16 SEQUENCE AND SERIES

Importance : In all competitive examinations 2-3 questions from this chapter are asked. The difficulty level depends on level of examination.

Scope of questions : Mixed series mainly involve mixture of Arithmetic or Geometric series and rarely Harmonic series.

Way to success : Main step is to identify and dis-associate the mixed terms to find out Arithmetic & Geometric series.

Sequence : Succession of numbers arranged in a definite order forming a definite pattern is known as sequence.

Series : If $a_1, a_2, a_3, a_4, ..., a_n, ...$ is a sequence, then the expression $a_1 + a_2 + a_3 + a_4 + ... + a_n + ...$ is a series.

A series is finite or infinite according to as the number of terms in the corresponding sequence is finite or infinite.

Progressions : Those sequences whose terms follow certain patterns are called progressions.

Arithmetic Progression (A.P.) : A sequence is called an Arithmetic Progression if the difference between two consecutive terms is always same. i.e., $a_{n+1} - a_n$ = constant (= d) for all $n \in N$

The constant difference, generally denoted by 'd' is called the common difference.

a_n is called the nth or last term of an A.P.

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

(i) Three consecutive, terms in an A.P are taken as $a - d, a, a + d$.

(ii) Four consecutive terms in an A.P taken as $a - 3d, a - d, a + d, a + 3d$.

Note : If each term of an A.P. is (increased/decreased) by K then A.M. is also (increased/decreased) by K.

If each term of an A.P. is (multiplied/Divided) by K, then A.M is also (multiplied/Divided) by same number K.

Rule 1. Let a be the first term and d be the common difference of an A.P. Then its nth term is a + (n – 1)d i.e., $\boxed{a_n = a + (n-1)d}$.

Rule 2. The sum S_n of n terms of an A.P. with first term is 'a' and common difference is 'd' is

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

where l = last term = a + (n – 1)d.

Rule 3. Three numbers a, b, c are in A.P. if $2b = a + c$ OR $b = \frac{a+c}{2}$ or vice versa. Here b is called Arithmetic Mean of a and c.

Arithmetic Mean : If between two given quantities a and b we have inserted n quantities $A_1, A_2, A_3, ... A_n$ such that $a, A_1, A_2, ... A_n$ to form A.P., then we say that $A_1, A_2, A_3 .... A_n$ are arithmetic means between a and b.

Insertion of 'n' Arithmetic Means between a and b :

Let $A_1, A_2, ... A_n$ be n Arithmetic Means between two quantities a and b. Such that,

$$a, A_1, A_2 ... A_n, b \text{ are in A.P. then } d = \left(\frac{b-a}{n+1}\right)$$

$$A_1 = \left(a + \frac{b-a}{n+1}\right), A_2 = \left[a + \frac{2(b-a)}{n+1}\right] ... \boxed{A_n = a + \frac{n(b-a)}{(n+1)}}$$

These are the required Arithmetic Means between a and b.

Note : Let A be the Arithmetic Mean between a and b, then a, A, b are in A.P. Such that

$$2A = a + b$$

$$\Rightarrow \quad A = \frac{a+b}{2}$$

Rule 4.

(i) $1 + 2 + 3 + ... + n = \frac{n(n+1)}{2}$

(ii) $1^2 + 2^2 + 3^2 + ... + n^2 = \frac{n(n+1)(2n+1)}{6}$

(iii) $1^3 + 2^3 + 3^3 + ... + n^3 = \left[\frac{n(n+1)}{2}\right]^2$

Note that : (ii) and (iii) are not AP's.

Geometric Progression : A sequence of non-zero numbers is called a Geometric Progression (abbreviated as G.P.) if the ratio of a term and the term preceding to it is always same.

The constant ratio is called the common ratio (r) of the G.P.

In other words, a sequence $a_1, a_2, a_3, ... a_n$ is called a Geometric Progression if

$$\frac{a_{n+1}}{a_n} = \text{constant for all } n \in N.$$

Three numbers in G.P is taken as a, ar, ar^2 or $\frac{a}{r}$, a, ar

Geometric Series : If $a_1, a_2, a_3, \ldots a_n, \ldots$ is a G.P., then the expression $a_1 + a_2 + a_3 + \ldots + a_n + \ldots$ is called a geometric series.

Rule 5. The nth term of a G.P. with first term a and common ratio r is given by $\boxed{a_n = ar^{n-1}}$.

Rule 6. The sum of n terms of a G.P. with first term 'a' and common ratio 'r'. is given by

$$\boxed{S_n = a\left(\frac{1-r^n}{1-r}\right)} \text{ for } r < 1 \text{ and } \boxed{S_n = a\left(\frac{r^n-1}{r-1}\right)} \text{ for } r > 1$$

In fact these two are exactly identical. The only thing which must be noted is that the above formulas do not hold for r = 1, the sum of n terms of the G.P. is $S_n = na$. where r = 1.

Rule 7. The sum of an infinite G.P. with 1st term is 'a' and common ratio is r($-1 < r < 1$ i.e., $|r| < 1$) is given by

$$S_\infty = \frac{a}{1-r}.$$

Rule 8. Three non-zero numbers a, b, c are in G.P. if $b^2 = ac$ or $\boxed{b = \sqrt{ac}}$. Here, b is known as the Geometric Mean of a and c.

Note : Let a and b be two given numbers. If 'n' numbers $G_1, G_2, \ldots, G_n$ are inserted between a and b such that the sequence a, $G_1, G_2, \ldots G_n$, b is a G.P. Then the numbers $G_1, G_2, \ldots G_n$ are known as n Geometric Means (G.M's) between a and b.

Rule 9. Geometric mean : If a single geometric mean G is inserted between two given numbers a and b, then G is known as the Geometric Mean between a and b. Thus, G is the G.M. between a and b.

$\therefore$ a, G, b are in G.P.

$\Leftrightarrow G^2 = ab$

$\Rightarrow \boxed{G = \sqrt{ab}}$

Rule 10. Insertion of n Geometric Means between two given numbers a and b : Let $G_1, G_2, \ldots, G_n$ be n Geometric Means between two given numbers a and b. Then a, $G_1, G_2, \ldots G_n$, b is a G.P. consisting of (n + 2) terms. Let r be the common ratio of this G.P., then

$$b = (n+2)\text{th term} = ar^{n+1}$$

$$\Rightarrow \quad r = \left(\frac{b}{a}\right)^{\frac{1}{n+1}}$$

$$\therefore \quad G_1 = ar = a\left(\frac{b}{a}\right)^{\frac{1}{n+1}}$$

$$G_2 = ar^2 = a\left(\frac{b}{a}\right)^{\frac{2}{n+1}}$$

$$\boxed{G_n = ar^n = a\left(\frac{b}{a}\right)^{\frac{n}{n+1}}}$$

Rule 11. If 'n' Geometric Means are inserted between two quantities, then the product of n geometric means is the nth power of the single geometric mean between the two quantities, i.e., – $G_1G_2G_3 \ldots G_n = \left(\sqrt{ab}\right)^n = G^n$. where, $\sqrt{ab} = G$ is the single Geometric Mean between a and b.

Harmonic Progression :

If a, b, c, d, are in H.P. then,

$\frac{1}{a}, \frac{1}{b}, \frac{1}{c}, \frac{1}{d}$ will form an A.P.

and then we can apply all rules of A.P.

- **Harmonic Mean (H.M.) :** H will be called Harmonic Mean between a and b if a, H, b are in H.P. Then

$$\boxed{H = \frac{2ab}{a+b}}$$

For two numbers a and b, A.M. $= \frac{a+b}{2}$;

G.M. $= \sqrt{ab}$; H.M. $= \frac{2ab}{a+b}$

Relation among A.M., G.M. and H.M. : For two numbers a and b, A.M. $= \frac{a+b}{2}$; G.M. $= \sqrt{ab}$;

H.M. $= \frac{2ab}{a+b}$

$$\because \frac{a+b}{2} \geq \sqrt{ab} \geq \frac{2ab}{a+b}$$

$$\therefore \boxed{\text{A.M.} \geq \text{G.M.} \geq \text{H.M.}}.$$

They will be equal if both numbers are equal to each other.

Now, A.M. × H.M.

$$= \frac{a+b}{2} \times \frac{2ab}{a+b} \text{ A.M.} \times \text{H.M.} = ab = (\text{G.M.})^2$$

or, $\boxed{\text{G.M.} = \sqrt{(\text{A.M.}) \times (\text{H.M.})}}$

■ ■

QUESTIONS ASKED IN PREVIOUS SSC EXAMS

TYPE–I

1. The next number of the sequence 3, 5, 9, 17, 33 ..... is :
(1) 65 (2) 60
(3) 50 (4) 49
(SSC CGL Prelim Exam. 27.02.2000 (First Sitting) & (SSC CPO S.I. Exam. 05.09.2004)

2. The next term of the sequence $\frac{1}{2}, 3\frac{1}{4}, 6, 8\frac{3}{4}$ ..... is :
(1) $10\frac{1}{4}$ (2) $10\frac{3}{4}$
(3) $11\frac{1}{4}$ (4) $11\frac{1}{2}$
(SSC CGL Prelim Exam. 27.02.2000 (First Sitting)

3. Find the missing number of the sequence :
" 3, 14, 25, 36, 47, ?"
(1) 1114 (2) 1111
(3) 1113
(4) None of these
(SSC CGL Prelim Exam. 27.02.2000 (First Sitting)

4. The next term of the sequence 1, 2, 5, 26, ... is :
(1) 677 (2) 47
(3) 50 (4) 152
(SSC CGLPrelim Exam. 27.02.2000 (Second Sitting)

5. The missing term in the sequence 0, 3, 8, 15, 24, ..,.., 48 is
(1) 35 (2) 30
(3) 36 (4) 39
(SSC CPO S.I. Exam. 07.09.2003)

6. In the sequence of numbers 5, 8, 15, 20, 29, 40, 53, one number is wrong. The wrong number is
(1) 15 (2) 20
(3) 29 (4) 40
(SSC CPO S.I. Exam. 07.09.2003)

7. 1 + 2 + 3 + ... + 49 + 50 + 49 + 48 + ... + 3 + 2 + 1 is equal to
(1) 1250 (2) 2500
(3) 2525 (4) 5000
(SSC CPO S.I. Exam. 07.09.2003)

8. The next number in the sequence 2, 8, 18, 32, 50, ... is :
(1) 68 (2) 72
(3) 76 (4) 80
(SSC CGL Prelim Exam. 08.02.2004 (First Sitting)

9. Next term of the sequence 8, 12, 9, 13, 10, 14, ..., is
(1) 11 (2) 15
(3) 16 (4) 17
(SSC CHSL DEO & LDC Exam. 28.11.2010 (IInd Sitting)

10. The number of terms in the series 1 + 3 + 5 + 7 ...+ 73 + 75 is
(1) 28 (2) 30
(3) 36 (4) 38
(SSC CPO S.I. Exam. 05.09.2004)

11. In the sequence of number 0, 7, 26, 63, ..., 215, 342 the missing term is
(1) 115 (2) 124
(3) 125 (4) 135
(SSC CPO S.I. Exam. 05.09.2004)

12. What will come in the place of question-mark (?) in the series "2, 7, 14, 23, ?, 47" ?
(1) 28 (2) 34
(3) 31 (4) 38
(SSC Section Officer (Commercial Audit) Exam. 25.09.2005)

13. The missing number of the sequence 0, 2, 8, 18, —, 50 is :
(1) 28 (2) 30
(3) 32 (4) 36
(SSC CGL Prelim Exam. 13.11.2005 (First Sitting)

14. The next number of the sequence 2, 5, 10, 14, 18, 23, 26, 32, ... is :
(1) 33 (2) 34
(3) 36 (4) 37
(SSC CGL Prelim Exam. 13.11.2005 (First Sitting)

15. The next term in the sequence – 1, 6, 25, 62, 123, 214, ... is
(1) 343 (2) 342
(3) 341
(4) None of these
(SSC CGL Prelim Exam. 13.11.2005 (Second Sitting)

16. The wrong term in the sequence 7, 28, 63, 124, 215, 342, 511 is
(1) 7 (2) 28
(3) 124 (4) 215
(SSC CPO S.I. Exam. 03.09.2006)

17. The sixth term of the sequence 11, 13, 17, 19, 23, –, 29 is
(1) 24 (2) 19
(3) 25 (4) 22
(SSC CPO S.I. Exam. 03.09.2006)

18. Given below is a finite sequence of numbers with an unknown x: 0, 1, 1, 2, 3, 5, 8, 13, x, 34, The value of x is
(1) 21 (2) 20
(3) 19 (4) 17
(SSC CGL Prelim Exam. 04.02.2007 (First Sitting)

19. The next number of the sequence 2, 6, 12, 20, 30, 42, 56, ___ is
(1) 60 (2) 64
(3) 70 (4) 72
(SSC CGL Prelim Exam. 04.02.2007 & 27.07.2008 (First Sitting)

