NIMCET-2019

Mathematics

1. For two circles $x^2 + y^2 = 16$ and $x^2 + y^2 - 2y = 0$, there is/are

(a) One pair of common tangents.
(b) Two pairs of common tangents.
(c) Three common tangents.
(d) No common tangents.

2. Let $f : R \to R$ be defined by $f(x) = \begin{cases} x \sin\left(\frac{1}{x}\right), & \text{if } x > 0 \\ 0, & \text{if } x \le 0 \end{cases}$.

Then,

(a) f is neither continuous nor differentiable at 0.
(b) f is continuous and differentiable at 0.
(c) f is continuous but not differentiable at 0.
(d) f is not continuous but differentiable at 0.

3. A particle P starts from the points $z_0 = 1 + 2i$, where $i = \sqrt{-1}$ moves first horizontally away from the origin by 5 units and then vertically away from the origin by 3 units to teach to point z_1. From z_1 the particle moves $\sqrt{2}$ units in the direction of the vector $\hat{i} + \hat{j}$ and, then it moves through an angle $\frac{\pi}{2}$ in the anti-clockwise direction on a circle with centre at the origin, to reach point z_2. The point z_2 is given by

(a) $6 + 7i$ (b) $-7 + 6i$
(c) $7 + 6i$ (d) $-6 + 7i$

4. If $\Delta = a^2 - (b - c)^2$, where Δ is the area of the ΔABC, then $\tan A$ equals

(a) $\frac{15}{16}$ (b) $\frac{8}{15}$
(c) $\frac{8}{17}$ (d) $\frac{1}{2}$

5. Two numbers a and b are chosen at random from a set of first 30 natural numbers, then the probability that $a^2 - b^2$ is divisible by 3 is

(a) $\frac{47}{87}$ (b) $\frac{15}{87}$
(c) $\frac{12}{87}$ (d) $\frac{9}{87}$

6. A man takes a step forward with probability 0.4 and backwards with probability 0.6. The probability that at the end of eleven steps, he is one step away from the starting point is

(a) $462(0.34)^5$ (b) $462(0.04)^5$
(c) $462(0.14)^5$ (d) $462(0.24)^5$

7. Let $x_i, i = 1, 2, \ldots, n$ be n observations and $w_i = px_i + k$, $i = 1, 2, \ldots, n$ where p and k are constants. If the mean of x_i is 48 and standard deviation is 12, whereas the mean of w_i's is 55 and standards deviation is 15, then the values of p and k should be

(a) $p = 1.25, k = -5$ (b) $p = -1.25, k = 5$
(c) $p = 2.5, k = -5$ (d) $p = 25, k = 5$

8. If x, y, z are distinct real numbers and $\begin{vmatrix} x & x^2 & 2 + x^3 \\ y & y^2 & 2 + y^3 \\ z & z^2 & 2 + z^3 \end{vmatrix} = 0$, then xyz is equal to

(a) 1 (b) -1 (c) 2 (d) -2

9. Let $f(x)$ be a polynomial satisfying, $f(0) = 2$, $f'(0) = 3$ and $f''(x) = f(x)$. Then, $f(4)$ is equal to

(a) $\frac{5(e^8 - 1)}{2e^4}$ (b) $\frac{5e^8 - 1}{2e^4}$
(c) $\frac{2e^4}{5e^8 - 1}$ (d) $\frac{2e^4}{5(e^8 + 1)}$

10. If $a, a_1, a_2, a_3, \ldots, a_{2n-1}, b$ are in AP, $a, b_1, b_2, b_3, \ldots, b_{2n-1}, b$ are in GP and $a, c_1, c_2, c_3, \ldots, c_{2n-1}, b$ are in HP, where a, b are positive, then the equation $a_n x^2 - b_n x + c_n = 0$ has its roots

(a) real and equal
(b) real and unequal
(c) imaginary
(d) one real and one imaginary

11. Solution set the inequality $\log_3(x + 2)(x + 4) + \log_{1/3}(x + 2) < \frac{1}{2}\log_{\sqrt{3}} 7$ is

(a) $(-2, -1)$ (b) $(-2, 3)$ (c) $(-1, 3)$ (d) $(3, \infty)$

12. If a, b, c are in GP and $\log a - \log 2b, \log 2b - \log 3c$ and $\log 3c - \log a$ are in AP, then a, b, c are the lengths of the sides of a triangle which is

(a) acute angle (b) obtuse angled
(c) right angled (d) equilateral

13. If x, $2x+2$, $3x+3$ are the firs three terms of a geometric progression, then 4th t m in the geometric progression is

(a) -13.5 (b) 13.5
(c) -27 (d) 27

14. If $(1+x-2x^2)^6 = 1 + a_1x + a_2x^2 + \ldots + a_{12}x^{12}$, then the value $a_2 + a_4 + a_6 + \ldots + a_{12}$ is

(a) 29 (b) 30 (c) 31 (d) 32

15. If a and b are the greatest values of ${}^{2n}C_r$ and ${}^{2n-1}C_r$ respectively, then

(a) $a = 2b$ (b) $b = 2a$
(c) $a = b$ (d) $a^2 = 2b^2$

16. Let U and V be two events of a sample spaces S and $P(A)$ denote the probability of an event A. Which of the following statements is true?

(a) If $P(U) = P(V)$ then $U = V$
(b) If $P(U) = 0$ then $U^c = S$
(c) If $U \cap V = \phi$ then U and V are independent.
(d) If U and V are independent then so are U^c and V^c.

17. If a man purchases a raffle ticket, he can win a first prize of ₹ 5000 or a second prize of ₹ 2000 with probabilities 0.001 and 0.003 respectively. What should be a fair price to pay for the ticket?

(a) ₹ 11 (b) ₹ 15
(c) ₹ 2000 (d) None of these

18. If the mean deviation of the number $1, 1+d, 1+2d, \ldots, 1+100d$ from their mean is 255, then d is equal to

(a) 10.1 (b) 10.2
(c) 10.3 (d) 10.4

19. If $\sum_{i=1}^{n} x_i = 80$ and $\sum_{i=1}^{n} x^2 = 400$, then a possible value of n among the following is

(a) 9 (b) 12 (c) 15 (d) 18

20. Let S be the set $\{a \in Z^+ : a \le 100\}$. If the equation $[\tan^2 x] - \tan x = 0$ has real roots (where $[\cdot]$ is the greatest integer function), then the number of elements in S is

(a) 10 (b) 8
(c) 9 (d) 0

21. If $\sin^2 x \tan x + \cos^2 x \cot x - \sin 2x = 1 + \tan x + \cot x$, $x \in (0, \pi)$, then x

(a) $\frac{3\pi}{12}, \frac{5\pi}{12}$ (b) $\frac{5\pi}{12}, \frac{7\pi}{12}$
(c) $\frac{7\pi}{12}, \frac{11\pi}{12}$ (d) $\frac{7\pi}{12}, \frac{9\pi}{12}$

22. a and b are non-zero non-collinear vectors such that $|a| = 2$, $a.b = 1$ and the angle between a and b is $\frac{\pi}{3}$.

If r is any vectors satisfying $r.a = 2$, $r.b = 8$, $(\mathbf{r} + 2a - 10\mathbf{b}) \cdot (\mathbf{a} \times \mathbf{b}) = 6$ and $r + 2a - 10a = \lambda(a \times b)$, then λ is equal to

(a) $\frac{1}{2}$ (b) 2 (c) $\frac{4}{\sqrt{3}}$ (d) 3

23. In a chess tournament, n men and 2 women players participated. Each player plays 2 games against every of her player. Also, the total number of games played by the men among themselves exceeded by 66 the number of games that the men played against the women. Then the total number of players in the tournament is

(a) 13 (b) 11 (c) 9 (d) 7

24. Suppose $A_1, A_2, \ldots, A_{30}$ are thirty sets each having 5 elements with no common element across the sets and $B_1, B_2, \ldots, B_n$ are n sets each having 3 elements with no common element across the sets. Let $\bigcup_{i=1}^{30} A_i = \bigcup_{j=1}^{n} B_j = S$ and each element of S belong to exactly 10 of A_i's and exactly 9 of B_j's. The value of n is equal to

(a) 15 (b) 30 (c) 40 (d) 45

25. If $f(x) = \begin{cases} \cos[x], & x \ge 0 \\ |x| + a, & x < 0 \end{cases}$, where $[x]$ denotes the greatest integer $\le x$. If f should be continuous at $x = 0$, then a must be

(a) 0 (b) 1 (c) 2 (d) -1

26. If x is real, then the minimum value of $\frac{x^2 - x + 1}{x^2 + x + 1}$ is

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

27. If $\int \cos x \cos 2x \cos 5x \, dx = A_1 \sin 2x + A_2 \sin 4x + A_3 \sin 6x + A_4 \sin 8x + c$, then the values of A_1, A_2, A_3, A_4 are

(a) $A_1 = \frac{1}{2}, A_2 = \frac{1}{4}, A_3 = \frac{1}{6}, A_4 = \frac{1}{8}$
(b) $A_1 = \frac{1}{8}, A_2 = \frac{1}{16}, A_3 = \frac{1}{24}, A_4 = \frac{1}{32}$
(c) $A_1 = \frac{1}{6}, A_2 = \frac{1}{12}, A_3 = \frac{1}{18}, A_4 = \frac{1}{24}$
(d) $A_1 = \frac{1}{4}, A_2 = \frac{1}{8}, A_3 = \frac{1}{12}, A_4 = \frac{1}{16}$

28. If $\int_{\log 2}^{x} \frac{1}{\sqrt{e^x - 1}} dx = \frac{\pi}{6}$, then x is equal to

(a) $\log 2$ (b) $2 \log 2$
(c) $3 \log 2$ (d) $4 \log 2$

29. Equation of the tangents from the point $(3, -1)$ to the ellipse $2x^2 + 9y^2 = 3$ is

(a) $2x - 3y - 3 = 0$ (b) $2x + 3y - 3 = 0$
(c) $2x + y - 3 = 0$ (d) None of these

