FIITJEE

MUKHYAMANTRI VIGYAN PRATIBHA PARIKSHA
PART – I
MENTAL ABILITY TEST (MAT)
Held on: January 22, 2023
ANSWER KEYS

1.	**2**	2.	**2**	3.	**1**	4.	**1**
5.	**1**	6.	**2**	7.	**3**	8.	**3**
9.	**3**	10.	**1**	11.	**2**	12.	**4**
13.	**3**	14.	**4**	15.	**2**	16.	**4**
17.	**2**	18.	**3**	19.	**4**	20.	**2**
21.	**3**	22.	**3**	23.	**4**	24.	**4**
25.	**1**	26.	**2**	27.	**1**	28.	**2**
29.	**4**	30.	**3**	31.	**2**	32.	**2**
33.	**2**	34.	**3**	35.	**1**	36.	**2**
37.	**2**	38.	**4**	39.	**4**	40.	**3**
41.	**3**	42.	**1**	43.	**2**	44.	**4**
45.	**2**	46.	**2**	47.	**4**	48.	**2**
49.	**2**	50.	**1**	51.	**1**	52.	**2**
53.	**2**	54.	**4**	55.	**4**	56.	**4**
57.	**2**	58.	**2**	59.	**3**	60.	**3**
61.	**1**	62.	**4**	63.	**1**	64.	**1**
65.	**4**	66.	**3**	67.	**4**	68.	**4**
69.	**2**	70.	**2**	71.	**2**	72.	**3**
73.	**4**	74.	**1**	75.	**1**	76.	**1**
77.	**3**	78.	**1**	79.	**4**	80.	**2**
81	**2 or 3**	82.	**3**	83.	*****	84.	**4**
85.	**3**	86.	**2**	87.	**1**	88.	**3**
89.	*****	90.	**3**	91.	**3**	92.	**3**
93.	**1* or 4**	94.	**2**	95.	**4**	96.	**1**
97.	**1**	98.	**1**	99.	**2**	100.	**1**

HINTS & SOLUTIONS

1.   2

Sol.   135 litres $\rightarrow \dfrac{1}{4}$ of tank

     1 litre $\rightarrow \dfrac{1}{4 \times 135}$ of tank

     180 litres $\rightarrow \dfrac{180}{4 \times 135}$ of tank $= \dfrac{1}{3}$

2.   2

Sol.   Number = LCM of (24, 32, 36 & 54) – 5
           = 864 – 5 = 859

3.   1

Sol. $\dfrac{(0.96)^3 - (0.1)^3}{(0.96)^2 + 0.096 + (0.1)^2} = \dfrac{(0.96 - 0.1)\left[(0.96)^2 + (0.1)^2 + (0.96)(0.1)\right]}{\left[(0.96)^2 + (0.96)(0.1) + (0.1)^2\right]}$

               $= 0.96 - 0.1 = 0.86$

               $\left[\because a^3 - b^3 = (a - b)\left(a^2 + b^2 + ab\right)\right]$

4.   1

Sol.   Let numbers are a, b & c

     $\therefore$ a + b = 10   ...(i)

            b + c = 19   ...(ii)

        & a + c = 21   ...(iii)

     $\Rightarrow$ 2(a + b + c) = 50

     $\therefore$ a + b + c = 25   ...(iv)

     Solving these equations we will get a = 6, b = 4 & c = 15.

5.   1

Sol. $5^a = 3125 = 5^5$

     $\Rightarrow a = 5$

     $\therefore 5^{a-3} = 5^{5-3} = 5^2 = 25$

6.   2

Sol. $\dfrac{3}{5}$ of cistern $\rightarrow$ 1 min (or 60 sec)

     $\therefore$ 1 of cistern $\rightarrow \dfrac{1}{3/5} = \dfrac{5}{3}$ min

     $\therefore \dfrac{2}{5}$ of cistern $\rightarrow \dfrac{5}{3} \times \dfrac{2}{5} = \dfrac{2}{3}$ of min $= \dfrac{2}{3} \times 60 = 40$ sec

     $[\because$ Remaining part $= 1 - \dfrac{3}{5} = \dfrac{2}{5}]$

7.   3

Sol.   7 spider $\rightarrow$ 7 web $\rightarrow$ 7 days

     Since $\dfrac{MDH}{W} = $ constant

     $\therefore \dfrac{7 \times 7}{7} = \dfrac{1 \times x}{1}$ (where x = days required)