20. The value of in the sequence 27, 9, 3, , $\frac{1}{3}, \frac{1}{9}, \frac{1}{27}$ is
(1) 0 (2) 1
(3) – 1 (4) –3
(SSC CGL Prelim Exam. 04.02.2007 (First Sitting)

21. The value of x in the sequence 1, 2, 6, 24, x is
(1) 46 (2) 56
(3) 96 (4) 120
(SSC CGL Prelim Exam. 04.02.2007 (Second Sitting)

22. The missing term of the sequence 9, 12, 11, 14, 13, __, 15 is
(1) 12 (2) 16
(3) 10 (4) 17
(SSC CGL Prelim Exam. 04.02.2007 (Second Sitting)

23. Which number in the sequence 8, 27, 64,100, 125, 216, 343 is wrongly written?
(1) 27 (2) 100
(3) 125 (4) 343
(SSC CPO S.I. Exam.16.12.2007)

24. The numbers of the sequence 56, 72, 90,110, 132, 154, form a pattern. Which of them is a misfit in the pattern?
(1) 72 (2) 110
(3) 132 (4) 154
(SSC CPO S.I. Exam.16.12.2007)

25. The wrong number in the sequence 3, 5, 7, 9, 13, 17, 19 is
(1) 17 (2) 13
(3) 9 (4) 7
(SSC CHSL DEO & LDC Exam. 28.11.2010 (IInd Sitting)

26. The wrong number in the sequence 1, 8, 27, 84, 125, 216, 343 is
(1) 1 (2) 27
(3) 84 (4) 216
(SSC CGL Prelim Exam. 27.07.2008 (First Sitting)

27. The next number of the sequence 5, 10, 13, 26, 29, 58, 61,... is
(1) 122 (2) 120
(3) 93 (4) 64
(SSC CGL Prelim Exam. 27.07.2008 (Second Sitting)

28. Which number in the sequence 41, 43, 47, 53, 61, 71, 73, 81 is wrongly written ?
(1) 61 (2) 71
(3) 73 (4) 81
(SSC CPO S.I. Exam. 09.11.2008)

29. The numbers of the sequence 52, 51, 48, 43, 34, 27, 16 form a pattern. Which of them is misfit in the pattern ?
(1) 27 (2) 34
(3) 43 (4) 485
(SSC CPO S.I. Exam. 09.11.2008)

30. The next term of the sequence 1, 9, 28, 65, 126, ... is
(1) 199 (2) 205
(3) 216 (4) 217
(SSC CISF ASI Exam. 29.08.2010 (Paper-1)

31. The wrong number of the sequence 36, 81, 144, 225, 256, 441 is
(1) 36 (2) 81
(3) 225 (4) 256
(SSC CISF ASI Exam. 29.08.2010 (Paper-1)

32. The next term of the sequence 2, 3, 6, 7, 14, ... is
(1) 15 (2) 17
(3) 18 (4) 20
(SSC (South Zone) Investigator Exam. 12.09.2010)

33. The next number of the sequence 3, 7, 15, 31, 63, ? is
(1) 95 (2) 111
(3) 123 (4) 127
(SSC CPO S.I. Exam. 12.12.2010 (Paper-I)

34. The wrong number of the sequence
4, 9, 25, 49, 121, 144 is
(1) 144 (2) 121
(3) 49 (4) 4
(SSC CPO S.I. Exam. 12.12.2010 (Paper-I)

35. The next number of the sequence 0, 3, 8, 15, 24, 35, ... is :
(1) 46 (2) 47
(3) 48 (4) 50
(SSC CGL Prelim Exam. 27.02.2000 (Second Sitting)

36. The next number of the sequence 2, 3, 5, 8, 13, 21,.... is
(1) 31 (2) 34
(3) 23 (4) 25
(SSC Data Entry Operator Exam. 31.08.2008)

37. The missing number in the sequence
5, 6, 15, _?_, 89, 170, 291 is
(1) 50 (2) 40
(3) 42 (4) 32
(SSC Data Entry Operator Exam. 02.08.2009)

38. Next number of the sequence
2, 9, 28, 65, 126, ____ is :
(1) 195 (2) 199
(3) 208 (4) 217
(SSC CHSL DEO & LDC Exam. 27.11.2010)

39. The wrong (misfit) number of the sequence 5, 15, 45, 135, 395, 1215, 3645 is :
(1) 395 (2) 135
(3) 45 (4) 5
(SSC CHSL DEO & LDC Exam. 27.11.2010)

40. The next number of the sequence 51, 52, 56, 65,_______is :
(1) 75 (2) 78
(3) 79 (4) 81
(SSC CHSL DEO & LDC Exam. 28.11.2010 (Ist Sitting)

41. The wrong number of the sequence 4,9,19,39,79,169,319 is
(1) 169 (2) 79
(3) 39 (4) 9
(SSC CHSL DEO & LDC Exam. 28.11.2010 (Ist Sitting)

42. Find out the wrong number in the sequence
169, 144, 121, 100, 82, 64, 49
(1) 144 (2) 49
(3) 64 (4) 82
(SSC CISF Constable (GD) Exam. 05.06.2011)

43. Insert the missing number
3, 18, 12, 72, 66, 396
(1) 300 (2) 380
(3) 350 (4) 390
(SSC Graduate Level Tier-II Exam.16.09.2012)

44. The wrong number in the series 2, 9, 28, 65, 126, 216, 344 is
(1) 65 (2) 216
(3) 9 (4) None of these
(SSC CHSL DEO & LDC Exam. 21.10.2012 (Ist Sitting)

45. The odd term in the sequence 0, 7, 26, 63, 124, 217 is
(1) 217 (2) 7
(3) 26 (4) 63
(SSC Graduate Level Tier-II Exam. 29.09.2013)

46. What will come in place of the question mark (?) in the series?
3, 8, 27, 112, (?), 3396
(1) 565 (2) 452
(3) 560 (4) 678
(SSC CGL Tier-I Re-Exam. (2013) 27.04.2014)

47. In the following number series a wrong number is given. Find out that number.
8, 18, 40, 86, 178, 370, 752
(1) 178 (2) 180
(3) 128 (4) 156
(SSC CGL Tier-I Re-Exam. (2013) 27.04.2014)

48. The odd one out from the sequence of numbers
19, 23, 29, 37, 43, 46, 47 is
(1) 23 (2) 46
(3) 37 (4) 19
(SSC CHSL DEO Exam. 16.11.2014 (Ist Sitting)

49. The next number of the sequence
$\frac{1}{2}, \frac{3}{4}, \frac{5}{8}, \frac{7}{16}$, ... is
(1) $\frac{10}{24}$ (2) $\frac{11}{32}$
(3) $\frac{9}{24}$ (4) $\frac{9}{32}$
(SSC CHSL DEO Exam. 16.11.2014 (Ist Sitting)

50. The next number of the sequence 3, 5, 9, 17, 33, ... is
(1) 65 (2) 60
(3) 50 (4) 49
(SSC CHSL (10+2) DEO & LDC Exam. 16.11.2014 , Ist Sitting TF No. 333 LO 2)

51. Find out the wrong number in the sequence :
40960, 10240, 2560, 640, 200, 40, 10
(1) 2560 (2) 200
(3) 640 (4) 40
(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 06.12.2015 (Ist Sitting) TF No. 1375232)

52. Find out the wrong number in the series.
190 166 145 128 112 100 91
(1) 100 (2) 166
(3) 145 (4) 128
(SSC CAPFs (CPO) SI & ASI, Delhi Police Exam. 05.06.2016) (Ist Sitting)

53. Find the wrong number in the following number series.
3 7 16 35 70 153
(1) 70 (2) 16
(3) 153 (4) 35
(SSC CGL Tier-I (CBE) Exam. 02.09.2016) (IInd Sitting)

TYPE–II

1. The sum (101 + 102 + 103 + ... + 200) is equal to :
(1) 15000 (2) 15025
(3) 15050 (4) 25000
(SSC CGL Prelim Exam. 27.02.2000 (First Sitting)

2. Which term of the series 72, 63, 54, ... is zero?
(1) 11th (2) 10th
(3) 9th (4) 8th
(SSC CGL Prelim Exam. 27.02.2000 (Second Sitting)

3. The sum 9 + 16 + 25 + 36 + ... + 100 is equal to :
(1) 350 (2) 380
(3) 400 (4) 420
(SSC CGLPrelim Exam. 27.02.2000 (Second Sitting)

4. What is the 507th term of the sequence
1, –1, 2, –2, 1, –1, 2, – 2, 1, ...?
(1) –1 (2) 1
(3) –2 (4) 2
(SSC CGL Prelim Exam. 27.02.2000 (Second Sitting)

5. If the 4th term of an arithmetic progression is 14 and the 12th term is 70, then the first term is :
(1) – 10 (2) – 7
(3) + 7 (4) + 10
(SSC CGL Prelim Exam. 27.02.2000 (Second Sitting)

6. By adding the same constant to each of 31, 7, – 1 a geometric progression results. The common ratio is :
(1) 13 (2) $2\frac{1}{3}$
(3) – 12 (4) None of these
(SSC CGL Prelim Exam. 27.02.2000 (Second Sitting)

7. The sum of the first 8 terms of a geometric progression is 6560 and the common ratio is 3. The first term is
(1) 1 (2) 2
(3) 3 (4) 4
(SSC CPO S.I. Exam. 07.09.2003)

8. How many terms of the series "1 + 2 + 3 ......" add upto 5050?
(1) 50 (2) 51
(3) 100 (4) 101
(SSC CPO S.I. Exam. 05.09.2004)

9. The seventh term of the sequence 1, 3, 6, 10, ... is :
(1) 20 (2) 26
(3) 28 (4) 32
(SSC CPO S.I. Exam. 26.05.2005)

10. If the 10th term of the sequence a, $a - b$, $a - 2b$, $a - 3b$, ... is 20 and the 20th term is 10, then the xth term of the series is
(1) $10 - x$ (2) $20 - x$
(3) $29 - x$ (4) $30 - x$
(SSC CPO S.I. Exam. 03.09.2006)

11. When simplified, the sum
$$\frac{1}{2}+\frac{1}{6}+\frac{1}{12}+\frac{1}{20}+\frac{1}{30}+\ldots+\frac{1}{n(n+1)}$$
is equal to
(1) $\frac{1}{n}$ (2) $\frac{1}{n+1}$
(3) $\frac{2(n-1)}{n}$ (4) $\frac{n}{n+1}$
(SSC Section Officer (Commercial Audit) Exam. 26.11.2006 (Second Sitting)

12. (1 + 3 + 5 + 7 + 9 + ... + 99) is equal to
(1) 2050 (2) 2500
(3) 2005 (4) 2002
(SSC CGL Prelim Exam. 04.02.2007 (Second Sitting)

13. The nth term of the sequence
$$\frac{1}{n}, \frac{n+1}{n}, \frac{2n+1}{n}, \ldots \text{ is}$$
(1) $\frac{n^2+1}{n}$ (2) $\frac{n^2-n+1}{n}$
(3) $n + 1$ (4) 2
(SSC CPO S.I. Exam. 16.12.2007)

14. If $1+10+10^2+\ldots\ldots$ upto n terms $= \frac{10^n - 1}{9}$, then the sum of the series
4 + 44 + 444 + ... upto n term is
(1) $\frac{4}{9}(10^n - 1) - \frac{4n}{9}$
(2) $\frac{4}{81}(10^n - 1) - \frac{4n}{9}$
(3) $\frac{40}{81}(10^n - 1) - \frac{4n}{9}$
(4) $\frac{40}{9}(10^n - 1) - \frac{4n}{9}$
(SSC CPO S.I. Exam. 16.12.2007)

15. Which term of the sequence $\frac{1}{2}, -\frac{1}{4}, \frac{1}{8}, -\frac{1}{16}, \ldots$ is $-\frac{1}{256}$?
(1) 9th (2) 8th
(3) 7th (4) 5th
(SSC CGL Prelim Exam. 27.07.2008 (First Sitting)

16. The first odd number is 1, the second odd number is 3, the third odd number is 5 and so on. The 200th odd number is
(1) 399 (2) 421
(3) 357 (4) 599
(SSC CGL Prelim Exam. 27.07.2008 (First Sitting)

17. Only two entries are known of the following Arithmetic progression :
—, 5, —, —, 14, —, ---
What should be the number just after 14 ?
(1) 17 (2) 18
(3) 19 (4) 20
(SSC CGL Prelim Exam. 27.07.2008 (First Sitting)

18. Which term of the sequence 7, 10, 13, ... is 151 ?
(1) 29th (2) 19th
(3) 59th (4) 49th
(SSC CGL Prelim Exam. 27.07.2008 (Second Sitting)

