ..... .

61. Sum of 1 + 3 + 5 + ... + 1999 is ..... .

62. The sum of 8 A.Ms between 3 and 15 is ..... .

63. The sum of n terms of an A.P. is $4n^2 - n$. The common difference = ...

64. The difference of corresponding terms of two A.P's will be ..... .

65. Sum of all the integers between 100 and 1000 which are divisible by 7 is ..... .

True / False

DIRECTIONS : *Read the following statements and write your answer as true or false.*

66. In an AP with first term a and common difference d, the n^{th} term (or the general term) is given by $a_n = a + (n - 1)d$.

67. 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 :

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

68. The balance money (in ₹) after paying 5% of the total loan of ₹ 1000 every month is 950, 900, 850, 800, . . . 50. represented A.P.

69. 2, 4, 8, 16, ... is not an A.P.

70. 10^{th} term of A.P. 2, 7, 12, ... is 45.

71. 301 is a term of A.P. 5, 11, 17, 23, ...

72. The general form of an A.P. is a, $a + d$, $a + 2d$, $a + 3d$, ...

73. In an Arithmetic progression, the first term is denoted by 'a' and 'd' is called the common difference.

74. If $a_{n+1} - a_n$ = same for all 'n', then the given numbers form an A.P.

75. If S_n of A.P. is $3n^2 + 2n$, then the first term of A.P. is 3.

ANSWER KEY & SOLUTIONS

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

$\Rightarrow 860 = \frac{n}{2}(5 + 81)$

$n = 860 \div 43 = 20$

2. (d) $(k + 2)$, $(4k - 6)$ and $(3k - 2)$ are in A.P.

$\Rightarrow 4k - 6 - k - 2 = 3k - 2 - 4k + 6$

$\Rightarrow 3k - 8 = -k + 4 \Rightarrow 3k + k = 4 + 8$

$\Rightarrow 4k = 12 \Rightarrow k = \frac{12}{4} = 3$

3. (b) $a = 5$, $t_{100} = -292$

$t_{100} = 5 + (100 - 1)d$

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

$\Rightarrow -292 = 5 + 99$d

$\Rightarrow -292 - 5 = 99$d

$\Rightarrow d = \frac{-297}{99} \Rightarrow d = -3$

$\therefore t_{50} = 5 + (50 - 1)(-3) = 5 + (-147)$

$= 5 - 147 \Rightarrow t_{50} = -142$

4. (a) Let a, b, c are in A.P.

$\therefore b - a = c - b \Rightarrow 2b = a + c$

So the given expression becomes

$(a + a + c - c)(a + c + c - a)(2b - b)$

$= (2a)(2c)(b) = 4abc$

5. (c) Here, $a_1 = \sqrt{2}$, $a_2 = \sqrt{8} = 2\sqrt{2}$

$\therefore \quad d = 2\sqrt{2} - \sqrt{2} = \sqrt{2}, a = \sqrt{2}$

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

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

6. (c) $t_8 = a + 7d$, $t_{12} = a + 11d$

According to question, $8t_8 = 12t_{12}$ (given)

$\Rightarrow \quad 8(a + 7d) = 12(a + 11d)$

$\Rightarrow \quad 8a + 56d = 12a + 132d$

$\Rightarrow \quad 8a - 12a + 56d - 132d = 0$

$\Rightarrow \quad -4a - 76d = 0$

$\Rightarrow a + 19d = 0 \qquad \ldots$(i)

$\therefore \quad t_{20} = a + 19d = 0$ using (i)

$\therefore \quad t_{20} = 0$

7. (a) Given that,

$t_{10} = a + 9d = 20 \qquad$ ....(i)

and $t_{19} = a + 18d = 101 \qquad$ ....(ii)

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

$a = -61$, $d = 9$

$t^3 = a + 2d = -61 + 2 \times 9 = -43$

8. (a) $S_n = 2n^2 + 3n$

$a_n = S_n - S_{n-1}$

$a_{12} = S_{12} - S_{11}$

$= 2(12)^2 + 3(12) - (2(11)^2 + 3(11))$

$= 288 + 36 - (242 + 33) = 288 + 36 - 242 - 33$

$= 46 + 3 = 49 = 7^2$

9. (c) $d = \frac{1-p}{p} - \frac{1}{p} = \frac{1-p-1}{p} = \frac{-p}{p} = -1$

10. (b) $a_n = a + (n - 1)d = a + (n - 1)2a$

[$\because d = 3a - a = 2a$]

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

11. (b)

12. (d) Take the four terms as $a - 3x$, $a - x$, $a + x$, $a + 3x$

The sum $= 4a = 20 \Rightarrow \quad a = 5$

Also, $3(a^2 - (3x)^2) = 2(a^2 - x^2)$

$\Rightarrow \quad x = 1$

However, the common difference is $2x$ and not x

$\therefore \quad$ When $x = 1$, $d = 2x = 2$

13. (d) Let d be the common difference

then 60^{th} term $= 8 + 59d = 185$

$\Rightarrow \quad 59d = 177$

$\Rightarrow d = 3$

$\Rightarrow \quad 31$st term $= 8 + 30 \times 3 = 98$.