     $\therefore$ x = 7 days

8. 3

Sol. Since $\dfrac{MDH}{W} = $ constant

$\therefore \dfrac{1 \times 12}{1} = \dfrac{2 \times x}{\frac{1}{2}}$ (where x = days required)

$\therefore x = \dfrac{12}{2} \times \dfrac{1}{2} = 3$ days

9. 3

Sol. $\dfrac{A_1}{A_2} = \dfrac{225}{256}$

$\dfrac{(a_1)^2}{(b_1)^2} = \dfrac{225}{256}$ (where a_1 & b_1 are sides of squares with areas A_1 & A_2 respectively)

$\therefore \dfrac{a_1}{b_1} = \dfrac{15}{16}$

$\therefore \dfrac{P_1}{P_2} = \dfrac{4a_1}{4b_1} = \dfrac{4 \times 15}{4 \times 16} = \dfrac{15}{16}$

10. 1

Sol. Vol. of water flows through pipe in 1 sec $= 1.5 \times 1.25 \times 20 \times \dfrac{5}{18} = \dfrac{187.5}{18} m^3$

$\therefore$ Required time $= \dfrac{200 \times 150 \times 2}{\frac{187.5}{18}}$ sec $\left(\dfrac{\text{vol. of tank}}{\text{vol. of water flows through pipe in 1 sec}} \right)$

$= 5760$ sec $= \dfrac{5760}{60}$ min

$= 96$ min

11. 2

Sol. Number of cubes required $= \dfrac{\text{vol. of bigger cube}}{\text{vol. of smaller cube}}$

$= \dfrac{18 \times 18 \times 18}{3 \times 3 \times 3} = 216$

12. 4

Sol. Surface area of cube $= 6a^2 = 600$

$\therefore a = 10$ cm

$\therefore$ Diagonal $= a\sqrt{3}$

$= 10 \times \sqrt{3} = 10\sqrt{3}$ cm

13. 3

Sol. Total of 4AH batteries = 75 + 90 + 96 + 105 + 90 + 105 + 115 = 676
Total of 7AH batteries = 144 + 126 + 114 + 90 + 75 + 60 + 85 = 694
Total of 32AH batteries = 114 + 102 + 75 + 150 + 135 + 165 + 160 = 901
Total of 35AH batteries = 102 + 84 + 105 + 90 + 75 + 45 + 100 = 601
Total of 55AH batteries = 108 + 126 + 135 + 75 + 90 + 120 + 145 = 799

14. 4

Sol. Required answer = (84 – 45) × 1000 = 39000

15.   2

Sol.   In 1994 required % = $\dfrac{96}{525} \times 100 = 18.28\%$

In 1995 required % = $\dfrac{105}{510} \times 100 = 20.58\%$

In 1996 required % = $\dfrac{90}{465} \times 100 = 19.35\%$

In 1998 required % = $\dfrac{115}{605} \times 100 = 19.00\%$

16.   4

Sol.   % increase $= \dfrac{145 - 108}{108} \times 100$

$= \dfrac{37}{108} \times 100 = 34.25\%$

17.   2

Sol.   Decrease is sales is of 7AH battery.

18.   3

Sol. $\dfrac{1}{4} + \dfrac{\left[(20.35)^2 - (8.35)^2\right] \times 0.0175}{(1.05)^2 + (1.05)(27.65)}$

$= \dfrac{1}{4} + \dfrac{(20.35 + 8.35)(20.35 + 8.35) \times 0.0175}{1.05(1.05 + 27.65)}$

$= \dfrac{1}{4} + \dfrac{28.7 \times 12 \times 0.0175}{1.05 \times 28.7} = \dfrac{1}{4} + \dfrac{12 \times 175}{10500} = \dfrac{1}{4} + \dfrac{1}{5} = \dfrac{9}{20}$

19.   4

Sol.   Required angle $= \left|5 \times 30 - 45 \times 5.5\right|$

$= \left|(-97.5°)\right| = 97.5°$

20.   2

Sol.   Required answer $= \left[1 - \left(1 - \dfrac{20}{100}\right)\left(1 - \dfrac{10}{100}\right)\left(1 - \dfrac{5}{100}\right)\right] \times 100\%$

$= \left(1 - \dfrac{80}{100} \times \dfrac{90}{100} \times \dfrac{95}{100}\right)\% = 31.6\%$