19. The sum of the first 20 terms of the series
$$\frac{1}{5\times6}+\frac{1}{6\times7}+\frac{1}{7\times8}+\ldots\ldots \text{ is}$$
(1) 0.16 (2) 1.6
(3) 16 (4) 0.016
(SSC CGL Prelim Exam. 27.07.2008 (Second Sitting)

20. Which term of the sequence 6, 13, 20, 27, ... is 98 more than its 24th term ?
(1) 36th (2) 38th
(3) 35th (4) 48th
(SSC CGL Prelim Exam. 27.07.2008 (Second Sitting)

21. The sum of series 1 + 2 + 3 + 4 + ... + 998 + 999 + 1000 is
(1) 5050 (2) 500500
(3) 550000 (4) 55000
(SSC CPO S.I. Exam. 09.11.2008)

22. The sum of n terms the series

$1+\frac{1}{2}+\frac{1}{2^2}+\frac{1}{2^3}$........ is

(1) $\frac{2^n-1}{2^{n-1}}$ (2) $\frac{2^{n-1}-1}{2^{n-2}}$

(3) $2-2^n$ (4) $\frac{2^n-1}{2^n}$

(SSC CPO S.I. Exam. 09.11.2008)

23. The ninth term of the sequence 0, 3, 8, 15, 24, 35, ... is

(1) 63 (2) 70

(3) 80 (4) 99

(SSC CGL Tier-I Exam. 16.05.2010 (First Sitting)

24. The sixth term of the sequence 2, 6, 11, 17, ... is

(1) 24 (2) 30

(3) 32 (4) 36

(SSC CGL Tier-I Exam. 16.05.2010 (Second Sitting)

25. The ratio of the fifth and sixth terms of the sequence 1, 3, 6, 10, ... is

(1) 5 : 6 (2) 5 : 7

(3) 7 : 5 (4) 6 : 5

(SSC CPO S.I. Exam. 12.12.2010 (Paper-I)

26. The middle term(s) of the following series 2 + 4 + 6 + ... + 198 is

(1) 98 (2) 96

(3) 94 (4) 100

(SSC CHSL DEO & LDC Exam. 04.11.2012 (IInd Sitting)

27. If p, q, r are in Geometric Progression, then which is true among the following ?

(1) $q = \frac{p+r}{2}$ (2) $p^2 = qr$

(3) $q = \sqrt{pr}$ (4) $\frac{p}{r} = \frac{r}{q}$

(SSC Graduate Level Tier-I Exam. 11.11.2012 (Ist Sitting)

28. Terms a, 1, b are in Arithmetic Progression and terms 1, a, b are in Geometric Progression. Find 'a' and 'b' given $a \neq b$.

(1) 2,4 (2) –2, 1

(3) 4,1 (4) –2, 4

(SSC FCI Assistant Grade-III Main Exam. 07.04.2013)

29. The fifth term of the sequence for which $t_1 = 1$, $t_2 = 2$ and $t_{n+2} = t_n + t_{n+1}$, is

(1) 5 (2) 10

(3) 6 (4) 8

(SSC Graduate Level Tier-I Exam. 21.04.2013)

30. $1 + (3 + 1)(3^2 + 1)(3^4 + 1)(3^8 + 1)(3^{16} + 1)(3^{32} + 1)$ is equal to

(1) $\frac{3^{64}-1}{2}$ (2) $\frac{3^{64}+1}{2}$

(3) $3^{64} - 1$ (4) $3^{64} + 1$

(SSC Section Officer (Commercial Audit) Exam. 25.09.2005)

31. The sum '5 + 6 + 7 + 8 + ... + 19' is equal to :

(1) 150 (2) 170

(3) 180 (4) 190

(SSC CGL Prelim Exam. 13.11.2005 (First Sitting)

32. Given that $1^2 + 2^2 + 3^2 + ... + 20^2 = 2870$, the value of $(2^2 + 4^2 + 6^2 + ... + 40^2)$ is :

(1) 11480 (2) 5740

(3) 28700 (4) 2870

(SSC CGL Prelim Exam. 13.11.2005 (First Sitting)

33. Given $1^3 + 2^3 + 3^3 + ... + 10^3 = 3025$ then $2^3 + 4^3 + 6^3 + ...+ 20^3$ is equal to

(1) 6050 (2) 9075

(3) 12100 (4) 24200

(SSC CGL Prelim Exam. 13.11.2005 (Second Sitting)

34. (45 + 46 + 47 + ... + 113 + 114 + 115) is equal to

(1) 5600 (2) 5656

(3) 5680 (4) 4000

(SSC CGL Prelim Exam. 04.02.2007 (First Sitting)

35. The 12th term of the series

$\frac{1}{x} + \frac{x+1}{x} + \frac{2x+1}{x} + ...$

(1) $\frac{11x+1}{x}$ (2) $\frac{12x+1}{x}$

(3) $\frac{x+12}{x}$ (4) $\frac{x+11}{x}$

(SSC CHSL DEO & LDC Exam. 02.11.2014 (IInd Sitting)

36. The first term of an Arithmetic Progression is 22 and the last term is – 11. If the sum is 66, the number of terms in the sequence is

(1) 10 (2) 12

(3) 9 (4) 8

(SSC CHSL DEO & LDC Exam. 9.11.2014)

37. The 30th term of the series 30, $25\frac{1}{2}$, 21, $16\frac{1}{2}$,...... is

(1) 0 (2) $-100\frac{1}{2}$

(3) –183 (4) $-133\frac{1}{2}$

(SSC CHSL DEO & LDC Exam. 16.11.2014)

38. Find the nth term of the following sequence :

5 + 55 + 555 + ... T_n

(1) $5(10^n - 1)$ (2) $5^n(10^n - 1)$

(3) $\frac{5}{9}(10^n - 1)$ (4) $\left(\frac{5}{9}\right)^n(10^n-1)$

(SSC CHSL DEO & LDC Exam. 16.11.2014)

39. Find the sum of first five terms of the following series :

$\frac{1}{1\times4} + \frac{1}{4\times7} + \frac{1}{7\times10} +$ ....+ ....

(1) $\frac{9}{32}$ (2) $\frac{7}{16}$

(3) $\frac{5}{16}$ (4) $\frac{1}{210}$

(SSC CHSL DEO Exam. 02.11.2014 (Ist Sitting)

40. The least value of n, such that $(1 + 3 + 3^2 + ... + 3^n)$ exceeds 2000, is

(1) 5 (2) 6

(3) 7 (4) 8

(SSC CHSL DEO Exam. 16.11.2014 (Ist Sitting)

41. The next term of the sequence,

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

$\left(1+\frac{1}{2}\right)\left(1+\frac{1}{3}\right)\left(1+\frac{1}{4}\right);$ ___ is

(1) 3 (2) $\left(1+\frac{1}{5}\right)$

(3) 5 (4) $\left(1+\frac{1}{2}\right)\left(1+\frac{1}{5}\right)$

(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam. 22.06.2014 TF No. 999 KP0)

42. The sum of 10 terms of the arithmetic series is 390. If the third term of the series is 19, find the first term

(1) 3 (2) 5

(3) 7 (4) 8

(SSC CGL Tier-I (CBE) Exam.11.09.2016) (Ist Sitting)

43. Given $2^2 + 4^2 + 6^2 + ...+40^2 = 11480$, then the value of $1^2 + 2^2 + 3^2 + ...+20^2$ is :

(1) 2870 (2) 2868

(3) 2867 (4) 2869

(SSC CAPFs (CPO) SI & ASI, Delhi Police Exam. 20.03.2016) (IInd Sitting)

44. If $1^2 + 2^2 + 3^2 + ... + p^2 = \frac{p(p+1)(2p+1)}{6}$, then $1^2 + 3^2 + 5^2 + ... + 17^2$ is equal to :
(1) 1785 (2) 1700
(3) 980 (4) 969
(SSC CAPFs (CPO) SI & ASI, Delhi Police Exam. 20.03.2016) (IInd Sitting)

45. If 7 times the seventh term of an Arithmetic Progression (AP) is equal to 11 times its eleventh term, then the 18th term of the AP will be
(1) 1 (2) 0
(3) 2 (4) –1
(SSC CGL Tier-I (CBE) Exam. 04.09.2016) (Ist Sitting)

TYPE–III

1. If 1 × 2 × 3 × ...... × n is denoted by $\lfloor n$,then $(\lfloor 8 - \lfloor 7 - \lfloor 6)$ is equal to :
(1) $6 \times 8 \times \lfloor 6$ (2) $7 \times 8 \times \lfloor 6$
(3) $6 \times 7 \times \lfloor 8$ (4) $7 \times 8 \times \lfloor 7$
(SSC CGL Prelim Exam. 27.02.2000 (First Sitting)

2. Find the sum of the first five terms of the following series.
$$\frac{1}{1\times 4}+\frac{1}{4\times 7}+\frac{1}{7\times 10}+.....+.....$$
(1) $\frac{9}{32}$ (2) $\frac{7}{16}$
(3) $\frac{5}{16}$ (4) $\frac{1}{210}$
(SSC CGL Prelim Exam. 24.02.2002 (Middle Zone)

3. If $(10^{12} + 25)^2 - (10^{12} - 25)^2 = 10^n$, then the value of n is
(1) 20 (2) 14
(3) 10 (4) 5
(SSC CPO S.I. Exam. 07.09.2003)

4. Given 1 + 2 + 3 + 4 + ... + 10 = 55, then the sum 6 + 12 + 18 + 24 + ... + 60 is equal to :
(1) 300 (2) 655
(3) 330 (4) 455
(SSC CGL Prelim Exam. 08.02.2004 (First Sitting)

5. When simplified the product
$$\left(1-\frac{1}{2}\right)\left(1-\frac{1}{3}\right)\left(1-\frac{1}{4}\right)....\left(1-\frac{1}{n}\right)$$
gives :
(1) $\frac{1}{n}$ (2) $\frac{2}{n}$
(3) $\frac{2(n-1)}{n}$ (4) $\frac{2}{n(n+1)}$
(SSC CGL Prelim Exam. 08.02.2004 (Ist Sitting) & (SSC CGL Prelim Exam. 27.07.2008)

6. The value of
$$\frac{3}{1^2.2^2}+\frac{5}{2^2.3^2}+\frac{7}{3^2.4^2}+\frac{9}{4^2.5^2}+\frac{11}{5^2.6^2}+\frac{13}{6^2.7^2}+\frac{15}{7^2.8^2}+\frac{17}{8^2.9^2}+\frac{19}{9^2.10^2}$$
is
(1) $\frac{1}{100}$ (2) $\frac{99}{100}$
(3) $\frac{101}{100}$ (4) 1
(SSC CGL Prelim Exam. 08.02.2004 (Second Sitting)

7. The value of
$$1-\frac{1}{20}+\frac{1}{20^2}-\frac{1}{20^3}+.......$$
correct to 5 places of decimal is :
(1) 1.05 (2) 0.95238
(3) 0.95239 (4) 10.5
(SSC CGL Prelim Exam. 08.02.2004 (Second Sitting)

8. For all integral values of n, *the* largest number that exactly divides each number of the sequence
$(n-1)\ n(n+1)$, $n(n+1)(n+2)$, $(n+1)(n+2)(n+3)$,.... is
(1) 12 (2) 6
(3) 3 (4) 2
(SSC CPO S.I. Exam. 03.09.2006)

9. Given that
$$1+2+3+....+x=\frac{x(x+1)}{2}$$ then
1 + 3 + 5 + ...+ 99 is equal to
(1) 2250 (2) 2500
(3) 2525 (4) 3775
(SSC CGL Prelim Exam. 27.07.2008 (Second Sitting)

10. $\left(1-\frac{1}{5}\right)\left(1-\frac{1}{6}\right)\left(1-\frac{1}{7}\right).....\left(1-\frac{1}{100}\right)$ is equal to
(1) 0 (2) $\frac{1}{25}$
(3) $\frac{1}{100}$ (4) $\frac{1}{50}$
(SSC CPO S.I. Exam. 09.11.2008)

11. The sum of the series (1 + 0.6 + 0.06 + 0.006 + 0.0006 + ...) is
(1) $1\frac{2}{3}$ (2) $1\frac{1}{3}$
(3) $2\frac{1}{3}$ (4) $2\frac{2}{3}$
(SSC CGL Tier-I Exam. 16.05.2010 (First Sitting)

12. $\left(1-\frac{1}{3}\right)\left(1-\frac{1}{4}\right)\left(1-\frac{1}{5}\right)......\left(1-\frac{1}{25}\right)$ is equal to
(1) $\frac{2}{25}$ (2) $\frac{1}{25}$
(3) $1\frac{19}{25}$ (4) $\frac{1}{325}$
(SSC CGL Tier-I Exam. 16.05.2010 (Second Sitting)

TYPE–IV

1. The sum $(5^3 + 6^3 + ... 10^3)$ is equal to :
(1) 2295 (2) 2425
(3) 2495 (4) 2925
(SSC CGL Prelim Exam. 27.02.2000 (Second Sitting)