30. The position vectors of the vertices A, B, C of a tetrahedron $ABCD$ are $\hat{i}+\hat{j}+\hat{k}$, $\hat{i}$ and $3\hat{i}$ respectively and the altitude from the vertex D to the opposite face ABC meets the face at E. If the length of the edge ED is 4 and volume of the tetrahedron is $\frac{2\sqrt{2}}{3}$, then the length of DE is

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

31. If S and S' are foci of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, B is the end of the minor axis and BSS' is an equilateral triangle, then the eccentricity of the ellipse is

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) $\frac{1}{5}$

32. The equation of the circle passing through the point (4, 6) and whose diameters are along $x+2y-5=0$ and $3x-y-1=0$ is

(a) $x^2+y^2-2x-6y-20=0$
(b) $x^2+y^2-6x-2y-20=0$
(c) $x^2+y^2-2x-4y-20=0$
(d) $x^2+y^2-4x-2y-20=0$

33. In a parallelogram $ABCD$, P is the mid-point of AD. Also, BP and AC intersect at Q. Then $AQ:QC$ is equal to

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

34. The median AD of ΔABC is bisected at E and BE is extended to meet the side AC in F, then $AF:FC$ is equal to

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

35. Let $p(x)$ be a quadratic polynomial such that $p(0)=1$. If $p(x)$ leaves remainder 4 when divided by $x-1$ and it leaves remainder 6 when divided by $x+1$, then

(a) $p(-2)=11$ (b) $p(2)=11$
(c) $p(2)=10$ (d) $p(-2)=10$

36. The tangent at the point $(2,-2)$ to the curve $x^2y^2-2x=4(1-y)$ does not pass through the point .....

(a) $(-2,-7)$ (b) $(-4,-9)$
(c) 4, 1/3 (d) (8, 5)

37. The integral $\int\sqrt{1+2\cot x(\operatorname{cosec}x+\cot x)}\,dx$; $\left(0<x<\frac{\pi}{2}\right)$ (where, C is a constant of integration) is equal to

(a) $2\log\left(\sin\frac{x}{2}\right)+C$ (b) $2\log\left(\cos\frac{x}{2}\right)+C$
(c) $4\log\left(\cos\frac{x}{2}\right)+C$ (d) $4\log\left(\sin\frac{x}{2}\right)+C$

38. If all the words, with or without meaning, are written using the letters of the word QUEEN and are arranged as in English dictionary, then the position of the word QUEEN is

(a) 47th (b) 44th (c) 45th (d) 46th

39. The curves satisfying the differential equation, $ydx-(x+3y^2)\,dy=0$ and passing through the point (1, 1) also passes through the point .....

(a) $\left(\frac{1}{4},\frac{1}{2}\right)$ (b) a $\left(\frac{1}{4},-\frac{1}{2}\right)$
(c) $\left(-\frac{1}{3},\frac{1}{3}\right)$ (d) $\left(\frac{1}{3},-\frac{1}{3}\right)$

40. $\lim\limits_{x\to 3}\frac{\sqrt{3x}-3}{\sqrt{2x-4}-\sqrt{2}}$ is equal to

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

41. The sum of infinite terms of decreasing GP is equal to the greatest values of the function $f(x)=x^3+3x-9$ in the interval $[-2, 3]$ and the difference between the first two terms is $f'(0)$. Then the common ratio of the GP is

(a) $-\frac{2}{3}$ (b) $\frac{4}{3}$
(c) $\frac{2}{3}$ (d) $-\frac{4}{3}$

42. Number of onto (surjective) function from A to B if $n(A)=6$ and $n(B)=3$ is

(a) 2^6-2 (b) 3^6-3 (c) 340 (d) 540

43. If $|z|<\sqrt{3}-1$, then $|z^2+2z\cos\alpha|$ is

(a) less than 2 (b) $\sqrt{3}+1$
(c) $\sqrt{3}-1$ (d) None of these

44. A computer producing factory has only two plants T_1 and T_2. Plant T_1 produces 20% and plant T_2 produces 80% of the total computer produced. 7% of the computers produced in the factory turn out to be defective. It is known that P(computer turns out to the defective given that it is produced in plant T_1) $=10P$(computer turns out to be defective given that it is produced in plant T_2).

A computer produced in the factory is randomly selected and its does not turn out to the defective. Then, the probability that it is produced in plant T_2 is

(a) $\frac{36}{73}$ (b) $\frac{47}{79}$ (c) $\frac{78}{93}$ (d) $\frac{75}{83}$

45. If $A>0, B>0$ and $A+B=\frac{\pi}{6}$, then the minimum value of $\tan A+\tan B$ is

(a) $\sqrt{3}-\sqrt{2}$ (b) $4-2\sqrt{3}$
(c) $\frac{2}{\sqrt{3}}$ (d) $2-\sqrt{3}$

46. The mean of 5 observation is 5 and their variance is 124. If three of the observations are 1, 2, 6, then the mean deviation from the mean of the data is

(a) 2.5 (b) 2.6
(c) 2.8 (d) 2.4

47. In a beauty contest, half the number of experts voted Mr. A and two-third voted for Mr. B 10 voted for both and 6 did not for either. How many experts were there in all?

(a) 13 (b) 36
(c) 24 (d) None of these

48. The value of scalar α and β such that for all non-collinear vectors a and b such that $\alpha(\mathbf{a}+2\mathbf{b})-\beta(4\mathbf{b}-\mathbf{a})=0$ is

(a) $\alpha=0, \beta=0$ (b) $\alpha=-2, \beta=-3$
(c) $\alpha=1, \beta=3$ (d) $\alpha=-2, \beta=3$

49. A force of 78 grams acts at the point (2, 3, 5). The direction ratios of the line of action being 2, 2, 1. The magnitude of its moment about the line joining the origin to the point (12, 3, 4), is

(a) 2 (b) –136
(c) 36 (d) 0

50. Number of real solution of the equation $\sin(e^x)=5^x+5^{-x}$ is

(a) 0
(b) 1
(c) 2 (d) Infinitely many

Analytical Ability & Logical Reasoning

51. Which one of the given options fits correctly in the blank space so that the pattern is maintained?

3 4 5
25 2 49 3 ? 3

(a) 49 (b) 64 (c) 81 (d) 100

52. **Statement I** Out of total of 200 readers, 100 read Indian Express, 120 read Times of India and 50 read Hindu.

Statement II Out of a total 200 readers, 100 read Indian Express, 121 reads Times of India and 50 read neither.

How many people (from the group surveyed) read both Indian Express and Times of India?

(a) The question can be answered with the help of Statement II alone.
(b) Both, Statement I and Statement II are needed to answer the question.
(c) The question can be answered with the help of Statement I alone.
(d) The question cannot be answered even with the help of both the statements

53. If 137 + 276 = 435, how much is 731 + 672?

(a) 534 (b) 1403 (c) 1623 (d) 1531

Direction (Q. No. 54) *Study the information carefully and answer the questions given below :*

54. If we arrange the alphabets in the word "RATE" in the English alphabetical order, word "AERT" is formed. Then the third alphabet from the left in this word in "R". Similarly, from the word "OPEN' we get "ENOP" and the third alphabet from left is "O". From the word "CHEF" we get - "CEFH" and the third alphabet from left is "F". From the word "TYER" we get - "ERTY" and the third alphabet from left is "T". From the word "TOY" we get - "OTY" and the third alphabet from left is "Y". If use all these letters, then a meaningful English word "FORTY" can be formed.

Now, find which of the following word set does not give a meaningful word in the similar way

(a) SAME, ROOM, BEST, AUTO
(b) GOAT, PEST, WATT, ARMY
(c) MALE, FIND, LOST, THAT
(d) JUMP, LIME, DUMB, SOME

55. Navjivan Express from Ahmedabad to Chennai leave Ahmedabad at 6:30 AM and travels at 50 kmph towards Baroda situated 100 km away. At 7:00 AM Howrah - Ahmedabad Express leave Baroda towards Ahmedabad and travels at 40 kmph. At 7:30 AM Mr. Shah, the traffic controller at Baroda, realizes that both the trains are running on the same track. How much time does he have to avert a head on collision between the two trains?

(a) 15 min (b) 20 min (c) 25 min (d) 30 min

56. If A, B and C are sets, then $(A-(B-C)$ equals

(a) $(A-B)\cup(A\cap C)$ (b) $(A-B)-C$
(c) $(A-B)\cap(A-C)$ (d) $(A-B)\cup(A-C)$

57. Some friends planned to contribute equally to jointly buy a CD player. However, two of them decided to withdraw at the last minute. As a result, each of the had to shell out one rupee more than what they had planned for. If the price (in ₹) of the CD player is an integer between 1000 and 1100, find the number of friends who actually contributed

(a) 44 (b) 23 (c) 21 (d) 46

58. Two liquid A and B are in the ratio 5 : 1 in container 1 and 1 : 3 in container 2 respectively. In what ratio should the content of the two containers be mixed so as to obtain a mixture of A and B in the ratio 1 : 1?

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

59. In five flats, one above the other, live five professionals. The professor has to go up to meet his IAS officer friend. The doctor is equally friendly to all and has to go up as frequently as go down. The engineer has to go up to meet his MLA friend above whose flat lives the professor's friend. From the ground floor to the top floor, in what order do the five professionals live?

(a) Engineer, professor, doctor, IAS officer, MLA
(b) Professor, engineer, doctor, IAS officer, MLA
(c) IAS officer, engineer, doctor, professor, MLA
(d) Professor, engineer, doctor, MLA, IAS officer

60. Fresh grapes contains 90% water by weight while dried grapes contain 20% water by weight. What is the weight of dry grapes available from 20 kg of fresh grapes?