21.   3

Sol.   2A = 3B = 4C = K

$\therefore$ A : B : C $= \dfrac{K}{2} : \dfrac{K}{3} : \dfrac{K}{4}$

$= \dfrac{12}{2} : \dfrac{12}{3} : \dfrac{12}{4}$

$= 6 : 4 : 3$

22.   3

Sol.   Let numbers be x & y

$\therefore$ x − y = 5

& xy = 336

$\Rightarrow (y + 5)y = 336$

$\Rightarrow y^2 + 5y - 336 = 0$

$\Rightarrow y^2 + 21y - 16y - 336 = 0$

$\Rightarrow (y - 16)(y + 21) = 0$

$\therefore$ y = 16 or -21

& x = 21 or -16

23. 4

Sol. Let present age of A = 3x & B = 4x

$\therefore$ 10 years ago A's age = 3x $-$ 10

& B's age = 4x $-$ 10
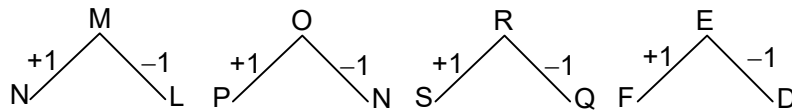
$\therefore 3x - 10 = \dfrac{1}{2}(4x - 10)$

$\Rightarrow$ 3x $-$ 10 = 2x $-$ 5

$\Rightarrow$ x = 5

$\therefore$ Sum of present ages = 3x + 4x = 7x = 7 × 5 = 35 years

24. 4

Sol.
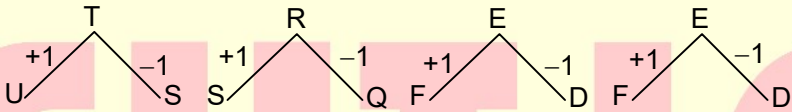
25. 1

Sol. $52 \div 4 + 5 \times 8 - 2 = 36$

$\Rightarrow 52 - 4 \times 5 + 8 \div 2 = 36$

$\Rightarrow 52 - 20 + 4 = 36$

$\Rightarrow 36 = 36$

26. 2

Sol. Let $\quad x = \sqrt{6 + \sqrt{6 + \sqrt{6 + ...}}}$

$\Rightarrow \quad x = \sqrt{6 + x}$

$\Rightarrow \quad x^2 = 6 + x$

$\Rightarrow \quad x^2 - x - 6 = 0$

$\Rightarrow \quad x^2 - 3x + 2x - 6 = 0$

$\Rightarrow \quad (x + 2)(x - 3) = 0$

$\Rightarrow \quad x = 3 \text{ or } -2$

27. 1

Sol. $\dfrac{2\dfrac{1}{3} - 1\dfrac{2}{11}}{3 + \dfrac{1}{3 + \dfrac{1}{3 + \dfrac{1}{3}}}} = \dfrac{\dfrac{7}{3} - \dfrac{13}{11}}{3 + \dfrac{1}{3 + \dfrac{1}{\dfrac{10}{3}}}}$

$$= \frac{\dfrac{77-39}{33}}{3 + \dfrac{1}{3 + \dfrac{3}{10}}} = \frac{\dfrac{38}{33}}{3 + \dfrac{1}{\dfrac{33}{10}}}$$

$$= \frac{\dfrac{38}{33}}{3 + \dfrac{10}{33}} = \frac{\dfrac{38}{33}}{\dfrac{109}{33}} = \frac{38}{109}$$

28. 2

Sol. $a^{\frac{1}{3}} = 11$

$\Rightarrow a = 11^3 = 1331$

$\therefore a^2 - 331\,a = a(a - 331)$

$= 1331\,(1331 - 331)$

$= 1331 \times 1000$

$= 1331000$

29. 4

Sol. $\dfrac{20}{(20 + 12.5 + 15 + 10 + 5 + 20 + 17.5)} \times 100 = 20\%$

30. 3

Sol. $\dfrac{\text{saving}}{\text{Transport}} = \dfrac{12.5\% \text{ of } 1,00,000}{20\% \text{ of } 1,00,000} = \dfrac{12.5}{20} = \dfrac{5}{8}$