2. If $1^3 + 2^3 + 3^3 + ... + 10^3 = 3025$, then find the value of $2^3 + 4^3 + 6^3 + ... + 20^3$
(1) 6050 (2) 9075
(3) 12100 (4) 24200
(SSC CGL Prelim Exam. 24.02.2002 (First Sitting)

3. If $1^3 + 2^3 + ... + 10^3 = 3025$, then 4 + 32 + 108 + ... + 4000 is equal to :
(1) 12000 (2) 12100
(3) 12200 (4) 12400
(SSC CGL Prelim Exam. 24.02.2002 (Second Sitting)

4. If $1^3 + 2^3 + 3^3 + 4^3 + 5^3 + 6^3 = 441$ then find the value of $2^3 + 4^3 + 6^3 + 8^3 + 10^3 + 12^3$
(1) 882 (2) 1323
(3) 1764 (4) 3528
(SSC CGL Prelim Exam. 24.02.2002 (Middle Zone)

5. If $1^2 + 2^2 + 3^2 ...... + x^2 = \frac{x(x+1)(2x+1)}{6}$ then $1^2 + 3^2 + 5^2 + ... 19^2$ is equal to
(1) 1330 (2) 2100
(3) 2485 (4) 2500
(SSC CGL Prelim Exam. 11.05.2003 (First Sitting)

6. If $1^3 + 2^3 + ... + 9^3 = 2025$, then the value of $(0.11)^3 + (0.22)^3 + ... + (0.99)^3$ is close to
(1) 0.2695 (2) 2.695
(3) 3.695 (4) 0.3695
(SSC CGL Prelim Exam. 11.05.2003 (Second Sitting)

7. The value of $5^2 + 6^2 + ... + 10^2 + 20^2$ is
(1) 755 (2) 760
(3) 765 (4) 770
(SSC CPO S.I. Exam. 07.09.2003)

8. $1^2 - 2^2 + 3^2 - 4^2 + ... - 10^2$ is equal to
(1) 45 (2) –45
(3) –54 (4) –55
(SSC Section Officer (Commercial Audit) Exam. 26.11.2006 (IInd Sitting) & (SSC Investigator Exam. 12.09.2010 (South Zone)

9. Given that $1^2 + 2^2 + 3^2 + ... + n^2 = \frac{n}{6}(n + 1)(2n + 1)$, then $10^2 + 11^2 + 12^2 + ... + 20^2$ is equal to
(1) 2616 (2) 2585
(3) 3747 (4) 2555
(SSC CGL Prelim Exam. 27.07.2008 (First Sitting)

10. $(1^2 + 2^2 + 3^2 + ... + 10^2)$ is equal to
(1) 380 (2) 385
(3) 390 (4) 392
(SSC CGL Tier-I Exam. 16.05.2010 (Second Sitting)

11. $(5^2 + 6^2 + 7^2 + ... + 10^2)$ is equal to
(1) 330 (2) 345
(3) 355 (4) 360
(SSC CISF ASI Exam. 29.08.2010 (Paper-1)

12. $[2^2 + 3^2 + 4^2 + 5^2 + 6^2 + 7^2 + 8^2 + 9^2 + 10^2]$ is equal to
(1) 385 (2) 2916
(3) 540 (4) 384
(SSC Data Entry Operator Exam. 31.08.2008)

13. $[1^3 + 2^3 + 3^3 + ... + 9^3 + 10^3]$ is equal to
(1) 3575 (2) 2525
(3) 5075 (4) 3025
(SSC Data Entry Operator Exam. 02.08.2009)

14. Given that $1^2 + 2^2 + 3^2 + ... + 10^2 = 385$, the value of $2^2 + 4^2 + 6^2 + ... + 20^2$ =
(1) 770 (2) 1540
(3) 1155 (4) $(385)^2$
(SSC CGL Tier-I Re-Exam. (2013) 20.07.2014 (Ist Sitting)

SHORT ANSWERS

TYPE-I

1. (1)	**2.** (4)	**3.** (4)	**4.** (1)
5. (1)	**6.** (1)	**7.** (2)	**8.** (2)
9. (1)	**10.** (4)	**11.** (2)	**12.** (2)
13. (3)	**14.** (2)	**15.** (3)	**16.** (2)
17. (3)	**18.** (1)	**19.** (4)	**20.** (2)
21. (4)	**22.** (2)	**23.** (2)	**24.** (4)
25. (3)	**26.** (3)	**27.** (1)	**28.** (4)
29. (2)	**30.** (4)	**31.** (4)	**32.** (1)
33. (4)	**34.** (1)	**35.** (3)	**36.** (2)
37. (2)	**38.** (4)	**39.** (1)	**40.** (4)
41. (1)	**42.** (4)	**43.** (4)	**44.** (2)
45. (1)	**46.** (1)	**47.** (1)	**48.** (2)
49. (4)	**50.** (1)	**51.** (2)	**52.** (4)
53. (1)			

TYPE-II

1. (3)	**2.** (3)	**3.** (2)	**4.** (4)
5. (2)	**6.** (4)	**7.** (2)	**8.** (3)
9. (3)	**10.** (4)	**11.** (4)	**12.** (2)
13. (2)	**14.** (3)	**15.** (2)	**16.** (1)
17. (1)	**18.** (4)	**19.** (1)	**20.** (2)
21. (2)	**22.** (1)	**23.** (3)	**24.** (3)
25. (2)	**26.** (4)	**27.** (3)	**28.** (4)
29. (4)	**30.** (2)	**31.** (3)	**32.** (1)
33. (4)	**34.** (3)	**35.** (1)	**36.** (2)
37. (2)	**38.** (3)	**39.** (3)	**40.** (3)
41. (1)	**42.** (1)	**43.** (1)	**44.** (4)
45. (2)			

TYPE-III

1. (1)	**2.** (3)	**3.** (2)	**4.** (3)
5. (1)	**6.** (2)	**7.** (2)	**8.** (2)
9. (4)	**10.** (2)	**11.** (1)	**12.** (1)

TYPE-IV

1. (4)	**2.** (4)	**3.** (2)	**4.** (4)
5. (1)	**6.** (2)	**7.** (1)	**8.** (4)
9. (2)	**10.** (2)	**11.** (3)	**12.** (4)
13. (4)	**14.** (2)		

EXPLANATIONS

TYPE-I

1. (1) Using Rule 1,
3, 5, 9, 17, 33, ...
+2 $+4=2^2$ $+8=2^3$ $+16=2^4$
∴ The next term in the sequence will be 65

2. (4) $\frac{1}{2}, 3\frac{1}{4}, 6, 8\frac{3}{4}$,.......
= 0.5, 3.25, 6, 8.75, ...
+2.75 +2.75 +2.75
∴ Next term of the sequence
$= 8.75 + 2.75 = 11.5 = 11\frac{1}{2}$

3. (4) 3, 14, 25, 36, 47, 58
+11 +11 +11 +11 +11
∴ Missing number in the sequence = 58

4. (1) The series is based on following pattern :
$(1)^2 + 1 = 2$
$(2)^2 + 1 = 5$
$(5)^2 + 1 = 26$
$(26)^2 + 1 = \boxed{677}$
Therefore, the next number of the series will be 677.

5. (1)
0 3 8 15 24 [35] 48
+3 +5 +7 +9 +11 +13
Missing no. = 35

6. (1)
[13]
5 8 15 20 29 40 53
+3 +5 +7 +9 +11 +13
Incorrect no. = 15

7. (2) Required sum
$= 2\left(\frac{x(x+1)}{2}\right) + 50$
$= \frac{2 \times 49 \times 50}{2} + 50 = 2500$

8. (2) The given sequence is based on the following pattern :
2 8 18 32 50 [72]
+6 +10 +14 +18 +22
Hence, 72 will be the next number.

9. (1) The pattern of the sequence is :
8 + 4 = 12

$12 - 3 = 9$
$9 + 4 = 13$
$13 - 3 = 10$
$10 + 4 = 14$
$14 - 3 = \boxed{11}$

10. (4) Let the number of terms be n. It is an Arithmetic Series whose first term, $a = 1$ and common difference $d = 2$.
$\therefore$ n^{th} term = a + $(n\text{-}1)d$
$\Rightarrow 75 = 1 + (n\text{-}1)2$
$\Rightarrow 2(n\text{-}1) = 74$
$\Rightarrow n\text{-}1 = \frac{74}{2} = 37$
$\Rightarrow n = 37 + 1 = 38$

11. (2) The given series is based on the following pattern :
$1^3 - 1 = 0$ $\quad 2^3 - 1 = 7$
$3^3 - 1 = 26$ $\quad 4^3 - 1 = 63$
$5^3 - 1 = \boxed{124}$ $\quad 6^3 - 1 = 215$
$7^3 - 1 = 352$
Hence, the missing term is 124.

12. (2)
2, 7, 14, 23, $\boxed{34}$, 47
+5, +7, +9, +11, +13
$\therefore$? = 34

13. (3) The sequence is based on the following pattern :
$2 \times 0^2 = 0$
$2 \times 1^2 = 2$
$2 \times 2^2 = 8$
$2 \times 3^2 = 18$
$2 \times 4^2 = \boxed{32}$

14. (2) The twin sequence is based on the following pattern :
2, 10, 18, 26, $\boxed{34}$
+8, +8, +8, +8
5, 14, 23, 32
+9, +9, +9
Hence, the required number is 34.

15. (3) The sequence is based on the following pattern :
$1^3 - 2 = 1 - 2 = -1$
$2^3 - 2 = 8 - 2 = 6$
$3^3 - 2 = 27 - 2 = 25$
$4^3 - 2 = 64 - 2 = 62$
$5^3 - 2 = 125 - 2 = 123$
$6^3 - 2 = 216 - 2 = 214$
$7^3 - 2 = 343 - 2 = \boxed{341}$

16. (2) The given sequence is based on the following Pattern:
$2^3 - 1 = 7$
$3^3 - 1 = 26$ not $\boxed{28}$
$4^3 - 1 = 63$
$5^3 - 1 = 124$
$6^3 - 1 = 215$ and so on.
$\therefore$ The wrong term = 28

17. (3) The sequence is based on the following rule:
11, 13, 17, 19, 23, $\boxed{25}$, 29
+2, +4, +2, +4, +2, +4
Hence, the sixth term is 25

18. (1) In the given sequence, (starting from the third number) the succeeding number is sum of two just preceding numbers. i.e.,
$1 = 0 + 1$
$2 = 1 + 1$
$3 = 1 + 2$
$\therefore$ $x = 8 + 13 = \boxed{21}$

19. (4) The given sequence is based on the following pattern :
2, 6, 12, 20, 30, 42, 56, $\boxed{72}$
+4, +6, +8, +10, +12, +14, +16
$\therefore$Required number = 72

20. (2) The given sequence is based on the following pattern :
27, 9, 3, $\boxed{1}$, $\frac{1}{3}$, $\frac{1}{9}$, $\frac{1}{27}$
÷3, ÷3, ÷3, ÷3, ÷3, ÷3
$\therefore$ The value of is 1.

21. (4) The given sequence is based on the following pattern:
1, 2, 6, 24, $\boxed{120}$
×2, ×3, ×4, ×5
Hence, 120 will replace x.

22. (2) The given sequence is based on the following pattern:
9, 12, 11, 14, 13, $\boxed{16}$, 15
+3, –1, +3, –1, +3, –1

23. (2) In the given sequence all the numbers except 100 are perfect cubes of natural numbers. As, $8 = 2^3$, $27 = 3^3$, $64 = 4^3$ etc.

24. (4) The given sequence is based on the following pattern :
$7 \times 8 = 56$
$8 \times 9 = 72$
$9 \times 10 = 90$
$10 \times 11 = 110$
$11 \times 12 = 132$
$12 \times 13 \neq 154$, but 156
$\therefore$ 154 is the wrong number.

25. (3) The numbers of the sequence are the consecutive prime numbers starting from 3.
Since, 9 is not a prime number, it should be replaced by 11.

26. (3) The given sequence is :
$1^3, 2^3, 3^3, 4^3, 5^3, 6^3, 7^3$
Clearly, 84 is the wrong number.

27. (1) The given sequence is based on the following pattern :
5, 10, 13, 26, 29, 58, 61, $\boxed{122}$
×2, ×2, ×2, ×2

28. (4) All the numbers except 81 are prime numbers.

29. (2) The given sequence is based on the following pattern :
$52 - 1 = 51$
$51 - 3 = 48$
$48 - 5 = 43$
$43 - 7 = 36 \neq \boxed{34}$
$36 - 9 = 27$
$27 - 11 = 16$
Hence, 34 is the wrong number.