(a) 2.5 kg (b) 2.4 kg
(c) 2 kg (d) 10 kg

Directions (Q. Nos. 61 and 62) *Answer the questions on the basis of the information given below.*

A, B, C, D, E and F are a group of friends. There are two housewives, one professor, one engineer, one accountant and one lawyer in the group. There are only two married couples in the group. The lawyer is married to D, who is housewife. No woman in the group is either an engineer or an accountant. C, the accountant, is married to F, who is professor. A is married to a housewife. E is not a housewife.

61. What is E's profession?

(a) Accountant (b) Lawyer
(c) Professor (d) Engineer

62. How many members of the group are males?

(a) 2 (b) 3
(c) 4 (d) Cannot be determined

63. Find the wrong number in the series 7, 8, 18, 57, 228, 1165, 6996

(a) 228 (b) 18 (c) 57 (d) 8

Directions (Q. Nos. 64 and 65) *Each of the questions given below consists of a statement and/or a question and two statement numbered I and II given below it. You have to decided whether the data provided in the statement(s) is/are sufficient to answer the given question. Read the both statements and*

Give answer (U) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.

Give answer (V) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.

Give answer (W) if the data either in Statement I or in Statement II alone are sufficient to answer the question.

Give answer (X) if the data is both Statements I and II together are not sufficient to answer the question.

Give answer (Y) if the data in both Statements I and II together are necessary to answer the question.

64. How much time will the leak take to empty the full cistern?

I. The cistern is normally filled in 9 hrs.
II. It takes one hour more than the usual time to fill the cistern because of a leak in the bottom.

(a) V (b) U (c) X (d) Y

65. How long will it take to empty the tank if both the inlet pipe P_1 and the outlet pipe P_2 are opened simultaneously?

I. P_1 can fill the tank in 16 minutes.
II. P_2 can empty the full tank in 8 minutes.

(a) X (b) U (c) Y (d) V

66. How many positive integer less than 10,000 are such that the product of their digits is 210?

(a) 36 (b) 42 (c) 48 (d) 54

67. Each of the five people K, L, M, P and Q is of a different weight. It is known that the number of people heavier than P is the same as the number of people lighter than Q. L is the heaviest and K is not the lightest. Who is the lightest?

(a) M (b) L (c) Q (d) P

68. John, Johny and Janardan participated in a race and each won a different medal among Gold, Silver and Bronze, not necessarily in that order. Each person among them gives two replies to any question, one of which is true and the other is false (in any order). When asked about the details of medals obtained by them, the following were their replies ;

John : I won the Gold medal. Johny won the Bronze medal.

Johny : John won the Silver medal. I won the Gold medal.

Janardan : Johny won the Silver medal. I won the Gold medal.

Which among the following is the correct order of the people who won the Gold medal, the Silver medal and the Bronze medal, respectively.

(a) John, Johny, Janardan (b) Janardan, John, Johny
(c) Johny, Janardan, John (d) Janardan, Johny, John

69. Each of A, B, and C is different digit among 1 to 9. How many different values of the sum of A, B and C are possible, if $ABA \times AA = ACCA$?

(a) 1 (b) 3 (c) 7 (d) 8

70. In a certain code language, if the word 'BASKET' is coded as 'UFLTBC', then how is the word 'SIMPLE' coded in that language?

(a) FMQNJT (b) FMQGNJ
(c) FMQNJH (d) MFNQTJ

71. A grocer sells half of the eggs that he has and another half an egg to Anurag. Then he sells half of the balance egg and another half an egg to Deepak. Then he sells half of the balance eggs and another half an eggs to Shivani. In the end he is left with just 7 eggs and he claims that he never broke an egg. How many eggs did he start with?

(a) 65 (b) 63 (c) 67 (d) 69

72. There are eight poets, namely O, P, Q, R, S, U, V and W in respect of whom question are being asked in the examination. The first four are ancient poets and the last four are modern poets. The question on ancient and modern poets is being asked in alternate year's. Those who like W also V, those who like S like R also. The examiner who sets question like S. Last year a question was asked on U, consideration these facts, on which poet the question is most likely to be asked this year?

(a) Q (b) R (c) S (d) V

73. A team must be selected from the ten probable players. A, B, C, D, E, F, G, H, I and J are forwards, B, G and H are points guards and D, F and I are defends. The team must have at least one forward, one point guard and one defender. If the team includes J, it must also include F. The team must include E or B but not both. If team includes G, It must include F. The team must include exactly one among C, G I and F cannot be members of the same team. D and H cannot be members of the same team. The team must include both A and D or neither of them. There is no restriction on the number of member in the team. What could be the maximum size of the team that include G?

(a) 4 (b) 5
(c) 6 (d) more than 6

74. How many 4 digit numbers can be formed from the digits 2, 3, 5, 6, 7 and 9, which are divisible by 5 and none of the digits is repeated?

(a) 216 (b) 60 (c) 24 (d) 25

75. P, Q, R, S, T and U are 6 members of family in which there are two married couples. T, a teacher, is married to a doctor who is mother of R and U. Q, the lawyer, is married to P. P has one son and one grandson. Of the two married ladies one is a housewife. There is also one student and one male engineer in the family.

Which of the following is true about the granddaughter of the family?

(a) She is a lawyer (b) She is an engineer
(c) She is a student (d) She is a doctor

76. 1. All chickens are birds.
2. Some chickens are hens.
3. Female birds lay eggs

If the above three statements are facts, which of the following statement must also be a fact?

I. All birds lay eggs
II. Some hens are birds
III. Some hens are chickens

(a) II only
(b) II and III only
(c) I, II and III
(d) None of the statements is a known fact

77. The number that comes next in the series 1, 2, 3, 6, 11, 20, 37, 68, ... is

(a) 105 (b) 124
(c) 125 (d) 126

78. Using only 2, 5, 10, 25 and 50 paise coin, the smallest number of coin required to pay exactly 78 paise, 69 paise and ₹ 1.01 to three different persons is

(a) 17 (b) 20
(c) 19 (d) 18

79. What pair comes next in the following sequence 99, 90, 83, 78, ...

(a) 75, 74 (b) 69, 57
(c) 67, 59 (d) 69, 63

80. A dealer offers a cash discount of 20% and still makes a profit of 20% when he further allows 16 articles to a dozen to a particularly sticky bargainer. How much above the actual price was the listed price of the article?

(a) 100% (b) 80%
(c) 75% (d) 66%

Directions (Q. Nos. 81-83) *Read the following information carefully and answer the questions based on it.*

Twelve classmates A, B, C, D, E, F, G, H, I, J, K and L are sitting on a square table with 3 persons on each side. ABC and GJK are sitting on opposite sides, A and L are adjacent to each other but not on the left, D and E are on the same side but not adjacent to each other. K is sitting diagonally opposite to C.

81. If F is sitting between D and E, who is sitting to the left of K?

(a) H (b) I
(c) H or I (d) None of these

82. If H is sitting between L and F, then he will be facing

(a) D (b) E (c) G (d) I

83. If G and E are facing C and H respectively, the neighbours of K are

(a) J and H (b) J and E
(c) H and J (d) H and [illegible]

84. The integers 34041 and 32506 when divided by a 3-digit integers n leave the same remainder. What is the value of n?

(a) 289 (b) 307 (c) 367 (d) 493

85. The number of solid spheres, each of diameter 3 cm that could be moulded to form a solid cylinder of height 54 cm and diameter 4 cm is

(a) 16 (b) 24 (c) 36 (d) 48

86. A clock is set right at 5 AM. The clock loses 16 m in 24 h. What will be the right time when the clock indicates 10 PM on the 4th day?

(a) 11:15 PM (b) 11:00 PM
(c) 12:00 PM (d) 12:30 PM

87. A train overtakes two persons who are walking in the same direction in which the train is moving at the rate of 2 kmph and 4 kmph and passes them completely in 9 and 10 seconds respectively. Then length of the train is

(a) 72 m (b) 54 m
(c) 50 m (d) 45 m

88. Decide which of the given conclusion logically follow from the given statements(s).

Statements

All suns are moons.
Some moons are planets.

Conclusions

I. All moons are suns.
II. At least some moons are planets.

(a) Either conclusion I or II is true
(b) Neither conclusion I nor II is true
(c) Both conclusion I and II are true
(d) Only conclusion II is true

89. Ten points are marked on a straight line and eleven points are marked on another straight line. How many triangle can be constructed with vertices from the above points?

(a) 495 (b) 550 (c) 1045 (d) 2475

90. The greatest number which on dividing 1657 and 2037 leaves remainders 6 and 5 respectively is

(a) 123 (b) 127 (c) 235 (d) 305

Computer Awareness

91. In IEEE single precision floating point representation, exponent is represent in .....

(a) 8 bit sign-magnitude representation.
(b) 8 bit 2, s complement representation.
(c) Biased exponent representation with a bias value of 127.
(d) Biased exponent representation with a bias value of 128.

92. With 4-bit 2's complement arithmetic, which of the following additions will result in an overflow?

(a) 1111 + 1101
(b) 01110 + 0110
(c) 1101 + 0101
(d) 0101 + 1011

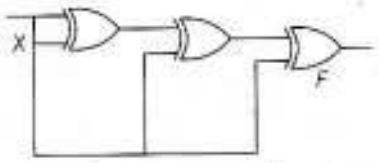
93. If we can generate a maximum of 4 boolean functions using n boolean variables, then what will be the minimum value of n?

(a) 65536 (b) 16
(c) 1 (d) 4

94. If the 2's complement representation of a number is $(011010)_2$, what is its equivalent hexadecimal representation?

(a) $(110)_{16}$
(b) $(1A)_{16}$
(c) $(16)_{16}$
(d) $(26)_{16}$

95. For the circuit shown below, the component of the output F is



(a) 0 (b) X (c) X^1 (d) 1

96. If N is a 16 bit signed integer, the 2's complement represent of N is $(F87B)_{16}$. The 2's complement representation of $8N$ is

(a) $(C3D8)_{16}$ (b) $(187B)_{16}$ (c) $(F878)_{16}$ (d) $(987B)_{16}$

97. The base (or radix) of the number system such that the following equation holds 312 / 20 = 13.1 is

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

98. Which of the following represents $(D4)$ is?

(a) $(4E)_{16} - (5B)_{16}$ (b) $(14E)_{16} - (7A)_{16}$
(c) $(15C)_{16} - (6D)_{16}$ (d) $(1E4)_{16} - (A7)_{16}$

99. How many Boolean expression can be formed with 3 Boolean variables?

(a) 16 (b) 1024 (c) 32 (d) 256

100. In an 8 bit representation of computer system the decimal number 47 has to be subtracted from 38 and the result in binary 2's complement is .....