31. 2

Sol. Let total income = x

$\therefore$ 5% of x = 12500

$\therefore$ x = 250000

$\therefore$ Expenditure on other = 17.5% of 250000 = 43750

32. 2

Sol. Let total expenditure = x

(20 – 12.5) % of x = 7500

$\therefore$ x = 1,00,000

$\therefore$ Expenditure on rent = 10% of x

$= \dfrac{10 \times 100000}{100} = 10000$

33. 2

Sol. Required percent = (15 – 12.5) = 2.5%

34. 3

Sol. Maximum number of animals in each flock = (HCF of 945 & 2475) = 45

35. 1

Sol. Total flocks $= \dfrac{945}{45} + \dfrac{2475}{45} = 21 + 55 = 76$

36. 2

Sol. Required time = LCM of (24, 36 & 54) = 216 sec

i.e. 10 : 15 : 00 AM + 216 sec = 10 : 18 : 36 AM

37. 2

Sol. Amount borrowed = P

$\therefore$ CI $-$ SI $= 140.40$

$\Rightarrow$ $P\left[\left(\dfrac{1+\frac{r}{2}}{100}\right)^{2n}-1\right]-\dfrac{P\times R\times T}{100}=140.40$

$\Rightarrow$ $P\left[1+\left(\dfrac{4}{100}\right)^2-1\right]-\dfrac{P\times 6\times 1}{100}=140.4$

$\Rightarrow$ $P\left[\left(\dfrac{26}{25}\right)^2-1\right]-\dfrac{P\times 3}{50}=140.4$

$\Rightarrow$ $P\times\dfrac{51}{625}-P\times\dfrac{3}{50}=140.4$

$\Rightarrow$ $P\left(\dfrac{102-75}{1250}\right)=140.4$

$\therefore$ $P=\dfrac{140.4\times 1250}{27}=6500$

38. 4

Sol. Total interest $=\dfrac{100000\times 6\times 6}{100}=36000$

Total money spent $= (2500 + 500) \times 6 = 18000$

$\therefore$ Money he will receive at the age of 18 = 1,00,000 + 36,000 − 18,000

= 1,18,000

39. 4

Sol. Let length of train = x m and length of platform = y m

Case (i)

$x+\dfrac{x}{2}=\left[(48+42)\times\dfrac{5}{18}\right]\times 12$ $(\because D = S\times T)$

$\Rightarrow$ $\dfrac{3x}{2}=25\times 12$

$\therefore x=\dfrac{50\times 12}{3}=200$ m

Case (ii)

$(x+y)=\left(48+\dfrac{5}{18}\right)\times 45$

$\Rightarrow$ $200 + y = 600$

$\therefore$ y = 400 m

40. 3

Sol. Time taken by thief = Time taken by police man

$\Rightarrow$ $\dfrac{x}{5\times\dfrac{5}{18}}=\dfrac{(x+400)}{9\times\dfrac{5}{18}}$ $\left(\because T=\dfrac{D}{S}\right)$

$\Rightarrow$ $9x = 5x + 2000$ (where x = required distance)

$\therefore$ x = 500 m

41. 3

Sol. $4r = h + \sqrt{r^2 + h^2}$

$\Rightarrow \quad \dfrac{4r}{h} = \dfrac{h}{h} + \dfrac{\sqrt{r^2 + h^2}}{h}$

$\Rightarrow \quad 4\left(\dfrac{r}{h}\right) = 1 + \sqrt{\left(\dfrac{r}{h}\right)^2 + 1} \qquad \left(\text{let } \dfrac{r}{h} = x\right)$

$\therefore 4x = 1 + \sqrt{x^2 + 1}$

$\Rightarrow \quad (4x - 1)^2 = \sqrt{x^2 + 1}$

$\Rightarrow \quad 16x^2 + 1 - 8x = x^2 + 1$

$\Rightarrow \quad 15x^2 = 8x$

$\Rightarrow \quad x = \dfrac{8}{15}$

$\text{i.e. } \dfrac{r}{h} = \dfrac{8}{15}$

42. 1

Sol. $x + \dfrac{1}{x} = \sqrt{3}$

$\Rightarrow \quad \left(\dfrac{x^2 + 1}{x}\right)^2 = \left(\sqrt{3}\right)^2$

$\Rightarrow \quad x^4 + 1 + 2x^2 = 3x^2$

$\Rightarrow \quad x^4 + 1 - x^2 = 0 \qquad \qquad \ldots(1)$

Now, $x^{18} + x^{12} + x^6 + 1 = x^{12}\left(x^6 + 1\right) + 1\left(x^6 + 1\right)$