30. (4) The pattern of the sequence is :
$1 + 2^3 = 9$
$1 + 3^3 = 28$
$1 + 4^3 = 65$
$1 + 5^3 = 126$
$1 + 6^3 = \boxed{217}$

31. (4) The pattern of the sequence is :
$6^2 = 36$
$9^2 = 81$
$12^2 = 144$
$15^2 = 225$
$18^2 = 324 \neq \boxed{256}$
$21^2 = 441$

32. (1) The pattern of the sequence is :
2, 3, 6, 7, 14, $\boxed{15}$
+ 1, × 2, + 1, × 2, + 1
Required no. = 15

33. (4) The pattern of the sequence is:
$3 + 4 = 7$
$7 + 8 = 15$
$15 + 16 = 31$
$31 + 32 = 63$
$63 + 64 = \boxed{127}$

34. (1) The pattern of the sequence is:
$2^2, 3^2, 5^2, 7^2, 11^2, 13^2$ or, squares of first 6 consecutive prime numbers. Hence, 144 should be replaced by 169.

35. (3) The series is based on following pattern :
$0 + 3 = 3$
$3 + 5 = 8$
$8 + 7 = 15$
$15 + 9 = 24$
$24 + 11 = 35$

$35 + 13 = \boxed{48}$

Therefore, the required answer is 48.

36. (2) The pattern is :
$2 + 3 = 5$; $5 + 3 = 8$
$8 + 5 = 13$; $13 + 8 = 21$
$21 + 13 = \boxed{34}$

37. (2) The pattern of the given number series is :
$5 + 1^2 = 6$
$6 + 3^2 = 15$
$15 + 5^2 = \boxed{40}$
$40 + 7^2 = 89$
$89 + 9^2 = 170$

38. (4) The pattern of the sequence is :
$1^3 + 1 = 2$
$2^3 + 1 = 9$
$3^3 + 1 = 28$
$4^3 + 1 = 65$
$5^3 + 1 = 126$
$6^3 + 1 = 216 + 1 = \boxed{217}$

39. (1) The pattern of the sequence is :
$5 \times 3 = 15$
$15 \times 3 = 45$
$45 \times 3 = 135$
$135 \times 3 = 405 \neq \boxed{395}$
$405 \times 3 = 1215$

40. (4) The pattern of the sequence is :
$51 + 1^2 = 52$
$52 + 2^2 = 56$
$56 + 3^2 = 65$
$65 + 4^2 = 65 + 16 = \boxed{81}$

41. (1) The pattern of the sequence is :
$4 \times 2 + 1 = 9$
$9 \times 2 + 1 = 19$
$19 \times 2 + 1 = 39$
$39 \times 2 + 1 = 79$
$79 \times 2 + 1 = 159 \neq \boxed{169}$

42. (4) The pattern of the sequence is :
$169 = 13^2$
$144 = 12^2$
$121 = 11^2$
$100 = 10^2$
$81 = 9^2 \neq \boxed{82}$

43. (4) The pattern is :
$3 \times 6 = 18$
$18 - 6 = 12$
$12 \times 6 = 72$
$72 - 6 = 66$
$66 \times 6 = 396$
$396 - 6 = \boxed{390}$

44. (2) The pattern is :
$1^3 + 1 = 1 + 1 = 2$
$2^3 + 1 = 8 + 1 = 9$
$3^3 + 1 = 27 + 1 = 28$
$4^3 + 1 = 64 + 1 = 65$
$5^3 + 1 = 125 + 1 = 126$
$6^3 + 1 = 216 + 1 = 217 \neq \boxed{216}$

45. (1) The pattern is :
$1^3 - 1 = 1 - 1 = 0$
$2^3 - 1 = 8 - 1 = 7$
$3^3 - 1 = 27 - 1 = 26$
$4^3 - 1 = 64 - 1 = 63$
$5^3 - 1 = 125 - 1 = 124$
$6^3 - 1 = 216 - 1 = 215 \neq \boxed{217}$

46. (1) The pattern is :
$3 \times 2 + 2 = 6 + 2 = 8$
$8 \times 3 + 3 = 24 + 3 = 27$
$27 \times 4 + 4 = 108 + 4 = 112$
$112 \times 5 + 5 = 560 + 5 = \boxed{565}$

47. (1) The pattern is :
$8 \times 2 + 2 = 16 + 2 = 18$
$18 \times 2 + 4 = 36 + 4 = 40$
$40 \times 2 + 6 = 80 + 6 = 86$
$86 \times 2 + 8 = 172 + 8$
$= 180 \neq \boxed{178}$
$180 \times 2 + 10 = 360 + 10 = 370$

48. (2) Except 46, all others are prime numbers.
$46 = 2 \times 23$

49. (4) Sequence of numerators
$\Rightarrow$ 1, 3, 5, 7, 9
Sequence of denominators
$\Rightarrow$ 2, 4, 8, 16, 32
$\therefore$ Next fraction = $\frac{9}{32}$

50. (1) The pattern is :
$3 + 2 = 5$
$5 + 2 \times 2 = 5 + 4 = 9$
$9 + 2 \times 4 = 9 + 8 = 17$
$17 + 2 \times 8 = 17 + 16 = 33$
$33 + 2 \times 16 = 33 + 32 = \boxed{65}$

51. (2) The pattern is :
$40960 \div 4 = 10240$
$10240 \div 4 = 2560$
$2560 \div 4 = 640$
$640 \div 4 = 160 \neq \boxed{200}$
$160 \div 4 = 40$
$40 \div 4 = 10$

52. (4) The pattern is :
$190 - 24 = 166$
$166 - 21 = 145$
$145 - 18 = 127 \neq \boxed{128}$
$127 - 15 = 112$
$112 - 12 = 100$
$100 - 9 = 91$

53. (1) The pattern is :
$3 \times 2 + 1 = 6 + 1 = 7$
$7 \times 2 + 2 = 14 + 2 = 16$
$16 \times 2 + 3 = 32 + 3 = 35$
$35 \times 2 + 4 = 70 + 4 = 74$
$\neq \boxed{70}$
$74 \times 2 + 5 = 148 + 5 = 153$

TYPE-II

1. (3) $101 + 102 + 103 + \ldots + 200$
$S = (100 + 1) + (100 + 2) + (100 + 3) + \ldots + (100 + 100)$
Thus, it consists of 100 terms.
$= (100 + 100 + 100 + \ldots 100 \text{ times}) + (1 + 2 + 3 + \ldots + 100)$
$= (100 \times 100) + (1 + 2 + 3 + \ldots + 100)$
$= (10000) + (1 + 2 + 3 + \ldots + 100)$
$= 10000 + \frac{100 \times (100+1)}{2}$
$= 10000 + 5050 = 15050$
Aliter : Using Rule 1 & 2,
Here, $a = 101$, $d = 102 - 101 = 1$
$l = 200$
$a_n = a + (n-1)d$
$200 = 101 + (n-1)1$
$n - 1 = 99$
$\boxed{n = 100}$
$S_n = \frac{n}{2}[a + l]$
$= \frac{100}{2}[101 + 200]$
$= 50 \times 301 = 15050$

2. (3) Using Rule 1,
Here, $a = 72$,
$d = 63 - 72 = -9$
$a_n = 0$
$\therefore a_n = a + (n-1)d$
$\Rightarrow 0 = 72 + (n-1) \times -9$
$\Rightarrow 72 = 9(7-1) \Rightarrow n - 1 = 8$
$\Rightarrow n = 9$

3. (2) ? = 9 + 16 + 25 + 36 + 49 + 64 + 81 + 100 = 380
Aliter : Using Rule 4 (ii),
$S_n = 9 + 16 + 25 + \ldots + 100$
$= 3^2 + 4^2 + 5^2 + \ldots + 10^2$
$= (1^2 + 2^2 + 3^2 + 4^2 + \ldots + 10^2) - 1^2 - 2^2$
$= \frac{n(n+1)(2n+1)}{6} - 5$
$= \frac{10(10+1)(2 \times 10+1)}{6} - 5$

$= \frac{10\times11\times21}{6} - 5$

$= 55 \times 7 - 5$

$= 385 - 5 = 380$

4. (4) Clearly, repetition takes place for each set of four terms.
Hence, 507th term will be 2
507, when divided by 4, gives 3 as remainder and 3rd term is 2.

5. (2) Using Rule 1,
$a_4 = a_1 + (4 - 1) \times d$
$14 = a_1 + 3d \Rightarrow a_1$
$= 14 - 3d$ ....(i)
$70 = a_1 + 11d$ ....(ii)
After putting the value of a_1 in equation (i)
$14 - 3d + 11d = 70$
$8d = 70 - 14$
$\therefore d = 7$
$\therefore a_1 = 14 - 21 = -7$

6. (4) A sequence is said to be in G.P if the ratio of a term to its precedding term is constant.
In 31, 7, –1, if we add 5, the sequence formed is 36, 12, 4 which is in G.P.

$\therefore$ Common ratio $= \frac{12}{36} = \frac{4}{12}$

$= \frac{1}{3}$

7. (2) Using Rule 6,
Sum of x terms of a GP

$= \frac{a\left(r^n - 1\right)}{r - 1}$ (when $r > 1$)

$\therefore 6560 = \frac{a\left(3^8 - 1\right)}{3 - 1}$

$\Rightarrow 6560 = \frac{a(6561 - 1)}{2}$

$\Rightarrow a = \frac{6560 \times 2}{6560} \Rightarrow a = 2$

8. (3) Using Rule 4 (i),
Let the number of terms be n.
$\therefore 1 + 2 + 3 + \ldots.. + n = 5050$

$\Rightarrow \frac{n\,(n+1)}{2} = 5050$

$\Rightarrow n\,(n + 1) = 10100$ [or use splitting middle term method]
$= 100 \times 101$
$\Rightarrow n\,(n + 1) = 100\,(100 + 1)$
$\Rightarrow n = 100$

9. (3) The given series is based on the following pattern :

1   3   6   10   15   21   [28]
+2   +3   +4   +5   +6   +7

Hence, the seventh term of the series will be 28.

10. (4) Using Rule 1,
$a, a - b, a - 2b$ ..... is an AP with first term = a and common difference = $-b$
Now, $t_{10} = a + (10-1) \times (-b)$
$\Rightarrow 20 = a - 9b$ .... (i)
$t_{20} = a + (20 - 1)(-b)$
$\Rightarrow 10 = a - 19b$ ... (ii)
From equation (i) – (ii),
$20 - 10 = a - 9b - a + 19b$
$\Rightarrow 10b = 10 \Rightarrow b = 1$
From equation (i),
$20 = a - 9 \Rightarrow a = 29$
$\therefore t_x = 29 + (x - 1) \times -1$
$= 29 - x + 1 = 30 - x$

11. (4) Expression

$= \frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20} + \ldots.. + \frac{1}{n\,(n+1)}$

$= \frac{1}{1\times2} + \frac{1}{2\times3} + \frac{1}{3\times4} + \frac{1}{4\times5} + \ldots. + \frac{1}{n\,(n+1)}$

$= 1 - \frac{1}{2} + \frac{1}{2} - \frac{1}{3} + \frac{1}{3} - \frac{1}{4} + \frac{1}{4} - \frac{1}{5} \ldots.. + \frac{1}{n} - \frac{1}{n+1}$

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

12. (2) Using Rule 4,
$1 + 3 + 5 + \ldots\ldots. + 99$
$= (1 + 2 + 3 + 4 + \ldots\ldots. + 100) - (2 + 4 + 6 \ldots.. + 100)$
$= (1 + 2 + 3 + 4 + \ldots\ldots. + 100) - 2(1 + 2 + 3 \ldots.. + 50)$

$= \frac{100\,(100+1)}{2} - \frac{2\times50(50+1)}{2}$

$\left[\because 1+2+3+\ldots..+n = \frac{n(n+1)}{2}\right]$

$= 50 \times 101 - 50 \times 51$
$= 50\,(101 - 51) = 50 \times 50$
$= 2500$

13. (2) Using Rule 1,

First term, $a = \frac{1}{n}$

Common difference,

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

$\therefore$ nth term $= a + (n - 1)\,d$

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

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

14. (3) Using Rule 6,
Tricky Approach
Expression
$= 4 + 44 + 444 + \ldots..$ to n terms
$= 4\,(1 + 11 + 111 + \ldots..$to n terms)

$= \frac{4}{9}(9 + 99 + 999 + \ldots$to n terms)

$= \frac{4}{9}$ [(10 – 1) + (100 –1) + (1000 – 1) + ... to n terms]

$= \frac{4}{9}$ [(10 + 10^2 + 10^3 + ... to n terms) – n] [$\because$ 1 has been added n times]

$= \frac{4}{9}$ [10 (1 + 10 + 10^2 + ... to n terms) – n]

$= \frac{40}{9} . \frac{\left(10^n - 1\right)}{9} - \frac{4}{9}n$

[$\because$ 1 + 10 + 10^2 + ... to n terms $= \frac{10^n - 1}{9}$]

$= \frac{40}{81}\left(10^n - 1\right) - \frac{4}{9}n$

15. (2) Using Rule 5,
The sequence is :