(a) 11110111 (b) 10001001
(c) 11111001 (d) 11110001

General English

101. Choose a phrasal verb replace the explanation in brackets "we must (be quick) ..... or we'll be late for school".

(a) act up (b) hurry up
(c) fasten on (d) speed in

102. Anne had to pay for everything because as usual, Peter .....his wallet at home.

(a) had left (b) was leaving
(c) left (d) leave

103. Extreme old age when a man behaves like a child.

(a) Imbecility (b) Senility
(c) Dotage (d) Superannuation

104. Identify the word that mean "to try achieve is something in difficult circumstances despite of setbacks".

(a) Persuade (b) Persevere
(c) Picturesque (d) Perpective

105. In the following a part of the sentence is underlined. Four different ways of phrasing the underlined part are indicated below. Choose the best alternative among the four choice given.

When he entered the house, it was at sixes and sevens.

(a) It was six O' clock when he entered the house.
(b) Inmates were eulogized when he entered.
(c) House was in pandimonium.
(d) House was blissful.

106. Fill in the blank choosing the correct adjective : The phoenix is a ..... Bird.

(a) Mythical (b) Ethical
(c) Natural (d) Carnivorous

107. Which of the following is the correct passive of the sentence "JOHN HAS EATEN THE APPLES?"

(a) The apples are being eaten by John.
(b) The apples are eaten by John.
(c) The apples have been eaten by John.
(d) The apples will be eaten by John.

108. Choose one of the words that is most nearly same as meaning of the given word **Indemnify**.

(a) Insure (b) Compensate for loss
(c) Assure (d) Sure for damages

109. Select a word from the given alternatives which has the same meaning as the underlined word.

He has a propensity for getting into debt.

(a) Tendency (b) Aptitude
(c) Characteristic (d) Quality

110. Select the most suitable synonym from the given choices for the word : ["ANTEDILUVIAN"]

(a) Recluse (b) Maverick (c) Archaic (d) Bellicose

111. Select the most suitable antonym from the given choices for the word : ["SANGFROID"]

(a) Equanimity
(b) Steadiness
(c) Aplomb
(d) Turbulence

112. The word PIN is used in four different ways. Choose the option in which the usage of the word is incorrect or inappropriate.

(a) She combed her hair backwards and secured it with a pin.
(b) Jack managed to grab the thief and pin him against the wall until the police arrived on the scene.
(c) It is imprudent to pin your hopes on someone to help you out of this situation.
(d) You can't pin the blame at anyone without verifying facts.

113. Pick the most appropriate substitute to the capitalized word in the following sentence.

The weapon inspector's report was not expected to provide INCONTROVERTIBLE evidence of weapons of mass destruction.

(a) Conclusive
(b) Disputable
(c) Inconvenient
(d) Indecisive

Direction (Q. No. 114) *In the sentence given below a part of sentence is underlined. Four different ways phrasing the underlined part are indicated as four choices. Choose the best alternative and mark its corresponding letter as your answer.*

114. A nation is built not by legislation but by stirrings in the hearts of the people.

(a) By legislation and inspiration.
(b) Not by laws but by the excitement of the people.
(c) By law and by inciting the people.
(d) More by the passion in the hearts of the people than by laws.

115. Select the most suitable synonym for the underlined word in the sentence.

All the members of organisation expressed implacable opposition to the move.

(a) Indignant (b) Adamant
(c) Unified (d) Quixotic

Directions (Q. Nos. 116 and 117) *There are two blanks in the sentences given below. From the pairs of words given below the sentence, choose the pair that fills blanks most appropriately.*

116. Private companies supplying 'breakfast cereals' have started ..... is agriculture in poorer countries. This has ..... the spectre of land grabs and political conflicts.

(a) Spending , intendified.
(b) Dealing , inflated
(c) Ploughing , increased
(d) Investing , raised

117. Use the appropriate phrasal verb and complete the sentence given below.

The new system in education is aimed at ..... the difference between the rich and poor.

(a) Goof around (b) Evening out
(c) Glossing over (d) Give over

Direction (Q. Nos. 118-120) *Read the following passage and answer the given questions.*

I have myself, full confidence that if all do their duty, of nothing is neglected, and if the best arrangements are made as they are being made, we shall prove ourselves once again able to defend our island home, to ride out storm of war and to outlive the menace of tyranny if necessary of year, if necessary alone. At any rate, that what we are going to try to do that is resolve of h Majesty's Government-every man of them. That is the w of Parliament and the nation. The British Empire and th French Republic linked together in their cause and in the need, will defend to the death their native soil, aiding eac other like good comrades to the utmost of their strengt Even thought large tracts of Europe and many old an famous states have fallen or may fall into the grip of th Gestapo and all the odious apparatus of Nazi rule, we sha not flag or fall. We shall go on to the end, we shall fight France, we shall fight on the seas.

118. What does the term ride out the storm mean?

(a) Handle a crisis successfully
(b) Hide from a storm
(c) Hide in some place where one cannot be found
(d) Ride on boat at the time a storm

119. What does subjugate mean?

(a) Surrender (b) Compare
(c) Control (d) Abandon

120. "That is the resolve of his Majesty's Government" What is their resolve?

(a) Surrender to the Nazis
(b) Negotiate with the Nazis
(c) Run away from the Nazis
(d) Fight the Nazis

Answers

Mathematics

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

Analytical Ability & Logical Reasoning

51. (b)	52. (a)	53. (c)	54. (d)	55. (b)	56. (a)	57. (d)	58. (d)	59. (d)	60. (a)
61. (d)	62. (b)	63. (a)	64. (d)	65. (c)	66. (d)	67. (a)	68. (b)	69. (c)	70. (a)
71. (b)	72. (b)	73. (c)	74. (b)	75. (c)	76. (b)	77. (c)	78. (c)	79. (a)	80. (a)
81. (c)	82. (d)	83. (a)	84. (b)	85. (d)	86. (b)	87. (c)	88. (d)	89. (c)	90. (b)

Computer Awareness

91. (c)	92. (b)	93. (c)	94. (d)	95. (a)	96. (a)	97. (c)	98. (b)	99. (d)	100. (a)

General English

101. (b)	102. (c)	103. (c)	104. (b)	105. (c)	106. (a)	107. (c)	108. (b)	109. (a)	110. (c)
111. (d)	112. (d)	113. (a)	114. (d)	115. (b)	116. (d)	117. (b)	118. (a)	119. (c)	120. (d)

(*) No any given option is correct.

Answer *with* Explanations

Mathematics

1. *(d)* Given, $x^2 + y^2 = 16$

Centre $(0, 0)$, $r_1 = 4$

$x^2 + y^2 - 2y = 0$

$(x-0)^2 + (y-1)^2 = 1$

Centre $(0, 1)$, $r_2 = 1$

Distance between their centre $= \sqrt{(0-0)^2 + (1-0)^2}$

$= \sqrt{0+1} = 1$

$|r_1 - r_2| = 4 - 1 = 3$

$c_1c_2 < |r_1 - r_2|$

$\therefore$ No common tangent.

2. *(c)* We have,

$$f(x) = \begin{cases} x\sin\left(\frac{1}{x}\right), & \text{if } x > 0 \\ 0 & \text{if } x \le 0 \end{cases}$$

$\therefore$ (RHL at $x = 0$)

$$= \lim_{x \to 0^+} x\sin\left(\frac{1}{x}\right) = \lim_{h \to 0} h\sin\left(\frac{1}{h}\right) = 0 \times [-1, 1] = 0$$

(LHL at $x = 0$) $= 0$ and $f(0) = 0$

$\therefore$ RHL = LHL = $f(0)$

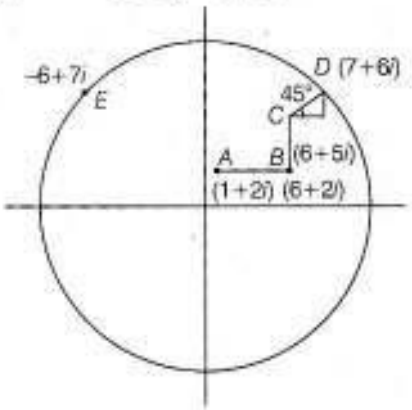
Hence, $f(x)$ is continuous at $x = 0$

Again, RHD $= \lim_{x \to 0^+} \dfrac{x\sin\left(\frac{1}{x}\right) - 0}{x - 0} = \lim_{x \to 0^+} \sin\left(\frac{1}{x}\right) = \lim_{h \to 0} \sin\left(\frac{1}{h}\right) = [-1, 1]$ and LHD $= 0$

$\therefore$ RHD $\neq$ LHD

Hence, $f(x)$ is not differentiable at $x = 0$.

3. *(d)* Given, $A = Z_0 = 1 + 2i$



Moving horizontally 5 units we reach at $B(6 + 2i)$, then moving vertically 3 units, we reach $C = Z_1 (6 + 5i)$, then moves $\sqrt{2}$ unit in the direction of $i + j$, we reach at $D(7 + 6i)$ and then moves through an angle $\dfrac{\pi}{2}$ with anti-clockwise direction, we reach at $\in Z_2(-6 + 7i)$.