$= \left(x^6 + 1\right)\left(x^{12} + 1\right)$

$= \left[\left(x^2\right)^3 + 1\right]\left(x^{12} + 1\right)$

$= \left(x^2 + 1\right)\left[\left(x^2\right)^2 + 1 - x^2\right]\left(x^{12} + 1\right)$

$= \left(x^2 + 1\right)\left(x^4 + 1 - x^2\right)\left(x^{12} + 1\right)$

$= 0$ [From equation (1)]

43. 2

Sol.
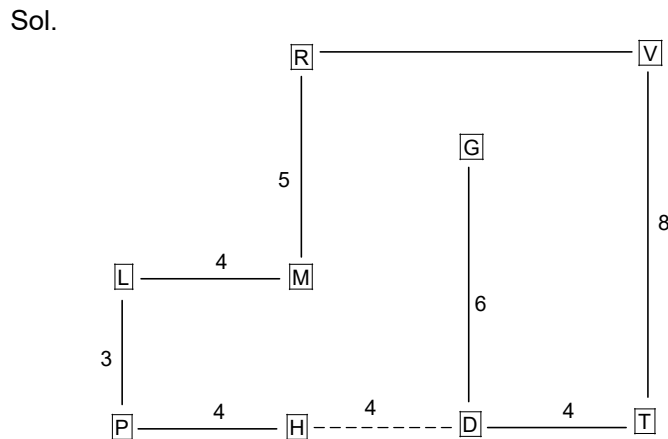
44. 4

Sol.
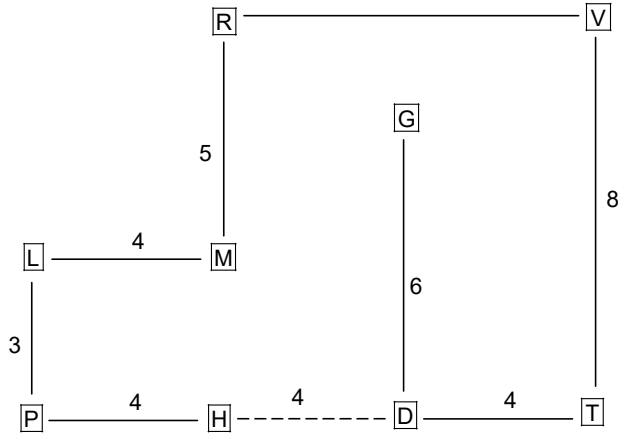
45. 2

Sol. Required time = $\dfrac{1}{\dfrac{1}{3} - \dfrac{1}{12}} = \dfrac{1}{\dfrac{4-1}{12}}$

$= \dfrac{12}{3} = 4$ hours

46. 2

Sol. Required ratio = $\dfrac{120 + 150 + 140}{200 + 180 + 110} = \dfrac{410}{490} = \dfrac{41}{49}$

47. 4

Sol. Required average = $\dfrac{120 + 150 + 140 + 180 + 160 + 210}{6}$

$= \dfrac{960}{6} = 160$

48. 2

Sol. Required % = $\dfrac{(150 + 180)}{(150 + 180)} \times 100 = 100\%$

49. 2

Sol. Required difference = $\left|(120 + 160) - (130 + 200)\right|$

$= \left|280 - 330\right|$

$= 50$

50. 1

Sol. Books read by A in 2005 = $\dfrac{120 \times 150}{100} = 180$

Books read by A in 2006 = 200

∴ Total book read by A = 180 + 200 = 380

51. 1

Sol. $2 \times 2 + 2 = 6$

$6 \times 2 + 2 = 14$

$14 \times 2 + 2 = 30$

$30 \times 2 + 2 = 62$

$62 \times 2 + 2 = \boxed{126}$

52.   2
Sol.   In this series three number from a set. The first two numbers of each set are in natural order and the third number is the sum of first and second numbers and the first number of the next set begins with double the first number of the previous set.

53.   2
Sol.   There are two alternate series
       Series I: A C E (follows +2 pattern)
       Series II: D G **J** (follows +3 pattern)

54.   4
Sol. $4 + 5 = 9$
       $9 + 10 = 19$
       $19 + 15 = 34$
       $34 + 20 = 54$
       $54 + 25 = \boxed{79}$
       $79 + 30 = 109$

55.   4
Sol. $32 \div 82 - 4 \times 12 + 4 + ?$
       After changing signs:
       $= 32 + 82 \div 4 - 12 \times 4$
       $= 32 + 20.5 - 48$
       $= 50.5 - 48$
       $= 4.5$

56.   4
Sol.   Common region of triangle and rectangle but lies outside circle.