$\frac{1}{2}, -\frac{1}{2^2}, \frac{1}{2^3}, -\frac{1}{2^4}, \ldots.. \frac{1}{-2^8}$

It is a G.P. with common ratio

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

$\therefore a_n = ar^{n-1}$

$\Rightarrow -\frac{1}{256} = \frac{1}{2} . \frac{1}{(-2)^{n-1}}$

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

$\Rightarrow n - 1 = 7 \Rightarrow n = 8$

16. (1) First odd number = 1
Second odd number = 3
Third odd number = 5
$\therefore$ n th odd number
$= 1 + (n - 1)\,2 = 2n - 1$
$\therefore$ 200th odd number
$= 2 \times 200 - 1 = 400 - 1 = 399$

17. (1) Using Rule 1,
For an arithmetic sequence,
$t_n = a + (n - 1)\,d$
$\therefore 5 = a + (2 - 1)\,d$
$\Rightarrow 5 = a + d$ ....(i)
and $14 = a + 4d$ ......(ii)
By subtracting equation (i) from (ii),

$$\begin{aligned} 14 &= a + 4d \\ 5 &= a + d \\ \hline 9 &= 3d \end{aligned}$$

$\therefore d = \frac{9}{3} = 3$

From equation (i),
$5 = a + 3 \Rightarrow a = 5 - 3 = 2$
$\therefore t_6 = 2 + (6 - 1) \times 3$
$= 2 + 15 = 17$

18. (4) Using Rule 1,
Let the n th term = 151
Here, first term = a = 7
common difference = d = 3
$\therefore t_n = a + (n - 1) d$
$\Rightarrow 151 = 7 + (n - 1) \times 3$
$\Rightarrow (n - 1) \times 3 = 144$
$\Rightarrow n - 1 = \frac{144}{3} = 48$
$\Rightarrow n = 49$

19. (1) First term = $\frac{1}{5 \times 6} = \frac{1}{5} - \frac{1}{6}$

Second term = $\frac{1}{6 \times 7} = \frac{1}{6} - \frac{1}{7}$

20th term = $\frac{1}{24 \times 25} = \frac{1}{24} - \frac{1}{25}$

$\therefore$ Required sum =

$\frac{1}{5} - \frac{1}{6} + \frac{1}{6} - \frac{1}{7} + ... + \frac{1}{24} - \frac{1}{25}$

$= \frac{1}{5} - \frac{1}{25} = \frac{5-1}{25} = \frac{4}{25}$
= 0.16

20. (2) Using Rule 1,
The 24th term of the sequence 6,13,20, 27........
$t_{24} = 6 + (24 - 1)\ 7$
$= 6 + 23 \times 7 = 6 + 161 = 167$
let the required nth term = 265
$\therefore 265 = 6 + (n - 1)\ 7$
$\Rightarrow (n-1)\ 7 = 265 - 6 = 259$
$\Rightarrow n - 1 = \frac{259}{7} = 37$
$\Rightarrow n = 38$

21. (2) Using Rule 4 (i),
We know that
$1 + 2 + 3 + 4 + ... + n$
$= \frac{n(n+1)}{2}$
$\therefore 1 + 2 + 3 + 4 + ... + 1000$
$= \frac{1000(1000+1)}{2}$
$= \frac{1000 \times 1001}{2} = 500500$

22. (1) Using Rule 6,
$1 + \frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} + ... n$ to n terms
is a Geometric series whose first term (a) is 1 and the common ratio (r) is $\frac{1}{2}$.

$S_n = \frac{a(1-r^n)}{1-r}$

$= 1.\frac{\left(1 - \frac{1}{2^n}\right)}{1 - \frac{1}{2}} = \frac{\left(\frac{2^n - 1}{2^n}\right)}{\frac{1}{2}}$

$= 2.\left(\frac{2^n - 1}{2^n}\right) = \frac{2^n - 1}{2^{n-1}}$

23. (3) 0 + 3 = 3
3 + 5 = 8
8 + 7 = 15
15 + 9 = 24
24 + 11 = 35
35 + 13 = 48
48 + 15 = 63
63 + 17 = $\boxed{80}$

24. (3) 2 + 4 = 6
6 + 5 = 11
11 + 6 = 17
17 + 7 = 24
24 + 8 = $\boxed{32}$

25. (2) The pattern of the sequence is:
1 +2 = 3
3 + 3 = 6
6 + 4 = 10
10 + 5 = 15
15 + 6 = 21
$\therefore$ Required ratio
= 15 : 21 = 5 : 7

26. (4) Using Rule 1,
2 + 4 + 6 + 8 + ... + 198
= 2 (1 + 2 + 3 + ... + 99)
$\therefore$ Number of terms = 99
Middle term
$= \frac{99+1}{2}$ = 50th term
= 100

Second Method
It is an arithmetic series.
$a = 2$, $a_n = 198$, d = common difference = 2
Number of terms = n
$\therefore a_n = a + (n - 1)d$
$\Rightarrow 198 = 2 + (n - 1)2$
$\Rightarrow (n - 1)2 = 198 - 2 = 196$
$\Rightarrow n - 1 = \frac{196}{2} = 98$
$\Rightarrow n = 99$
Middle term
$= \frac{99+1}{2}$ = 50th term
$\therefore a_{50} = 2 + (50 - 1)2$
$= 2 + 98 = 100$

27. (3) Using Basic concept of G.P., p, q, r are in geometric progression.
$\therefore \frac{q}{p} = \frac{r}{q} \Rightarrow q^2 = pr$
$\Rightarrow q = \sqrt{pr}$

28. (4) a, 1, b are in A.P.
$\therefore 1 = \frac{a+b}{2}$
$\Rightarrow a + b = 2$ ....(i)
Again, 1, a, b are in G.P.
$\therefore a^2 = b$ ......(ii)
$\therefore a + a^2 = 2$
$\Rightarrow a^2 + a - 2 = 0$
$\Rightarrow a^2 + 2a - a - 2 = 0$
$\Rightarrow a\ (a + 2) - 1\ (a + 2) = 0$
$\Rightarrow (a - 1)\ (a + 2) = 0$
$\Rightarrow a = -2,\ 1 b = 4,\ 1$
$\therefore b = 4$ since $a \neq b$

29. (4) Using Rule 1,
$t_{n+2} = t_n + t_{n+1}$
$t_3 = t_1 + t_2 = 3$
$t_4 = t_3 + t_2 = 3 + 2 = 5$
$t_5 = t_4 + t_3 = 3 + 5 = 8$

30. (2) $1 + (3+1)(3^2+1)(3^4+1)$
$(3^8+1)(3^{16}+1)(3^{32}+1)$

$= 1 + \frac{(3-1)(3+1)}{3-1}(3^2+1)\ (3^4+1)...(3^{32}+1)$

$= 1 + \frac{(3^2-1)(3^2+1)(3^4+1)...(3^{32}+1)}{2}$

$= 1 + \frac{(3^4-1)(3^4+1)(3^8+1)...(3^{32}+1)}{2}$

$= 1 + \frac{(3^8-1)(3^8+1)(3^{16}+1)(3^{32}+1)}{2}$

$= 1 + \frac{(3^{16}-1)(3^{16}+1)(3^{32}+1)}{2}$

$= 1 + \frac{(3^{32}-1)(3^{32}+1)}{2}$

$= 1 + \frac{3^{64}-1}{2} = \frac{3^{64}+1}{2}$

31. (3) Using Rule 4(i),
$1 + 2 + 3 + ... + n = \frac{n(n+1)}{2}$
$\therefore 5 + 6 + 7 + ... + 19$
$= (1 + 2 + 3 + ... + 19) - (1 + 2 + 3 + 4)$
$= \frac{19(19+1)}{2} - 10 = 180$

32. (1) Using Rule 4(ii),
$2^2 + 4^2 + 6^2 + ... + 40^2$
$= 2^2 (1^2 + 2^2 + 3^2 +.... + 20^2)$
$= 4 \times 2870 = 11480$

33. (4) Using Rule 4(iii),
It is given,
$1^3 + 2^3 + 3^3 + ... + 10^3 = 3025$
Now,
$2^3 + 4^3 + 6^3 + ... + 20^3$
$= (1 \times 2)^3 + (2 \times 2)^3 + (2 \times 3)^3 + ... + (2 \times 10)^3$
$= 2^3 [1^3 + 2^3 + 3^3 + ... + 10^3]$
$= 8 \times 3025 = 24200$

34. (3) Using Rule 4(i),
$(45 + 46 + 47 + ... + 114 + 115)$
$= (1 + 2 + 3 +..... + 115) - (1 + 2 + 3 + ... + 44)$
$$= \frac{115 \times (115+1)}{2} - \frac{44 \times (44+1)}{2}$$
$$\left[\because 1+2+3+.....+n = \frac{n(n+1)}{2}\right]$$
$$= \frac{115 \times 116}{2} - \frac{44 \times 45}{2}$$
$= 115 \times 58 - 22 \times 45$
$= 6670 - 990 = 5680$

35. (1) First term $= \frac{x \times 0 + 1}{x}$
$$= \frac{x(1-1)+1}{x}$$
Second term $= \frac{x \times 1 + 1}{x}$
$$= \frac{x(2-1)+1}{x}$$
Third term $= \frac{x \times 2 + 1}{x}$
$$= \frac{x(3-1)+1}{x}$$
$\therefore$ 12th term $= \frac{x(12-1)+1}{x}$
$$= \frac{11x+1}{x}$$

36. (2) Using Rule 2,
First term $(a) = 22$
Last term $(l) = -11$
Sum $(S) = 66$
Number of terms $= n$ (let)
$$\therefore S = \frac{n}{2}(a + l)$$
$$\Rightarrow 66 = \frac{n}{2}(22 - 11)$$
$$\Rightarrow 66 = \frac{11n}{2}$$
$\Rightarrow 11n = 66 \times 2$
$$\Rightarrow n = \frac{66 \times 2}{11} = 12$$

37. (2) Using Rule 1,
First term $= a = 30$
Common difference (d)
$$= 25\frac{1}{2} - 30 = -4\frac{1}{2} = \frac{-9}{2}$$
Number of terms $= n = 30$
$t_n = a + (n - 1)d$
$$\Rightarrow t_{30} = 30 + (30 - 1) \times \frac{-9}{2}$$
$$= 30 - \frac{29 \times 9}{2}$$
$$= 30 - \frac{261}{2}$$
$$= \frac{60 - 261}{2}$$
$$= \frac{-201}{2} = -100\frac{1}{2}$$

38. (3) Using Rule 6,
Series $= 5 + 55 + 555 +....+ T_n$
$= 5(1 + 11 + 111 + ...$ to n terms)
$= \frac{5}{9}(9 + 99 + 999 + ...$ to n terms)
$= \frac{5}{9}\{(10 - 1) + (10^2 - 1) +.....+ (10^n - 1)\}$
$\therefore$ nth term $= \frac{5}{9}(10^n - 1)$

39. (3) Expression
$$= \frac{1}{1 \times 4} + \frac{1}{4 \times 7} + \frac{1}{7 \times 10} + \frac{1}{10 \times 13} + \frac{1}{13 \times 16}$$
$$= \frac{1}{3}\left(1 - \frac{1}{4}\right) + \frac{1}{3}\left(\frac{1}{4} - \frac{1}{7}\right) + ...+ \frac{1}{3}\left(\frac{1}{13} - \frac{1}{16}\right)$$
$$= \frac{1}{3}\left(\begin{array}{l}1 - \frac{1}{4} + \frac{1}{4} - \frac{1}{7} + \frac{1}{7} - \frac{1}{10} \\ + \frac{1}{10} - \frac{1}{13} + \frac{1}{13} - \frac{1}{16}\end{array}\right)$$
$$= \frac{1}{3}\left(1 - \frac{1}{16}\right) = \frac{1}{3} \times \frac{15}{16} = \frac{5}{16}$$

40. (3) Using Rule 6,
Series $\Rightarrow 1 + 3 + 3^2 +...+ 3^n$
It is a geometric series whose common ratio is 3.
$a + ar + ar^2 + ... + ar^{n-1}$
$$= \frac{a(r^n - 1)}{r - 1}$$
$\therefore 1 + 3 + 3^2 +...... + 3^n$
$$= \frac{1(3^{n+1} - 1)}{3 - 1}$$
$$= \frac{3^{n+1} - 1}{2}$$
According to question,
$$\frac{3^{n+1} - 1}{2} > 2000$$
$\Rightarrow 3^{n+1} - 1 > 4000$
$\Rightarrow 3^{n+1} > 4000 + 1 = 4001$
For $n = 7$.
$3^8 = 6561 > 4001$