14. (d) Let the means be X_1, X_2, X_3, X_4 and the common difference be b; then 2, X_1, X_2, X_3, X_4, –18 are in A.P.;

$\Rightarrow \quad -18 = 2 + 5b$

$\Rightarrow \quad 5b = -20$

$\Rightarrow b = -4$

Hence, $X_1 = 2 + b = 2 + (-4) = -2$;

$X_2 = 2 + 2b = 2 - 8 = -6$

$X_3 = 2 + 3b = 2 - 12 = -10$;

$X_4 = 2 + 4b = 2 - 16 = -14$

The required means are –2, –6, –10, –14.

15. (c)

16. (b)

17. (b) We have, $S = \frac{n}{2}(a+\ell) \Rightarrow \frac{2S}{a+\ell} = n$ …(i)

Also, $\ell = a + (n-1)\,d \Rightarrow d = \frac{\ell - a}{n-1} = \frac{\ell - a}{\frac{2S}{a+\ell} - 1}$

$= \frac{\ell^2 - a^2}{2S - (\ell + a)} \qquad \therefore \; k = 2S$

18. (a)

19. (c)

20. (c) Given, $\frac{2n}{2}\{2.2 + (2n-1)3\} = \frac{n}{2}\{2.57 + (n-1)2\}$

or $2\,(6n + 1) = 112 + 2n$

or $10n = 110 \quad \therefore \; n = 11$

21. (b)

22. (b)

23. (b) Let x be the common difference of the A.P.

$a, b, c, d, e, f.$

$\therefore \quad e = a + (5 - 1)x$

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

$\Rightarrow \quad e = a + 4x \qquad$ ...(i)

and $c = a + 2x \qquad$ ...(ii)

$\therefore$ Using equations (i) and (ii), we get

$e - c = a + 4x - a - 2x$

$\Rightarrow e - c = 2x = 2(d - c).$

24. (b) Common terms will be 21, 41, 61, ...

$21 + (n-1)\,20 \le 417$

$\Rightarrow n \le 20.8 \Rightarrow n = 20$

25. (c) Two digit numbers which are divisible by 3 are 12, 15, 18,..., 99;

So, $99 = 12 + (n-1) \times 3$.

26. (b) Putting $n = 1, 10$, we get $a = 2, l = 47$.

$\therefore \quad S_{10} = \frac{10}{2}(2 + 47) = 5 \times 49 = 245.$

27. (b) $S_1 = \frac{n}{2}[2(1) + (n-1)(1)]$

$S_2 = \frac{n}{2}[2(2) + (n-1)(3)]$

$S_3 = \frac{n}{2}[2(3) + (n-1)(5)]$

.....

.....

.....

$S_r = \frac{n}{2}[2(r) + (n-1)(2r-1)]$

Adding $S_1, S_2, S_3, ..., S_r$, we have

$S_1 + S_2 + ... + S_r = \frac{n}{2}\left[(2)\frac{r(r+1)}{2} + (n-1)\frac{r}{2}[1 + 2r - 1]\right]$

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

$= \frac{nr}{2}\left[r + 1 + nr - r\right] = \frac{nr}{2}\left[nr + 1\right]$

28. (d) $a = 2, d = d,$

According to question,

$S_5 = \frac{1}{4}(S_{10} - S_5)\,,\; 4S_5 = S_{10} - S_5,\; 5S_5 = S_{10}$

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

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

$\Rightarrow \quad 5 \times \frac{5}{2}(4 + 4d)\;\; \frac{10}{2}[4 + 9d]$

$\Rightarrow \quad 20 + 20d = 8 + 18d$

$\Rightarrow \quad d = -6$

$S_{30} = \frac{30}{2}[2 \times 2 + (30-1)(-6)] = \frac{30}{2}[4 + 29 \times (-6)]$

$= \frac{30}{2} \times (-170) = \frac{-5100}{2} = -2550$

29. (a) Since, the general term of sum of odd natural number in the group is = n $(2n)^2 = 4n \times n^2 = 4n^3$

Hence, the required sum of numbers in the 10th group = $4 \times 10^3 = 4000$

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30. (c) Given, $S_m = n$ and $S_n = m$

$$S_m = \frac{m}{2}[2a + (m-1)d] = n \quad \text{...(i)}$$

$$S_n = \frac{n}{2}[2a + (n-1)d] = m \quad \text{...(ii)}$$

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

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

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

$\Rightarrow$ 2a + (m + n –1) d = –2 $\quad [m \neq n]$

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

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

31. (a) $a_1 = 2, d = 4$

$$M_n = \frac{\frac{n}{2}[2a_1 + (n-1)d]}{n} = 2(n+1) - 2 = 2n$$

$$\therefore \quad \sum_{n=1}^{10} M_n = 2\sum_{n=1}^{10} n = 110$$

32. (a) Since there is a common difference option (a),
$d = 0.4 - 0.2 = 0.6 - 0.4 = 0.2$

33. (c) Put $n + 1$ in place of n in $T_n = 6n + 5$

34. (b)