57.   2
Sol.   Only circle (No other figure)

58.   2
Sol.   Common region of rectangle and square but lies outside triangle and circle.

59.   3
Sol.   Common region of circle and square but lies outside rectangle.

60.   3
Sol.   Common region of rectangle, circle and square but lies outside triangle

61.   1
Sol.   A square is a two dimensional figure having all its sides equal and a cube is its corresponding three dimensional figure. Similarly, three dimensional figure corresponding to a circle is a sphere.

62.   4
Sol.   'Redish' is a modified form of 'Root'. Similarly 'Rose' is a 'flower'

63. 1

Sol.

S Y S T E M , N E A R E R

S Y S M E T , A E N R E R

Similarly,

F R A C T I O N

C A R F N O I T

64. 1

Sol.

M E C H A N I C S

H C E M A S C I N

Similarly,

P O S T E R

O P T S R E

65. 4

Sol. By observation

66. 3

Sol. By observation

67. 4

Sol. By observation

68. 4

Sol. By observation

69. 2

Sol. By observation

70. 2

Sol. 3rd Dec 1999 to 3rd Jan 2000

Total number of odd days $= \dfrac{31}{7} = 3$

So, Sunday + 3 = Wednesday is the answer.

71. 2
Sol.
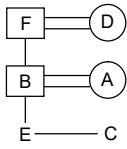
Name	Profession
A	Teacher
B	Engineer
C	Student
D	House wife
E	Student
F	Lawyer
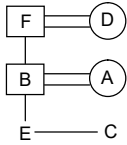
→Male
→Female

72. 3
Sol.

Name	Profession
A	Teacher
B	Engineer
C	Student
D	House wife
E	Student
F	Lawyer
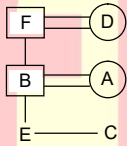
→Male
→Female

73. 4
Sol.

Name	Profession
A	Teacher
B	Engineer
C	Student
D	House wife
E	Student
F	Lawyer
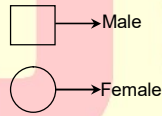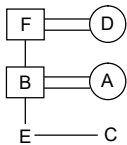
→Male
→Female

74. 1
Sol.

Name	Profession
A	Teacher
B	Engineer
C	Student
D	House wife
E	Student
F	Lawyer
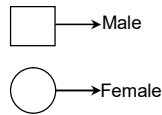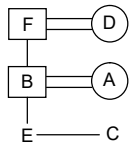
→Male
→Female

75. 1

Sol.

Name	Profession
A	Teacher
B	Engineer
C	Student
D	House wife
E	Student
F	Lawyer

□ → Male

○ → Female

76. 1

Sol.

B C F : D E G :: M N Q : O P R

+2 +2 +1   +2 +2 +1

77. 3

Sol.

S U W : R S T :: D F H : C D E

−1 −2 −3   −1 −2 −3

78. 1

Sol.

O D R S → O S R D   Similarly   P A G J → P J G A
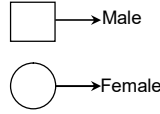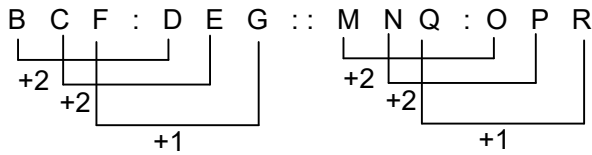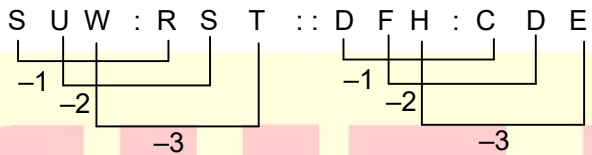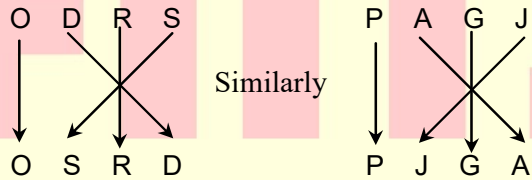
79. 4

Sol. E G I : N P R :: H J L : T V X

5 7 9   8 10 12

5 x 2 + 4 = 12 (N)
7 x 2 + 2 = 16 (P)
9 x 2 + 0 = 18 (R)

Similarly,

8 x 2 + 4 = 20 (T)
10 x 2 + 2 = 22 (V)
12 x 2 + 0 = 24 (X)

80. 2

Sol.