$\therefore$ The point $Z_2 = -6 + 7i$

4. *(b)* Given, $\Delta = a^2 - (b-c)^2$

$\Rightarrow \sqrt{s(s-a)(s-b)(s-c)}$

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

$\Rightarrow \sqrt{s(s-a)(s-b)(s-c)} = (2s - 2b)(2s - 2c)$

$\Rightarrow \sqrt{s(s-a)(s-b)(s-c)} = 4(s-b)(s-c)$

$\Rightarrow \dfrac{1}{4} = \dfrac{(s-b)(s-c)}{\sqrt{s(s-a)(s-b)(s-c)}}$

$\Rightarrow \dfrac{1}{4} = \sqrt{\dfrac{(s-b)(s-c)}{s(s-a)}} = \tan\dfrac{A}{2}$

$\Rightarrow \tan\dfrac{A}{2} = \dfrac{1}{4}$

Now, $\tan A = \dfrac{2\tan A/2}{1 - \tan^2 A/2} = \dfrac{2 \times \frac{1}{4}}{1 - \left(\frac{1}{4}\right)^2} = 8/15$

5. *(a)* We have, first 30 natural numbers.

Two number are selected a and b such that $a^2 - b^2$ is divisible by 3.

$n(S) = {}^{30}C_2$

$\because$ $a^2 - b^2$ is divisible by 3

$\therefore$ $(a + b)(a - b) = 3m$

If $(a - b)$ is multiple of 3, then $a^2 - b^2$ is multiple of 3

$\therefore$ Such numbers are

(1, 4, 7, ... 28), (2, 5, ... , 29), (3, 6, 9, ... 30) are possible.

$\therefore$ ${}^{10}C_2 + {}^{10}C_2 + {}^{10}C_2 = 45 \times 3 = 135$

$(a + b)$ is multiple of 3 then $a^2 - b^2$ is multiple of 3

Such numbers are possible

{(1, 2), (1, 5) ... 1, 29}, {(4, 2) (4, 5) ... } ... {28, 2) ... 28, 29}

Total $= 10 \times 10 = 100$

Total numbers are $135 + 100 = 235$

$\therefore$ Required probability $= \dfrac{235}{{}^{30}C_2} = \dfrac{235 \times 2}{30 \times 25} = \dfrac{47}{87}$

6. *(d)* The man is one step away from starting point after 11 steps. This can happen in two ways

(i) He takes 5 steps forward and 6 steps backward.

(ii) He takes 6 steps forward and 5 steps backwards.

$\therefore$ Probability of first case

$= {}^{11}C_5(0.4)^5(0.6)^6$

Probability of second case

$= {}^{11}C_6(0.4)^6(0.6)^5$

Hence, required probability

$= {}^{11}C_5(0.4)^5(0.6)^6 + {}^{11}C_6(0.4)^6(0.6)^5$

$= {}^{11}C_5(0.4)^5(0.6)^5(0.6 + 0.4)^5$

$= {}^{11}C_5(0.24)^5 = 462(0.24)^5$.

7. *(a)* Given, $w_i = px_i + k$

$\bar{x} = 48\ \sigma_x = 12, \bar{w} = 55$ and $\sigma_w = 15$

$\bar{w} = p\bar{x} + k$

$\Rightarrow \quad 55 = 48p + k \quad \ldots$ (i)

$\sigma_w = p\sigma_x$

$\Rightarrow \quad 15 = 12p$

$\Rightarrow \quad p = 1.25$

On putting the value of p in Eq. (i), we get

$k = -5$

8. *(d)* Given,

$$\begin{vmatrix} x & x^2 & 2+x^3 \\ y & y^2 & 2+y^3 \\ z & z^2 & 2+z^3 \end{vmatrix} = 0$$

$$\Rightarrow \begin{vmatrix} x & x^2 & 2 \\ y & y^2 & 2 \\ z & z^2 & 2 \end{vmatrix} + \begin{vmatrix} x & x^2 & x^3 \\ y & y^2 & y^3 \\ z & z^2 & z^3 \end{vmatrix} = 0$$

$$\Rightarrow 2\begin{vmatrix} x & x^2 & 1 \\ y & y^2 & 1 \\ z & z^2 & 1 \end{vmatrix} + xyz\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} = 0$$

$$\Rightarrow (xyz+2)\begin{vmatrix} x & x^2 & 1 \\ y & y^2 & 1 \\ z & z^2 & 1 \end{vmatrix} = 0$$

$\Rightarrow \quad xyz + 2 = 0$

$\Rightarrow \quad xyz = -2$

9. *(b)* Given, $f(0) = 2, f'(0) = 3$

and $f''(x) = f(x)$

$\Rightarrow \quad \dfrac{d^2y}{dx^2} - y = 0 \quad [\because y = f(x)]$

Auxiliary equation $= m^2 - 1 = 0$

$m = \pm 1$

Solution of given differential equation is

$y = ae^x + be^{-x}$

$\Rightarrow \quad f(x) = ae^x + be^{-x}$

$f(0) = a + b = 2 \quad \ldots$ (i)

$f'(x) = ae^x - be^{-x}$

$f'(0) = a - b = 3 \quad \ldots$ (ii)

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

$a = \dfrac{5}{2}, b = -\dfrac{1}{2}$

$\therefore \quad f(x) = \dfrac{1}{2}(5e^x - e^{-x})$

$f(4) = \dfrac{1}{2}(5e^4 - e^{-4})$

$f(4) = \dfrac{1}{2}\left(\dfrac{5e^8 - 1}{e^4}\right)$

$f(4) = \dfrac{5e^8 - 1}{2e^4}$

10. *(c)* Given, $a, a_1, a_2, a_3, a_4, \ldots, a_{2n-1}, b$ are in AP

$a, b_1, b_2, b_3, b_4, b, \ldots, b_{2n-1}, b$ are in GP

$a, c_1, c_2, c_3, \ldots, c_{2n-1}, b$ are in HP

$a_n = \dfrac{a+b}{2} \Rightarrow b_n = \sqrt{ab}$

$c_n = \dfrac{2ab}{a+b}$

Now, $a_n x^2 - b_n x + c_n = 0$

$D = (b_n)^2 - 4a_n c_n$

$D = ab - 4\dfrac{(a+b)}{2}\dfrac{2(ab)}{a+b}$

$D = ab - 4ab$

$D = -3ab < 0$

$\therefore$ Roots are imaginary.

11. *(b)* We have,

$\log_3(x+2)(x+4) + \log_{1/3}(x+2) < \dfrac{1}{2}\log_{\sqrt{3}} 7$

$\Rightarrow \quad \log_3(x+2)(x+4) - \log_3(x+2) < \log_3 7$

$\Rightarrow \quad \log_3 \dfrac{(x+2)(x+4)}{x+2} < \log_3 7$

$\Rightarrow \quad \log_3(x+4) < \log_3 7$

$\Rightarrow \quad (x+4) < 7$

and $\quad x + 2 > 0$

$x < 3$ and $x > -2$

$\therefore \quad x \in (-2, 3)$

12. *(a)* Given, a, b, c are in GP and $\log a - \log 2b, \log 2b - \log 3c$ and $\log 3c - \log a$ are in AP

$\therefore \quad b^2 = ac$

and $\quad 2(\log 2b - \log 3c) = \log a - \log 2b + \log 3c - \log a$

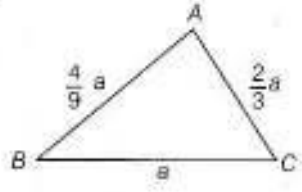
$\Rightarrow \quad 2\log\dfrac{2b}{3c} = \log\dfrac{3c}{2b}$

$\Rightarrow \quad 2\log\dfrac{2b}{3c} = -\log\dfrac{2b}{3c}$

$\Rightarrow \quad 3\log\dfrac{2b}{3c} = 0$

$\Rightarrow \quad \dfrac{2b}{3c} = 1$

$\Rightarrow \quad \dfrac{c}{b} = \dfrac{2}{3}$



$\therefore \quad r = 2/3$

$\therefore$ Sides are $a, \dfrac{2}{3}a, \dfrac{4}{9}a$

$$\cos A = \frac{a^2\left(1 + \frac{4}{9} - \frac{16}{81}\right)}{2a^2 \times 1 \times \frac{2}{3}} > 0$$

$\therefore$ Triangle is acute angle.

13. *(a)* Given, $x, 2x+2, 3x+3$ are the first term of GP

$\therefore \quad (2x+2)^2 = x(3x+3)$

$\Rightarrow \quad 4x^2 + 8x + 4 = 3x^2 + 3x$

$\Rightarrow \quad x^2 + 5x + 4 = 0$

$\Rightarrow \quad (x+4)(x+1) = 0$

$\Rightarrow \quad x = -4, x \neq -1$

$\therefore$ Terms are $-4, -6, -9$

$$r = \frac{-6}{-4} = 3/2$$

$$a_4 = -4\left(\frac{3}{2}\right)^3 = -4 \times \frac{27}{8} = -\frac{27}{2} = -13.5$$