41. (1) First term $\Rightarrow 1 + \frac{1}{2} = \frac{3}{2}$
Second term $\Rightarrow \left(1 + \frac{1}{2}\right)\left(1 + \frac{1}{3}\right)$
$$= \frac{3}{2} \times \frac{4}{3} = 2$$
Third term
$$\Rightarrow \left(1 + \frac{1}{2}\right)\left(1 + \frac{1}{3}\right)\left(1 + \frac{1}{4}\right)$$
$$= \frac{3}{2} \times \frac{4}{3} \times \frac{5}{4} = \frac{5}{2}$$
$\therefore$ Fourth term
$$= \left(1 + \frac{1}{2}\right)\left(1 + \frac{1}{3}\right)\left(1 + \frac{1}{4}\right)\left(1 + \frac{1}{5}\right)$$
$$= \frac{3}{2} \times \frac{4}{3} \times \frac{5}{4} \times \frac{6}{5} = \frac{6}{2} = 3$$
The solution of question 42 to 45 is at the page

42. (1) Let the first term of A.P. be 'a' and the common difference be 'd'.
$$\therefore S_n = \frac{n}{2}[2a + (n-1)d]$$
$$\Rightarrow 390 = \frac{10}{2}[2a + (10-1)d]$$
$\Rightarrow 390 = 5(2a + 9d)$

$\Rightarrow 2a + 9d = \frac{390}{5} = 78$ ... (i)

Again, third term = 19

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

$\Rightarrow a + 2d = 19$ .... (ii)

By equation (i) – 2 × (ii),

$2a + 9d - 2a - 4d = 78 - 38$

$\Rightarrow 5d = 40$

$\Rightarrow d = \frac{40}{5} = 8$

From equation (ii),

$a + 2 \times 8 = 19$

$\Rightarrow a = 19 - 16 = 3$

43. (1) $2^2 + 4^2 + 6^2 + ... + 40^2 = 11480$

$\Rightarrow 1^2.2^2 + 2^2.2^2 + 3^2.2^2 + ...+ 20^2.2^2 = 11480$

$\Rightarrow 2^2 (1^2 + 2^2 + 3^2 + ... + 20^2) = 11480$

$= 1^2 + 2^2 + 3^2 + ... + 20^2$

$= \frac{11480}{4} = 2870$

44. (4) $1^2 + 2^2 + 3^2 + ... + p^2$

$= \frac{p(p+1)(2p+1)}{6}$

$\therefore 1^2 + 3^2 + 5^2 + ... + 17^2$

$= (1^2 + 2^2 + 3^2 + ... + 17^2) - (2^2 + 4^2 + ...+16^2)$

$= (1^2 + 2^2 + 3^2 + ... + 17^2) - 4(1^2 + 2^2 + ... + 8^2)$

$= \frac{17(17+1)(34+1)}{6} - \frac{4 \times 8(8+1)(16+1)}{6}$

$= \frac{17 \times 18 \times 35}{6} - \frac{4 \times 8 \times 9 \times 17}{6}$

$= 1785 - 816 = 969$

45. (2) nth term of an arithmetic progression :

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

$\therefore a_7 = a + (7-1)d = a + 6d$

$a_{11} = a + (11-1)d = a + 10d$

According to the question,

$7a_7 = 11a_{11}$

$\Rightarrow 7(a + 6d) = 11(a + 10d)$

$\Rightarrow 7a + 42d = 11a + 110d$

$\Rightarrow 11a - 7a = 42d - 110d$

$\Rightarrow 4a = -68d$

$\Rightarrow a = -17d$ .... (i)

$\therefore a_{18} = a + (18-1)d = a + 17d$

$= -17d + 17d = 0$

TYPE-III

1. (1) $\lfloor n = 1 \times 2 \times 3 \times ....\times n$

$\therefore \lfloor 8 - \lfloor 7 - \lfloor 6$

$= (8 \times 7 \times \lfloor 6) - (7 \times \lfloor 6) - \lfloor 6$

$= 56\lfloor 6 - 7\lfloor 6 - \lfloor 6$

$= (56 - 7 - 1)\lfloor 6$

$= 48\lfloor 6 = 6 \times 8 \times \lfloor 6$

2. (3)

$\frac{1}{1\times4} + \frac{1}{4\times7} + \frac{1}{7\times10} + \frac{1}{10\times13} + \frac{1}{13\times16}$

$= \left(1 - \frac{1}{4} + \frac{1}{4} - \frac{1}{7} + \frac{1}{7} - \frac{1}{10} + \frac{1}{10} - \frac{1}{13} + \frac{1}{13} - \frac{1}{16}\right) \times \frac{1}{3}$

$= \frac{15}{16} \times \frac{1}{3} = \frac{5}{16}$

3. (2) $\because (a+b)^2 - (a-b)^2 = 4ab$

$\therefore (10^{12} + 25)^2 - (10^{12} - 25)^2$

$= 4 \times 10^{12} \times 25 = 10^{14}$

$\Rightarrow 10^{14} = 10^n$

$\Rightarrow n = 14$

4. (3) $1 + 2 + 3 + 4 + ... + 10 = 55$. Then,

$6 + 12 + 18 + 24 + ... + 60$

$= 6(1 + 2 + 3 + 4 + ... + 10) = 6 \times 55 = 330$

5. (1) Expression

$= \frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times .... \frac{n-1}{n} = \frac{1}{n}$

6. (2) Expression

$= \frac{3}{1^2.2^2} + \frac{5}{2^2.3^2} + \frac{7}{3^2.4^2} + ...$

$+ \frac{17}{8^2.9^2} + \frac{19}{9^2.10^2}$

$\frac{2^2 - 1^2}{1^2.2^2} + \frac{3^2 - 2^2}{2^2.3^2} + \frac{4^2 - 3^2}{3^2.4^2} + ...$

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

$...... + \left(\frac{1}{8^2} - \frac{1}{9^2}\right) + \left(\frac{1}{9^2} - \frac{1}{10^2}\right)$

$= \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{2^2} - \frac{1}{3^2} + \frac{1}{3^2} - \frac{1}{4^2} + ...$

$+ \frac{1}{8^2} - \frac{1}{9^2} + \frac{1}{9^2} - \frac{1}{10^2}$

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

$= 1 - \frac{1}{100} = \frac{100-1}{100}$

$= \frac{99}{100}$

7. (2) Using Rule 7,

Let S

$= 1 - \frac{1}{20} + \frac{1}{20^2} - \frac{1}{20^3} + ...$

It is a geometric series to infinity with first term, $a = 1$ and common ratio,

$r = -\frac{1}{20}$

$\therefore S_\infty = \frac{a}{1-r}$

$= \frac{1}{1 - \left(-\frac{1}{20}\right)}$

$= \frac{1}{1 + \frac{1}{20}} = \frac{20}{21} = 0.9523809$

$\therefore$ The value correct to 5 places of decimal

= 0.95238

8. (2) The largest number will be 6.

For $n = 2$

$(n-1)\,n(n+1) = 6$,

for $n = 3$, $(n-1)(n)(n+1) = 24$ etc.

9. (4) Using Rule 1,

$1 + 2 + 3 + ... + x = \frac{x(x+1)}{2}$

$\therefore 1 + 3 + 5 + ... + 99$

$= (1 + 2 + 3 + 4 + 5 + ...100) - (2 + 4 + 6 + ...100)$

$= \frac{100 \times (100+1)}{2} - \frac{50 \times (50+1)}{2}$

$= 5050 - 1275 = 3775$

10. (2) Expression,

$= \left(1 - \frac{1}{5}\right)\left(1 - \frac{1}{6}\right)\left(1 - \frac{1}{7}\right)....\left(1 - \frac{1}{100}\right)$

$= \left(\frac{5-1}{5}\right)\left(\frac{6-1}{6}\right)\left(\frac{7-1}{7}\right)...\left(\frac{99-1}{99}\right)\left(\frac{100-1}{100}\right)$

$= \frac{4}{5} \times \frac{5}{6} \times \frac{6}{7} \times .... \times \frac{98}{99} \times \frac{99}{100}$

$= \frac{4}{100} = \frac{1}{25}$

11. (1) Tricky approach

$1 + 0.6 + 0.06 + 0.006 + 0.0006 + \ldots = 1.666 \ldots = 1.\overline{6}$

$= 1\frac{6}{9} = 1\frac{2}{3}$

12. (1) $\left(1-\frac{1}{3}\right)\left(1-\frac{1}{4}\right)\left(1-\frac{1}{5}\right) \ldots\ldots \left(1-\frac{1}{24}\right)\left(1-\frac{1}{25}\right)$

$= \frac{2}{3}\times\frac{3}{4}\times\frac{4}{5}\ldots\ldots\times\frac{23}{24}\times\frac{24}{25} = \frac{2}{25}$

TYPE-IV

1. (4) ? = 125 + 216 + 343 + 512 + 729 + 1000 = 2925

Aliter : Using Rule 4(iii),

$S_n = (5^3 + 6^3 + \ldots\ldots\ldots\ldots 10^3)$

$= (1^3 + 2^3 + 3^3 + 4^3 + 5^3 + \ldots 10^3) - (1^3 + 2^3 + 3^3 + 4^3)$

$= \left[\frac{n(n+1)}{2}\right]^2 - (1+8+27+64)$

$= \left[\frac{10(10+1)}{2}\right]^2 - 100$

$= (55)^2 - 100 = 3025 - 100 = 2925$

2. (4) $2^3 + 4^3 + 6^3 + \ldots. + 20^3$

$= (2 \times 1)^3 + (2 \times 2)^3 + (2 \times 3)^3 + \ldots.. + (2 \times 10)^3$

$= 8 \times 1^3 + 8 \times 2^3 + 8 \times 3^3 \ldots. + 8 \times 10^3$

$= 8 \times [1^3 + 2^3 + 3^3 + 4^3 + \ldots + 10^3]$

$= 8 \times 3025 = 24200$

[$\because$ $1^3 + 2^3 + 3^3 + \ldots. + 10^3$ = 3025 (given)]

3. (2) Here, $1^3 + 2^3 + \ldots. + 10^3 = 3025$

Now, 4 + 32 + 108 + ... + 4000

= 4 (1 + 8 + 27 + ... + 4000)

$= 4 (1^3 + 2^3 + 3^3 + \ldots. + 10^3)$

$= 4 \times 3025 = 12100$

4. (4) $1^3 + 2^3 + 3^3 + 4^3 + 5^3 + 6^3 = 441$ (Given)

$2^3 + 4^3 + 6^3 + 8^3 + 10^3 + 12^3$

$= 8 (1^3 + 2^3 + 3^3 + 4^3 + 5^3 + 6^3)$

$= 8 \times 441 = 3528$

5. (1) Using Rule 4(ii),

$1^2 + 2^2 + 3^2 + \ldots.. + n^2$

$= \frac{n(n+1)(2n+1)}{6}$

$\therefore$ $1^2 + 3^2 + 5^2 + \ldots.. + 19^2$

$= (1^2 + 2^2 + 3^2 + \ldots.. + 20^2) - (2^2 + 4^2 + \ldots.. + 20^2)$

$= \frac{20(20+1)(40+1)}{6} - 2^2 (1^2 + 2^2 + \ldots.. + 10^2)$

$= \frac{20 \times 21 \times 41}{6} - \frac{4 \times 10(10+1)(20+1)}{6}$

= 2870 – 1540 = 1330

6. (2) Using Rule 4(iii),

$1^3 + 2^3 + \ldots.. + 9^3 = 2025$ (Given)

Now, $(0.11)^3 + (0.22)^3 + \ldots. + (0.99)^3$

$= \left(\frac{11}{100}\right)^3 + \left(\frac{22}{100}\right)^3 + \ldots.. + \left(\frac{99}{100}\right)^3$

$= \left(\frac{11}{100}\right)^3 (1^3 + 2^3 + \ldots.. + 9^3)$

$= \frac{1331}{1000000} \times 2025$

$= \frac{2695275}{1000000} = 2.695275$

≈ 2.695

7. (1) Using Rule 4(ii),

$1^2 + 2^2 + 3^2 + \ldots.. + n^2$

$= \frac{n(n+1)(2n+1)}{6}$

$? = \frac{10 \times 11 \times 21}{6} + 20^2 - \frac{4 \times 5 \times 9}{6}$

= 385 + 400 – 30 = 755

8. (4) $S = 1^2 - 2^2 + 3^2 - 4^2 + \ldots - 10^2$

$S = (1^2 + 3^2 + 5^2 + 7^2 + 9^2) - (2^2 + 4^2 + 6^2 + 8^2 + 10^2)$

We know that sum of squares of first n odd natural numbers

$= \frac{n(4n^2 - 1)}{3}$

Sum of squares of first n even natural numbers

$= \frac{2}{3}n(n+1)(2n+1)$

Hence,

$S = \frac{5(4 \times 5 \times 5 - 1)}{3} - \frac{2}{3} \times 5 (5 + 1)(2 \times 5 + 1)$