A B C : Z Y X :: I J K : R Q P

Opposite letters   Opposite letters
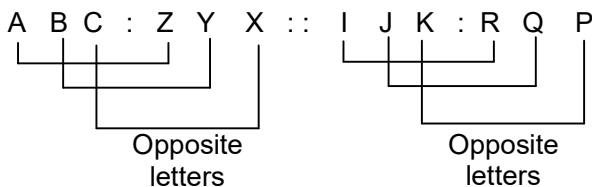
81   2 or 3
Sol.   There can be two logics for this question:
2. 460 – For this option, the pattern is: the 3rd digit is the unit's digit of the sum of the first 2 digits.
3. 572 – For this option, the pattern is: Sum of smaller 2 digits is the 3rd digit.

82.   3
Sol.   In all the numbers, the product of the 1st and last digits is a multiple of the sum of the middle two digits.
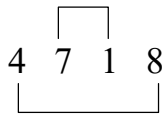
4   7   1   8   4 x 8 = 32 is a multiple of 8(7 + 1)

Similarly,
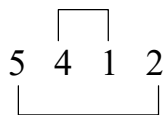
5   4   1   2   5 x 2 = 10 is a multiple of 5(4 + 1)

83.   *
Sol.   However, given question is incorrect. In place of 52 there should be 63. Then, answer will be option 2.

84.   4
Sol.   Each set consists of numbers which are obtained by multiplying a certain number by 9, 7 and 5 respectively.
So, in the given set:
7 x 9 = 63
7 x 7 = 49
7 x 5 = 35

Similarly,

(81, 63, 45)
9 x 9 = 81
9 x 7 = 63
9 x 5 = 45

Or we can say that the ratio of the given set is 9 : 7 : 5

85.   3
Sol.

G   =   D

A   =   B   — R =   P
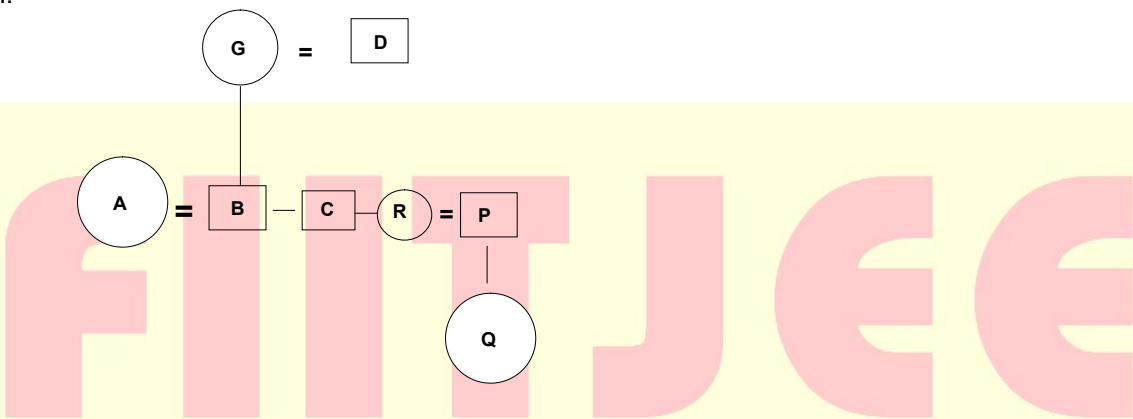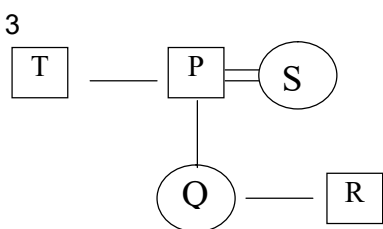
Q

86.   2
Sol.

87.   1
Sol.
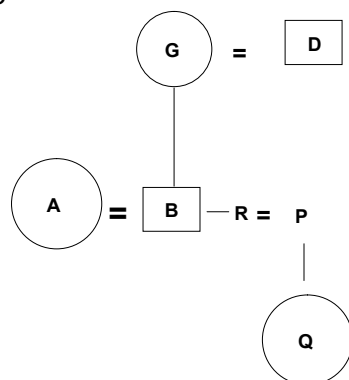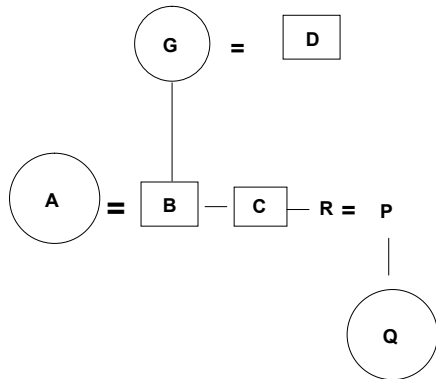
88.   3
Sol.