14. *(c)* We have,

$$(1 + x - 2x^2)^6 = 1 + a_1x + a_2x^2 + \ldots + a_{12}x^{12}$$

Put $x = 1$ on both sides we, get

$$0 = 1 + a_1 + a_2 + a_3 + a_4 + \ldots + a_{12} \quad \ldots (i)$$

Put $x = -1$ on both sides, we get

$$64 = 1 - a_1 + a_2 - a_3 + a_4 - a_5 \ldots + a_{12} \quad \ldots (ii)$$

Adding Eqs. (i) and (ii), we get

$$64 = 2 + 2(a_2 + a_4 + a_6 + \ldots a_{12})$$

$$\Rightarrow \quad a_2 + a_4 + a_6 \ldots + a_{12} = 31$$

15. *(a)* We have,

a is the greatest value of ${}^{2n}C_r$

$$\therefore \quad a = {}^{2n}C_n$$

b is the greatest value of ${}^{2n-1}C_r$

$$\therefore \quad b = {}^{2n-1}C_n$$

$${}^{2n}C_n = \frac{2n!}{n!(2n-n)!}$$

$$= \frac{2n(2n-1)!}{n \cdot (n-1)!(n)!}$$

$${}^{2n}C_n = 2 \cdot {}^{2n-1}C_n$$

$$\therefore \quad a = 2b$$

16. *(b)* $P(U) = 0$

$$\therefore \quad U = \phi$$

$$U' (\phi)' = S$$

17. *(a)* Fair price of ticket = Expected value of ticket $= \Sigma\, p_i x_i$

$$= 0.001 \times 5000 + 0.003 \times 2000$$

$$= 5 + 6$$

$$= 11$$

18. *(a)* $\bar{x} = \dfrac{1 + 1 + d + 1 + 2d + \ldots 1 + 100d}{101}$

$$\bar{x} = \frac{101}{2}\frac{(1 + 1 + 100d)}{101} = 1 + 50d$$

$$\text{M. D}(x) = \frac{[|1 - 1 - 50d| + |1 + d - 1 - 50d|] + \ldots + |1 + 100d - 1 - 50d|]}{101}$$

$$255 = \frac{2(50d + 49d + \ldots + 2d + d)}{101}$$

$$255 = \frac{2 \times d \times 50 \times 51}{2 \times 101}$$

$$d = \frac{255 \times 101}{50 \times 51} = \frac{101}{10} = 10.1$$

19. *(d)* Given,

$$\sum_{i=1}^{n} x_i = 80 \text{ and } \sum_{i=1}^{n} x_i^2 = 400$$

We know that,

$$\frac{\Sigma x_i^2}{n} > \left(\frac{\Sigma x_i}{n}\right)^2$$

$$\therefore \quad \frac{400}{n} > \left(\frac{80}{n}\right)^2$$

$$\Rightarrow \quad n > 16$$

$\therefore$ Possible value of x is 18.

20. *(a)* Given, $[\tan^2 x] - \tan x = 0$

$$\Rightarrow \quad \tan x = [\tan^2 x]$$

$\tan x$ must be integer

$$\therefore \quad x = \tan^{-1} 1, \tan^{-1} 4, \tan^{-1} 9, \ldots, \tan^{-1} 100$$

$$a = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$$

$\therefore$ Number of elements in $S = 10$

21. *(c)* We have,

$$\sin^2 x \tan x + \cos^2 x \cot x - \sin 2x = 1 + \tan x + \cot x, x \in (0, \pi)$$

$$\Rightarrow \quad 1 + \tan x (1 - \sin^2 x) + \cot x(1 - \cos^2 x) + \sin 2x = 0$$

$$\Rightarrow \quad 1 + \tan x \cos^2 x + \cot x \sin^2 x + \sin 2x = 0$$

$$\Rightarrow \quad 1 + \sin x \cos x + \cos x \sin x + \sin 2x = 0$$

$$\Rightarrow \quad 1 + 2\sin x \cos x + \sin 2x = 0$$

$$\Rightarrow \quad 1 + 2\sin 2x = 0$$

$$\Rightarrow \quad \sin 2x = -\frac{1}{2}$$

$$\Rightarrow \quad \sin 2x = \pi + \frac{\pi}{6} \text{ or } 2\pi - \frac{\pi}{6}$$

$$\therefore \quad x = \frac{7\pi}{12} \text{ or } \frac{11\pi}{12}$$

22. *(b)* Given, $|a| = 2$ and $\mathbf{a} \cdot \mathbf{b} = 1$

Angle between a and b is $\dfrac{\pi}{3}$

$$\therefore \quad \mathbf{a} \cdot \mathbf{b} = |a||b| \cos\frac{\pi}{3}$$

$$1 = 2 \times |b| \times \frac{1}{2}$$

$$\Rightarrow \quad |b| = 1$$

$$(\mathbf{r} + 2\mathbf{a} - 10\mathbf{b}) \cdot (\mathbf{a} \times \mathbf{b}) = 6$$

and $\quad (\mathbf{r} + 2\mathbf{a} - 10\mathbf{b}) = \lambda(\mathbf{a} \times \mathbf{b})$

$$\therefore \quad \lambda(\mathbf{a} \times \mathbf{b}) \cdot (\mathbf{a} \times \mathbf{b}) = 6$$

$$\lambda |\mathbf{a} \times \mathbf{b}|^2 = 6$$

$$\lambda |a|^2 |b|^2 \sin^2\frac{\pi}{3} = 6$$

$$\lambda \times 4 \times 1 \times \frac{3}{4} = 6$$

$$\lambda = 2$$

23. *(a)* We have, n men and 2 women

Total number of games played by men among themselves $= 2 \cdot {}^{n}C_2 = \dfrac{2(n)(n-1)}{2}$

$= n^2 - n$

Total number of games played by men against women $= 2(2n) = 4n$

$\therefore \quad n^2 - n = 4n + 66$

$\Rightarrow \quad n^2 - 5n - 66 = 0$

$(n - 11)(n + 6) = 0$

$n = 11$

$n \neq -6$

$\therefore$ Total number of players $= 11 + 2 = 13$

24. *(d)* We have,

$n(A_r) = 5,\ r = 1, 2, 3, \ldots 30$

$\bigcup_{r=1}^{30} A_r = 5 \times 30 = 150 = S$

But each element of S belongs to exactly 10 of A_r's

So, $\dfrac{150}{10} = 15$ are distinct element in S.

Also each element of S belongs to exactly 9 elements in B_r's and each B_r contains 3 elements.

If S has n elements in B_r

then, $\quad \dfrac{3n}{9} = 15$

$\Rightarrow \quad n = 45$

25. *(c)* Given,

$$f(x) = \begin{cases} \cos[x], & x \geq 0 \\ [x] + a, & x < 0 \end{cases}$$

$f(x)$ is continuous at $x = 0$

$\lim_{x \to 0} f(x) = \lim_{x \to 0^+} f(x) = f(0)$

$\lim_{x \to 0^-} [x] + a = \lim_{x \to 0^+} \cos[x]$

$-1 + a = \cos 0$

$-1 + a = 1$

$\Rightarrow \quad a = 2$

26. *(d)* Let $y = \dfrac{x^2 - x + 1}{x^2 + x + 1}$

$x^2 y + xy + y = x^2 - x + 1$

$x^2(y - 1) + x(y + 1) + y - 1 = 0$

$\because \quad x \in R$

$\therefore \quad (y + 1)^2 - 4(y - 1)^2 \geq 0 \qquad [\because D \geq 0]$

$y^2 + 2y + 1 - 4y^2 + 8y - 4 \geq 0$

$\Rightarrow \quad 3y^2 - 10y + 3 \leq 0$

$3y^2 - 9y - y + 3 \leq 0$

$(3y - 1)(y - 3) \leq 0$

$y \in \left[\dfrac{1}{3}, 3\right]$

Hence, minimum value is $\dfrac{1}{3}$

27. *(b)* Let

$I = \int \cos x \cos 2x \cos 5x\, dx$

$I = \dfrac{1}{2}\int 2\cos x \cos 5x \cos 2x\, dx$

$I = \dfrac{1}{2}\int (\cos 6x + \cos 4x)\cos 2x\, dx$

$I = \dfrac{1}{4}\int (2\cos 6x \cos 2x + 2\cos 4x \cos 2x)\, dx$

$I = \dfrac{1}{4}\int (\cos 8x + \cos 4x + \cos 6x + \cos 2x)\, dx$

$I = \dfrac{1}{4}\left[\dfrac{\sin 8x}{8} + \dfrac{\sin 4x}{4} + \dfrac{\sin 6x}{6} + \dfrac{\sin 2x}{2}\right] + C$

$I = \dfrac{1}{8}\sin 2x + \dfrac{1}{16}\sin 4x + \dfrac{1}{24}\sin 6x + \dfrac{1}{32}\sin 8x + C$

$\therefore \quad A_1 = \dfrac{1}{8}, A_2 = \dfrac{1}{16}, A_3 = \dfrac{1}{24}, A_4 = \dfrac{1}{32}$

28. *(b)* Let

$$I = \int_{\ln 2}^{x} \frac{1}{2\sqrt{e^x - 1}}\, dx$$

Put $\quad e^x - 1 = t^2 \Rightarrow e^x\, dx = 2t\, dt$

$\Rightarrow \quad dx = \dfrac{2t}{t^2 + 1}\, dt$

$\therefore \quad I = \int_{1}^{\sqrt{e^x - 1}} \dfrac{2t}{(t^2 + 1)\, t}\, dt$

$= 2\int_{1}^{\sqrt{e^x - 1}} \dfrac{dt}{t^2 + 1} = 2\left[\tan^{-1} t\right]_1^{\sqrt{e^x - 1}}$

$\therefore \quad 2\left[\tan^{-1}\sqrt{e^x - 1} - \tan^{-1} 1\right] = \pi/6$

$\Rightarrow \quad \tan^{-1}\sqrt{e^x - 1} = \dfrac{\pi}{12} + \dfrac{\pi}{4} = \dfrac{\pi}{3}$

$\Rightarrow \quad \sqrt{e^x - 1} = \tan\dfrac{\pi}{3} = \sqrt{3}$

$\Rightarrow \quad e^x - 1 = 3 \Rightarrow e^x = 4$

$x = \log 4 = 2\log 2$

29. *(b)* Equation of ellipse

$2x^2 + 9y^2 = 3$

$\Rightarrow \quad \dfrac{x^2}{3/2} + \dfrac{y^2}{1/3} = 1$

Here, $\quad a = \sqrt{\dfrac{3}{2}}, b = \sqrt{\dfrac{1}{3}}$

Equation of tangent of ellipse is

$$y = mx \pm \sqrt{\frac{3}{2}m^2 + \frac{1}{3}}$$

Since, this is passes through $(3, -1)$

$\therefore \quad -1 = 3m \pm \sqrt{\dfrac{9m^2 + 2}{6}}$

$\Rightarrow \quad (3m + 1)^2 = \dfrac{9m^2 + 2}{6}$

$\Rightarrow 6(9m^2 + 6m + 1) = 9m^2 + 2$

$\Rightarrow \quad 45m^2 + 36m + 4 = 0$

$\Rightarrow \quad 45m^2 + 30m + 6m + 4 = 0$

$\Rightarrow \quad (3m + 2)(15m + 2) = 0$

$\Rightarrow \quad m = -2/3 \text{ or } -2/15$

$\therefore$ Equation of tangent

$$y = \frac{-2}{3}x \pm \sqrt{\frac{2}{3} + \frac{1}{3}}$$

$$y = \frac{-2}{3}x \pm 1$$

$$2x + 3y - 3 = 0$$

30. *(b)* The position vector of vertices of A, B, C of tetrahedron $ABCD$ are $\hat{i} + \hat{j} + \hat{k}$, $\hat{i}$ and $3\hat{i}$