$S = \frac{5 \times 99}{3} = \frac{2 \times 30 \times 11}{3}$

= 165 – 220 = – 55

9. (2) Using Rule 4(ii),

$1^2 + 2^2 + 3^2 + \ldots + n^2$

$= \frac{n(n+1)(2n+1)}{6}$

$\therefore$ $10^2 + 11^2 + 12^2 + \ldots. + 20^2$

$= (1^2 + 2^2 + 3^2 + \ldots. + 20^2) - (1^2 + 2^2 + 3^2 + \ldots + 9^2)$

$= \frac{20(20+1)(2 \times 20+1)}{6} - \frac{9(9+1)(2 \times 9+1)}{6}$

$= \frac{20 \times 21 \times 41}{6} - \frac{9 \times 10 \times 19}{6}$

= 2870 – 285 = 2585

10. (2) Using Rule 4(ii),

$1^2 + 2^2 + 3^2 + \ldots + n^2$

$= \frac{n(n+1)(2n+1)}{6}$

$\therefore$ $1^2 + 2^2 + 3^2 + \ldots. + 10^2$

$= \frac{10(10+1)(20+1)}{6} = 385$

11. (3) Using Rule 4(ii),

$1^2 + 2^2 + 3^2 + 4^2 + \ldots + n^2$

$= \frac{n(n+1)(2n+1)}{6}$

$\therefore$ $5^2 + 6^2 + \ldots. 10^2 = (1^2 + 2^2 + \ldots + 10^2) - (1^2 + 2^2 + 3^2 + 4^2)$

$= \frac{10 \times 11 \times 21}{6} - \frac{4 \times 5 \times 9}{6}$

= 385 – 30 = 355

12. (4) Using Rule 4(ii),

We know that

$1^2 + 2^2 + 3^3 + \ldots. + n^2$

$= \frac{n(n+1)(2n+1)}{6}$

$\therefore$ $2^2 + 3^2 + 4^2 + \ldots.. + 10^2$

$= (1^2 + 2^2 + 3^2 + \ldots.. + 10^2) - 1$

$= \frac{10(10+1)(2 \times 10+1)}{6} - 1$

$= \frac{10 \times 11 \times 21}{6} - 1 = 385 - 1 = 384$

13. (4) Using Rule 4(ii),

Using formula $1^3 + 2^3 + 3^3 + \ldots + n^3 = \left(\frac{n(n+1)}{2}\right)^2$ we have,

$1^3 + 2^3 + 3^3 + \ldots.. + 10^3$

$= \left(\frac{10 \times 11}{2}\right)^2 = (55)^2$

$= 55 \times 55 = 3025$

14. (2) $1^2 + 2^2 + 3^2 + \ldots\ldots + 10^2 = 385$

$\therefore$ $2^2 + 4^2 + 6^2 + \ldots. + 20^2$

$= 2^2 (1^2 + 2^3 + 3^2 + \ldots.. + 10^2)$

$= 4 \times 385 = 1540$

TEST YOURSELF

1. In the sequence of number 0, 7, 26, 63, ..., 215, 342 the missing term is

(1) 115 (2) 124
(3) 125 (4) 135

2. What is the next term in the following sequence ?

2 3 11 38 102 ?

(1) 225 (2) 227
(3) 230 (4) 235

3. Find $1^3 + 2^3 + 3^3 + ... + 15^3$

(1) 11025 (2) 13400
(3) 900 (4) 14400

4. The value of
$(1^3 + 2^3 + 3^3 + ... + 15^3) - (1 + 2 + 3 + ... + 15)$ is —

(1) 14280 (2) 14400
(3) 12280 (4) 13280

5. What is the next number in the series given below ?
53, 48, 50, 50, 47

(1) 51 (2) 46
(3) 53 (4) 52

6. In a GP, the first term is 5 and the common ratio is 2. The eighth term is —

(1) 640 (2) 1280
(3) 256 (4) 160

7. If the arithmetic mean of two numbers is 5 and geometric mean is 4, then the numbers are —

(1) 4, 6 (2) 4, 7
(3) 3, 8 (4) 2, 8

8. What is the next number in the series given below ?
2, 5, 9, 14, 20

(1) 25 (2) 26
(3) 27 (4) 28

9. The sum of 40 terms of an AP whose first term is 4 and common difference is 4, will be —

(1) 3200 (2) 1600
(3) 200 (4) 2800

10. Let S_n denote the sum of the first 'n' terms of an AP

$S_{2n} = 3S_n$. Then, the ratio $\frac{S_{3n}}{S_n}$ is equal to

(1) 4 (2) 6
(3) 8 (4) 10

11. The missing number in the series 8, 24, 12, 36, 18, 54, ... is —

(1) 27 (2) 108
(3) 68 (4) 72

12. The sum of the 6th and 15th elements of an arithmetic progression is equal to the sum of 7th, 10th and 12th elements of the same progression. Which element of the series should necessarily be equal to zero ?

(1) 10th (2) 8th
(3) 1st (4) 9th

13. If p, q, r, s are in harmonic progression and p > s, then —

(1) $\frac{1}{ps} < \frac{1}{qr}$

(2) $q + r = p + s$

(3) $\frac{1}{q} + \frac{1}{p} = \frac{1}{r} + \frac{1}{s}$

(4) None of these

14. What is the eighth term of the sequence 1, 4, 9, 16, 25 ..... ?

(1) 8 (2) 64
(3) 128 (4) 200

15. In a geometric progression, the sum of the first and the last term is 66 and the product of the second and the last but one term is 128. Determine the first term of the series.

(1) 64 (2) 64 or 2
(3) 2 or 32 (4) 32

16. A sequence is generated by the rule that the xth term is $x^2 + 1$ for each positive integer x. In this sequence, for any value $x > 1$, the value of $(x + 1)$th term less the value of xth term is —

(1) $2x^2 + 1$ (2) $x^2 + 1$
(3) $2x + 1$ (4) $x + 2$

17. Four different integers form an increasing AP. If one of these numbers is equal to the sum of the squares of the other three numbers, then the numbers are —

(1) –2, –1, 0, 1 (2) 0, 1, 2, 3
(3) –1,0, 1, 2 (4) 1, 2, 3, 4

18. How many terms are there in an AP whose first and fifth terms are –14 and 2 respectively and the sum of terms is 40 ?

(1) 15 (2) 10
(3) 5 (4) 20

19. The first three numbers in a series are –3, 0, 3, the 10th number in the series will be —

(1) 18 (2) 21
(3) 24 (4) 27

SHORT ANSWERS

1.(2)	**2.**(2)	**3.**(4)	**4.**(1)
5.(4)	**6.**(1)	**7.**(4)	**8.**(3)
9.(1)	**10.**(2)	**11.**(1)	**12.**(2)
13.(4)	**14.**(2)	**15.**(2)	**16.**(3)
17.(3)	**18.**(2)	**19.**(3)	

EXPLANATIONS

1. (2) The given series is based on the following pattern :

$1^3 - 1 = 0$ $2^3 - 1 = 7$
$3^3 - 1 = 26$ $4^3 - 1 = 63$
$5^3 - 1 = \boxed{124}$ $6^3 - 1 = 215$
$7^3 - 1 = 342$

2. (2) The pattern is :

$2 + 1^3 = 2 + 1 = 3$
$3 + 2^3 = 3 + 8 = 11$
$11 + 3^3 = 11 + 27 = 38$
$38 + 4^3 = 38 + 64 = 102$
$102 + 5^3 = 102 + 125 = \boxed{227}$

3. (4) According to question, we have,

$$1^3 + 2^3 + 3^3 + ... + n^3$$
$$= \left[\frac{n \times (n+1)}{2}\right]^2$$

Here, n = number of terms = 15

$$\therefore \left[\frac{n\ (n+1)}{2}\right]^2 = \left[\frac{15 \times 16}{2}\right]^2$$
$$= (120)^2 = 14400$$

4. (1) According to question,

$(1^3 + 2^3 + 3^3 + ... + 15^3) - (1 + 2 + 3 + ... + 15)$

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

$= \left[\frac{15\times16}{2}\right]^2 - \left[\frac{15\times16}{2}\right]$

$=(120)^2-(120)$

$=120 \times 119 = 14280$

5. (4) According to question,
53, 48, 50, 50, 47, ...
The above series can be splitted into two series one in ascending order and other in descending order

$\underbrace{53\ \ 50}_{-3}\underbrace{\ \ 47}_{-3}$ and other is

$\underbrace{48\ \ 50}_{+2}\underbrace{\ \ 52}_{+2}$

Hence, 52 will be the next number.

6. (1) According to question, nth term of a GP = ar^{n-1}.
$\therefore$ 8th term = $5 \times (2)^{8-1} = 5 \times (2)^7$
$= 5 \times 128 = 640$

7. (4) Let the two numbers be x and y. Then, AM,

$$\frac{x+y}{2}=5$$

$\Rightarrow \quad x+y=10$

and GM, $\sqrt{xy} = 4$ ...(i)

$xy = 16$

$\Rightarrow \quad (x-y)^2 = (x+y)^2 - 4xy$

$100 - 64 = 36$

$x-y=6$ ...(ii)

Or

Solving Eqs. (i) and (ii),
$x = 8$ and $y = 2$

8. (3) According to question,

$\underbrace{2\ \ 5}_{+3}\underbrace{\ \ 9}_{+4}\underbrace{\ \ 14}_{+5}\underbrace{\ \ 20}_{+6}\underbrace{\ \ 27}_{+7}$

Hence, the next number of the series will be 27.

9. (1) According to question,

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

$= 20\ [4 + 39 \times 4] = 20 \times 160$
$= 3200$

10. (2) Let a be the first term and d be the common difference.

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

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

and $S_{3n} = \frac{3n}{2}\ [2a + (3n-1)d]$

Given, $\quad S_{2n} = 3S_n$

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

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

$\Rightarrow 4a + (4n-2)d = 6a + (3n-3)d$

$\Rightarrow \quad d\ (4n - 2 - 3n + 3) = 2a$

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

$\therefore \quad S_n=\frac{2an^2}{n+1}$

and $S_{3n} = \frac{12an^2}{n+1}$

$\therefore \quad \frac{S_n}{S_{3n}}=\frac{2an^2}{n+1}\times\frac{n+1}{12an^2}=\frac{1}{6}$

$\Rightarrow \quad \frac{S_{3n}}{S_n}=6$

11. (1) According to question,
8, 24, 12, 36, 18, 54

8 24 12 36 18 54 27
×3 ÷2 ×3 ÷2 ×3 ÷2

Hence, 27 will come in the blank space.

12. (2) Let the first term and common term of the AP be a and d respectively.
Then, $(a + 5d) + (a + 14d) =$
$(a + 6d) + (a + 9d) + (a + 11d)$
$\Rightarrow \quad 2a + 19d = 3a + 26\ d$
$\Rightarrow \quad a + 7d = 0$
$\therefore \quad$ 8th term is 0.

13. (4) According to question,
If p, q, r, s are in HP.

$\Rightarrow \quad \frac{1}{p},\frac{1}{q},\frac{1}{r},\frac{1}{s}$ are in AP.

$\Rightarrow \quad \frac{1}{q}-\frac{1}{p}=\frac{1}{s}-\frac{1}{r}$

$\Rightarrow \quad \frac{1}{q}+\frac{1}{r}=\frac{1}{s}+\frac{1}{p}$

Hence, the none of these be answer

14. (2) According to question,
1, 4, 9, 16, 25
$(1)^2\ (2)^2\ (3)^2\ (4)^2\ (5)^2$
Each term of the progression is the square of a natural number.
Hence, the eighth term of the sequence will be $(8)^2 = 64$

15. (2) Let the last term be n, then
$a + ar^{n-1} = 66$
and $\quad ar.\ ar^{n-2} = 128$
$a^2r^{n-1} = 128$
From Eqs. (i) and (ii),
$a\ (66 - a) = 128$
$\Rightarrow \quad a^2 - 66a + 128 = 0$
$\Rightarrow \quad a = 64, 2$

16. (3) According to question,
$(x + 1)^{th}$ term $-x^{th}$ term
$= (x+1)^2 + 1 - (x^2+1)$
$= x^2 + 2x + 1 + 1 - x^2 - 1 = 2x + 1$

17. (3) By hit and trial or common sense, we have,
$2 = (-1)^2 + (0)^2 + (1)^2$
Hence the numbers are
$-1, 0, 1, 2$

18. (2) According to question,
$T_5 = a + (n-1).d$
$2 = -14 + 4d$

$d = \frac{16}{4} = 4$

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

$40 = \frac{n}{2}\ [-28 + (n-1) \times 4]$

$\Rightarrow \quad 80 = -28n + 4n^2 - 4n$
$\Rightarrow \quad 4n^2 - 32n - 80 = 0$
$n^2 - 8n - 20 = 0$
$\Rightarrow \quad (n-10)(n+2) = 0$
$\therefore \quad n = 10\ (\because n \neq -2)$

19. (3) According to question,
$a = -3,\ d = 3$
$\therefore\ T_{10} = a + (10-1)\ .\ d$
$T_{10} = -3 + 9 \times 3 = 24$