35. (a) $S_n = 513$; $\frac{n}{2}[2(54) + (n - 1)(-3)] = 513$

$\Rightarrow n(108 - 3n + 3) = 1026$
$\Rightarrow n^2 - 37n + 342 = 0$
$\Rightarrow n^2 - 19n - 18n + 342 = 0$
$\Rightarrow n(n - 19) - 18(n - 19) = 0$
$\Rightarrow (n - 18)(n - 19) = 0 \Rightarrow n = 18$ or $n = 19$

36. (d) $t_1 = 2(1) - 1 = 1$
$t_2 = 2(2) - 1 = 3$, $t_3 = 2(3) - 1 = 5$ and so on.
$\therefore \quad t_1 + t_2 + t_3 + \ldots + t_n = 1 + 3 + 5 + \ldots [2(n) - 1]$

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

37. (c) $\frac{b+c-a}{a}, \frac{c+a-b}{b}, \frac{a+b-c}{c}$ are in A.P.

Adding 2 to each term

$\frac{b+c-a}{a} + 2, \frac{c+a-b}{b} + 2, \frac{a+b-c}{c} + 2$ are in A.P.

$\frac{a+b+c}{a}, \frac{a+b+c}{b}, \frac{a+b+c}{c}$ are in A.P.

Dividing each term by $(a + b + c)$,

$\frac{a+b+c}{a(a+b+c)}, \frac{a+b+c}{b(a+b+c)}, \frac{a+b+c}{c(a+b+c)}$ are in A.P.

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

38. Given that

$a_6 = a + 5d = 16000$ ..... (i)
$a_9 = a + 8d = 22600$ ..... (ii)
$\underline{\quad - \quad - \quad -}$
$-3d = -6600 \Rightarrow d = 2200$

$\Rightarrow$ a = 5000

$\therefore$ Production during first year = 5000

39. Production during 8th year is (a + 7d) = 5000 + 2(2200)
= 20400

40. Production during first 3 year = 5000 + 7200 + 9400
= 21600

41. 5000 + (n – 1) 2200 = 29200 $\Rightarrow$ n = 12th year

42. Difference = (a + 6d) – (a + 3d) = 3d = 6600

43. (b)

44. (c) $a_n = 51 - (n - 1)2 = 31 \Rightarrow n = 11$

45. (b) $a_n = 51 - (n - 1)2 = 30 \Rightarrow n = 11.5$ (not possible)

46. (a) $d = a_2 - a_1 = [2(2) + 3] - [2(1) + 3] = 2$

47. (a) $2(x + 10) = 2x + 3x + 2 \Rightarrow x = 6$

48. (a) **49. (d)**

50. (a) Both are correct. Reason is the correct reasoning for assertion.

Assertion : $S_{10} = \frac{10}{2}[2(-0.5) + (10-1)(-0.5)]$

$= 5[-1 - 4.5] = 5(-5.5) = 27.5$

51. (d) Assertion is incorrect.

Assertion : Even natural numbers divisible by 5 are 10, 20, 30, 40, ...

They form an A.P. with $a = 10$, $d = 10$

$$S_{100} = \frac{100}{2}[2(10) + 99(10)] = 50500$$

Reason is correct.

52. (a) Both are correct. Reason is the correct explanation.

Assertion : $a_n = 7 - 4n$

$d = a_{n+1} - a_n = 7 - 4(n + 1) - (7 - 4n)$
$= 7 - 4n - 4 - 7 + 4n = -4.$

53. (c) Assertion is correct. Reason is incorrect.

$a_{10} = a + 9d = 5 + 9(3) = 5 + 27 = 32.$

54. **(a)** Both are correct and Reason is the correct explanation for the Assertion.

55. (A) → (s); (B) → (r); (C) → (q); (D) → (p)

(A) Common difference = $d = \frac{3}{2} - 1 = \frac{1}{2}$

(B) $d = \frac{5}{3} - \frac{1}{3} = \frac{4}{3}$

(C) $d = 2 - 1.8 = 0.2$

(D) $d = -4 - 0 = -4$.

56. (A) → (s); (B) → (r); (C) → (q); (D) → (p)

$13 - 3n = 13 - 3(1) = 10$

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

$3 + 4n = 3 + 4(1) = 7$

$17n + 102 = 17(1) + 102 = 119$

57. 28, 34

58. –7, –9

59. –32

60. n = 10

61. $\frac{1000}{2}[2(1) + (1000 - 1)2]$

62. $72\left[8\left(\frac{3+15}{2}\right)\text{etc.}\right]$

63. 11 [$S_2 = 4(2)^2 - 2 \Rightarrow 14$

$S_1 = 4(1)^2 - 1 \Rightarrow 3$ etc.]

64. another A.P.

65. 70336 [Hint : S = 105 + 112 + ... 994 and 105 + (n – 1)7 = 994 ⇒ 105 + 7n – 7 = 994 ⇒ n = 128 etc.]

66. True

67. True

68. True

69. True

70. False

71. False

72. True

73. True

74. True

75. False

First term = $a = a_1 = 3\,(1)^2 + 2(1) = 5$