$\therefore \quad A = (\hat{i} + \hat{j} + \hat{k})$

$B = \hat{i}$

$C = 3\hat{i}$

$\mathbf{AB} = -\hat{i} - \hat{k}$

$\mathbf{AC} = 2\hat{i} - \hat{j} - \hat{k}$

$$\mathbf{AB} \times \mathbf{AC} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & -1 & -1 \\ 2 & -1 & -1 \end{vmatrix} = -2\hat{j} + 2\hat{k}$$

Volume of tetrahedron $= \frac{1}{6} \times h\,|\mathbf{AB} \times \mathbf{AC}|$

$$\frac{2\sqrt{2}}{3} = \frac{1}{6} \times h\sqrt{4+4}$$

$$\frac{2\sqrt{2}}{3} = \frac{1}{6} \times h \times 2\sqrt{2}$$

$$h = 2$$

$\therefore$ Length of $DE = 2$

31. *(a)* Since, we know that

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

$$SS' = 2ae$$

$$OB = b$$

Given, BSS' is an equilateral triangle.

$\therefore \quad OB = \frac{\sqrt{3}}{2} SS'$

$$b = \frac{\sqrt{3}}{2} 2ae \Rightarrow \frac{b}{a} = \sqrt{3}e$$

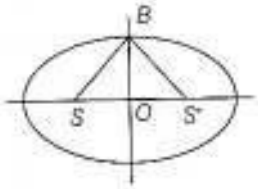
We know, $e^2 = 1 - \frac{b^2}{a^2}$

$e^2 = 1 - 3e^2$

$4e^2 = 1$

$e^2 = \frac{1}{4}$

$\Rightarrow \quad e = \frac{1}{2}$



32. *(c)* Diametre of circles are

$x + 2y - 5 = 0$ ... (i)

and $3x - y - 1 = 0$ ... (ii)

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

$x = 1, y = 2$

$\therefore$ Centre of circle is $(1, 2)$

Since, circle is passes through $(4, 6)$

$\therefore \quad r = \sqrt{(4-1)^2 + (6-2)^2} = \sqrt{9+16} = \sqrt{25} = 5$

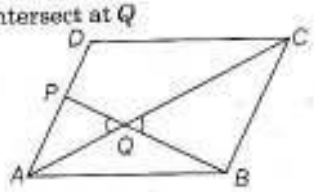
Equation of circle,

$$(x-1)^2 + (y-2)^2 = 25$$

$$x^2 + y^2 - 2x - 4y - 20 = 0$$

33. *(d)* Given,

$ABCD$ is a parallelogram and P is mid-point of AD, BP and AC intersect at Q



In ΔAPQ and ΔCBQ

$\angle AQP = \angle CQB$

$\angle QAP = \angle BCQ$

$\therefore \quad \Delta APQ \sim \Delta CBQ$

$$\frac{AP}{BC} = \frac{AQ}{CQ}$$

$$\frac{AP}{2AP} = \frac{AQ}{CQ} \qquad \left[\because AP = \frac{1}{2}AD = \frac{1}{2}BC\right]$$

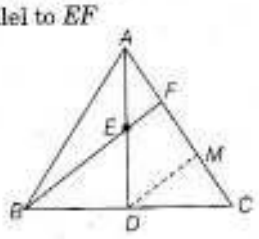
$$\frac{AQ}{QC} = \frac{1}{2} \Rightarrow 1:2$$

34. *(c)* Given, AD is median of ΔABC

$\therefore \quad D$ is mid-point of BC

and E is mid-point of AD

Draw DM parallel to EF



In ΔADM,

By mid-point theorem,

F is mid-point of AM

$\therefore \quad AF = \frac{1}{2}AM = FM$

In ΔBFC,

DM is parallel to BF and D is mid-point of BC.

$\therefore$ By mid-point theorem,

M is mid-point of FC

$\therefore \quad FM = \frac{1}{2}FC$

$AF = \frac{1}{2}FC \qquad [\because AF = FM]$

$\frac{AF}{FC} = \frac{1}{2}$

$AF : FC = 1 : 2$

35. (*) Given, $p(x) = ax^2 + bx + c$

$$p(0) = c = 1$$

$$p(1) = a + b + 1 = 4$$

$$\Rightarrow \quad a + b = 3 \quad \ldots (i)$$

$$p(-1) = a - b + 1 = 6$$

$$\Rightarrow \quad a - b = 5 \quad \ldots (ii)$$

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

$$a = 4, b = -1$$

$$\therefore \quad p(x) = 4x^2 - x + 1$$

$$p(-2) = 16 + 2 + 1 = 19$$

$$p(2) = 16 - 2 + 1 = 15$$

36. *(a)* We have, $x^2y^2 - 2x = 4(1 - y)$

On differentiating with respect to x, we get

$$2x^2y\frac{dy}{dx} + 2xy^2 - 2 = -4\frac{dy}{dx}$$

$$\frac{dy}{dx} = \frac{2 - 2xy^2}{2x^2y + 4} = \frac{1 - xy^2}{x^2y + 2}$$

$$\left(\frac{dy}{dx}\right)_{(2,-2)} = \frac{1 - (2)(-2)^2}{(2)^2(-2) + 2} = \frac{1 - 8}{-8 + 2} = \frac{7}{6}$$

Equation of tangent at $(2, -2)$ is

$$y + 2 = \frac{7}{6}(x - 2)$$

$$7x - 6y = 26$$

$(-2, -7)$ does not lie on the line $7x - 6y = 26$

37. *(a)* Let

$$I = \int \sqrt{1 + 2\cot x(\operatorname{cosec} x + \cot x)}\, dx$$

$$I = \int \sqrt{1 + 2\cot x \operatorname{cosec} x + 2\cot^2 x}\, dx$$

$$I = \int \sqrt{1 + \cot^2 x + 2\cot x \operatorname{cosec} x + \cot^2 x}\, dx$$

$$I = \int \sqrt{\operatorname{cosec}^2 x + 2\operatorname{cosec} x \cot x + \cot^2 x}\, dx$$

$$I = \int \sqrt{(\operatorname{cosec} x + \cot x)^2}\, dx$$

$$I = \int |\operatorname{cosec} x + \cot x|\, dx$$

$$I = \int (\operatorname{cosec} x + \cot x)\, dx \qquad \left[\because x \le \in \left(0, \frac{\pi}{2}\right)\right]$$

$$I = \log(\operatorname{cosec} x - \cot x) + \log \sin x + C$$

$$I = \log(\operatorname{cosec} x - \cot x)(\sin x) + C$$

$$I = \log(1 - \cos x) + C$$

$$I = \log 2\sin^2\frac{x}{2} + C \Rightarrow \quad I = 2\log\left(\sin\frac{x}{2}\right) + C$$

38. *(c)* Given,

Word QUEEN

Starting with letters E the total number of words form $= 4! = 24$

Starting with $N = \frac{4!}{2!} = 12$

Starting with $QE = 3! = 6$

Starting with $QN = \frac{3!}{2} = 3$

The position of word QUEEN $= 24 + 12 + 6 + 3 = 45$

39. *(a)* We have,

$$ydx - (x + 3y^2)\, dy = 0$$

$$ydx - xdy = 3y^3 dy$$

$$\frac{ydx - xdy}{y^2} = dy$$

$$\int d\left(\frac{x}{y}\right) = \int dy$$

On integrating both sides, we get

$$\frac{x}{y} = y + c$$

This curves is passes through $(1, 1)$

$$\therefore \quad \frac{1}{1} = 1 + c \Rightarrow c = 0$$

$\therefore$ Curves are

$$\frac{x}{y} = y \Rightarrow y^2 = x$$

$\left(\frac{1}{4}, \frac{1}{2}\right)$ lie on curve $y^2 = x$

40. *(d)* Let

$$L = \lim_{x \to 3} \frac{\sqrt{3x} - 3}{\sqrt{2x - 4} - \sqrt{2}}$$

$$= \lim_{x \to 3} \frac{(\sqrt{3x} - 3)(\sqrt{3x} + 3)(\sqrt{2x - 4} + \sqrt{2})}{(\sqrt{2x - 4} - \sqrt{2})(\sqrt{2x - 4} + \sqrt{2})(\sqrt{3x} + 3)}$$

$$= \lim_{x \to 3} \frac{(3x - 9)(\sqrt{2x - 4} + \sqrt{2})}{(2x - 4 - 2)(\sqrt{3x} + 3)}$$

$$= \lim_{x \to 3} \frac{3(x - 3)(\sqrt{2x - 4} + \sqrt{2})}{2(x - 3)(\sqrt{3x} + 3)}$$

$$= \frac{3}{2} \times \frac{2\sqrt{2}}{6} = \frac{1}{\sqrt{2}}$$

41. *(c)* We have,

$$f(x) = x^3 + 3x - 9$$

$$f'(x) = 3x^2 + 3 > 0 \ \forall\ x \in R$$

$$\therefore \quad f(-2) = (-2)^3 + 3(-2) - 9$$

$$= -8 - 6 - 9 = -23$$

$$f(3) = (3)^3 + 3(3) - 9$$

$$= 27 + 9 - 9 = 27$$

$$\therefore \quad f_{max} = f(3) = 27$$

$$f'(0) = 3$$

Let the GP is $a, ar, ar^2, \ldots, |r| < 1$

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

$$27 = \frac{a}{1 - r} \qquad [\because S_\infty = f_{max} = 27]$$

and $\quad a - ar = 3 \qquad [\because f'(0) = 3]$

$$a(1 - r) = 3 \Rightarrow a = \frac{3}{1 - r}$$

$$\therefore \quad 27 = \frac{3}{(1 - r)^2} \Rightarrow (1 - r)^2 = \frac{1}{9}$$