S is Sister – in – law of T

89.   *
Sol.   A = 3 B … (i)
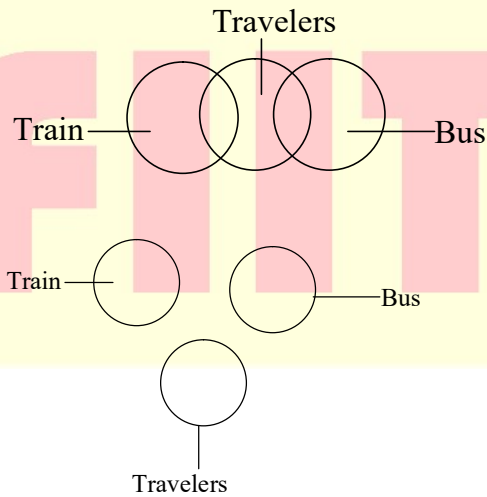   C – 4 = 3 (A – 4) … (ii)
        A + 4 = 31 (given) So, A = 27

        By eq (i) → A = 3 B ⇒ 27 = 3B ⇒ B = $\dfrac{27}{3} = 9$

        By eq. (ii) C – 4 = 3 (27 - 4)
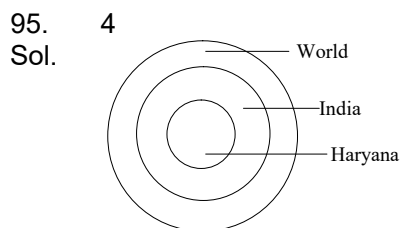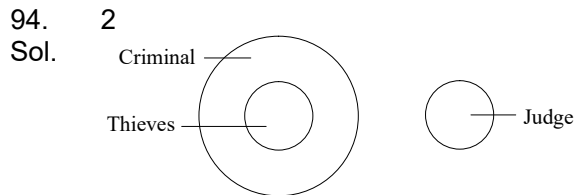   C – 4 = 69, C = 73

90. 3

Sol. A → opposite E
      B → opposite D
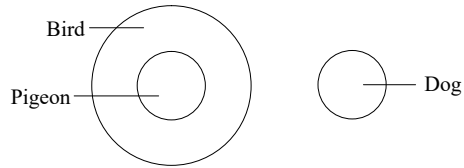   C → opposite F

91. 3

Sol.

92. 3

Sol.
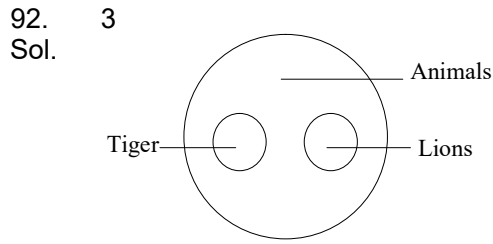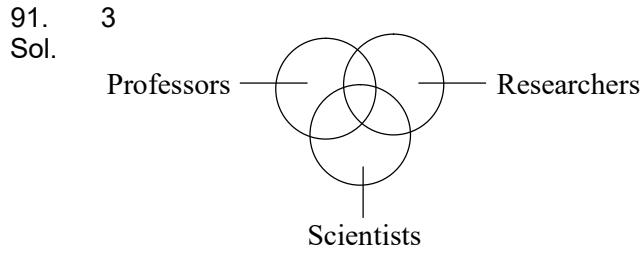
93. 1* or 4

Sol.

Option is 1 most suitable answer. However, 4 also can be considered as it as 3 different entities Traveler, Train and Bus.

94. 2

Sol.

95. 4

Sol.

96. 1
Sol.

97. 1
Sol. In all other options except 1, second is the collective group of the first

98. 1
Sol. In all other options except 1, second word indicates a state of non – functioning of the first.

99. 2
Sol. In all other options except 2, first is the disease caused by the second

100. 1
Sol. 4 → opposite 3
      2 → opposite 5
      6 → opposite 1