$$\Rightarrow \quad 1 - r = \frac{1}{3}, r = \frac{2}{3}$$

42. *(d)* Number of onto functions from A to B when $n(A) = 6$, $n(B) = 3$ is

$$\sum_{r=1}^{3}(-1)^{3-r}\,{}^{3}C_r(r)^6 = {}^{3}C_1 - {}^{3}C_2(2)^6 + {}^{3}C_3(3)^6$$

$$= 3 - 3 \times 64 + 729 = 732 - 192 = 540$$

43. *(a)* Given,

$$|z| < \sqrt{3} - 1$$

$$|z^2 + 2z\cos\alpha| \le |z|^2 + |2z\cos\alpha|$$

$$= |z|^2 + 2|z||\cos\alpha|$$

$$\le |z|^2 + 2|z|$$

$$< (\sqrt{3} - 1)^2 + 2(\sqrt{3} - 1)$$

$$< 3 + 1 - 2\sqrt{3} + 2\sqrt{3} - 2$$

$$< 2$$

44. *(c)* Let T_1 and T_2 be the event that computer is produced by plant T_1 and T_2 respectively. Again, let D and ND be the event that computer produced is defective and non-defective respectively

$$\therefore \quad P(T_1) = \frac{20}{100},\ P(T_2) = \frac{80}{100},\ P(D) = \frac{7}{100}$$

Again let $P(D/T_1) = 10\ P(D/T_2) = k$

$$\therefore \quad P(D/T_1) = k \text{ and } P(D/T_2) = \frac{k}{10}$$

Now, $P(D) = P(T_1)\,P(D/T_1) + P(T_2)\,P(D/T_2)$

$$\Rightarrow \quad \frac{7}{100} = \frac{20}{100} \times k + \frac{80}{100} \times \frac{k}{10}$$

$$\Rightarrow \quad 7 = 20k + 8k$$

$$\Rightarrow \quad k = \frac{1}{4}$$

$$\therefore \quad P(D/T_1) = \frac{1}{4} \text{ and } P(D/T_2) = \frac{1}{40}$$

Now, required probability $= P(T_2/ND)$

$$= \frac{P(T_2)P(ND/T_2)}{P(T_1)P(ND/T_1) + P(T_2)P(ND/T_2)}$$

$$= \frac{\frac{80}{100} \times \left(1 - \frac{1}{40}\right)}{\frac{20}{100}\left(1 - \frac{1}{4}\right) + \frac{80}{100}\left(1 - \frac{1}{40}\right)} = \frac{4 \times \frac{39}{40}}{\frac{3}{4} + 4 \times \frac{39}{40}}$$

$$= \frac{4 \times 39}{30 + 4 \times 39} = \frac{156}{186} = \frac{78}{93}$$

45. *(b)* Given, $A > 0, B > 0$

$$A + B = \frac{\pi}{6}$$

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\tan\frac{\pi}{6} = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$1 - \tan A \tan B = \sqrt{3}(\tan A + \tan B)$$

$$\tan A \tan B = 1 - \sqrt{3}(\tan A + \tan B)$$

By $AM \ge GM$

$$\therefore \quad \frac{\tan A + \tan B}{2} \ge \sqrt{\tan A \tan B}$$

$$\Rightarrow \quad \tan A + \tan B \ge 2\sqrt{1 - \sqrt{3}(\tan A + \tan B)}$$

$$\Rightarrow \quad (\tan A + \tan B)^2 \ge 4(1 - \sqrt{3}(\tan A + \tan B)$$

$$\Rightarrow \quad x^2 + 4\sqrt{3}x - 4 \ge 0\ [\because \tan A + \tan B = x]$$

Now, $x^2 + 4\sqrt{3}x - 4 = 0$

$$\Rightarrow \quad x = \frac{-4\sqrt{3} \pm \sqrt{48 + 16}}{2}$$

$$x = \frac{-4\sqrt{3} \pm 8}{2}$$

$$x = -2\sqrt{3} \pm 4$$

$$(x + 2\sqrt{3} - 4)(x + 2\sqrt{3} + 4) \ge 0$$

Minimum value of $\tan A + \tan B = 4 - 2\sqrt{3}$

46. *(c)* Let the numbers are 1, 2, 6, x, y

$$\bar{x} = \frac{1 + 2 + 6 + x + y}{5}$$

$$5 = \frac{9 + x + y}{5}$$

$$\Rightarrow \quad x + y = 16$$

$$M.D(\bar{x}) = \frac{|1 - 5| + |2 - 5| + |6 - 5| + |x - 5| + |y - 5|}{5}$$

$$M.D(\bar{x}) = \frac{4 + 3 + 1 + x + y - 10}{5}$$

$$= \frac{8 + 16 - 10}{5} = \frac{14}{5} = 2.8$$

47. *(c)* Let the total numbers of expert in beauty contest is x

$$n(A) = \frac{x}{2}$$

$$n(B) = \frac{2}{3}x$$

$$n(A \cap B) = 10$$

$$n(A \cup B)' = 6$$

$$n(A \cup B) = x - n(A \cup B)' = x - 6$$

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

$$x - 6 = \frac{x}{2} + \frac{2x}{3} - 10$$

$$x - \frac{x}{2} - \frac{2x}{3} = -10 + 6$$

$$\frac{6x - 3x - 4x}{6} = -4$$

$$x = 24$$

48. *(a)* We have, $\alpha(\mathbf{a} + 2\mathbf{b}) - \beta(4\mathbf{b} - \mathbf{a}) = 0$

$$\Rightarrow \quad (\alpha + \beta)\mathbf{a} + (2\alpha - 4\beta)\mathbf{b} = 0$$

$$\Rightarrow \quad \alpha + \beta = 0 \text{ and } 2\alpha - 4\beta = 0$$

$$\Rightarrow \quad \alpha + \beta = 0 \text{ and } \alpha - 2\beta = 0$$

$$\Rightarrow \quad \alpha = \beta = 0$$

49. *(b)* Let F be the force

Then $F = \frac{78(2\hat{i} + 2\hat{j} + \hat{k})}{\sqrt{4 + 4 + 1}} = \frac{78}{3}(2\hat{i} + 2\hat{j} + \hat{k})$

$$F = 26(2\hat{i} + 2\hat{j} + \hat{k})$$

Force acts at point $P(2, 3, 5)$ the moment of F acting at P about a line in the direction $(12\hat{i} + 3\hat{j} + 4\hat{k})$ is euqal to resolve part along the line of moment of F

$$\mathbf{OP} = 2\hat{i} + 3\hat{j} + 5\hat{k}$$

$$M = \mathbf{OP} \times \mathbf{F} = 26\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & 5 \\ 2 & 2 & 1 \end{vmatrix}$$

$$= 26(-7\hat{i} + 8\hat{j} - 2\hat{k})$$

Let a be unit vector in the direction $12\hat{i} + 3\hat{j} + 4\hat{k}$

$$\hat{a} = \frac{12\hat{i} + 3\hat{j} + 4\hat{k}}{|12\hat{i} + 3\hat{j} + 4\hat{k}|} = \frac{1}{13}(12\hat{i} + 3\hat{j} + 4\hat{k})$$

The moment of F about the given line is

$$= M.\hat{a} = 26(-72\hat{i} + 8\hat{j} - 2\hat{k}) \cdot \frac{1}{13}(12\hat{i} + 3\hat{j} + 4\hat{k})$$

$$= 2(-84 + 24 - 8) = -136$$

50. *(a)* We know that,

$$AM \geq GM$$

$$\Rightarrow \quad \frac{5^x + 5^{-x}}{2} \geq \sqrt{5^x \cdot 5^{-x}}$$

$$\Rightarrow \quad 5^x + 5^{-x} \geq 2$$

Now, $\sin(e^x) = 5^x + 5^{-x}$

$$\Rightarrow \quad \sin(e^x) \geq 2$$

Which is not possible

$\therefore$ No solution exists

Analytical Ability & Logical Reasoning

51. *(b)* The pattern is as follows

$$\begin{matrix} a \\ b \quad c \end{matrix} \Rightarrow (a + c)^2 = b$$

As, $(3 + 2)^2 = 25$ and $(4 + 3)^2 = 49$

So, missing number $= (5 + 3)^2 = 8^2 = \square$

52. *(a)* **From statement II**

Total readers = 200

Number of readers who read Indian Express = 100

Number of readers who read Times of India = 121

Number of readers who neither read Indian Express nor Times of India = 50

$\because \quad n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$= 100 + 121 - (200 - 50)$

$= 221 - 150 = 71$

$\therefore$ Required number of people who read both Indian Express and Times of India = 71

53. *(c)* $137 + 276 = 435$

$(1 \times 8^2 + 3 \times 8^1 + 7 \times 8^0) + (2 \times 8^2 + 7 \times 8^1 + 6 \times 8^0)$

$= 95 + 190 = 285$

Now,

8	285
8	35 – 5
	4 – 3

$\Rightarrow 435$

Similarly, $731 + 672 = ?$

$(7 \times 8^2 + 3 \times 8^1 + 1 \times 8^0) + (6 \times 8^2 + 7 \times 8^1 + 2 \times 8^0)$

$= 473 + 442 = 915$

Now,

8	915
8	114 – 3
8	14 – 2
	1 – 6

$\Rightarrow 1623$

54. *(d)* **From option (a),**

AEMS $\Rightarrow$ M (3rd)

MOOR $\Rightarrow$ O (3rd)

BEST $\Rightarrow$ S (3rd)

AOTU $\Rightarrow$ T (3rd)

$\therefore$ Meaningful word = MOST

From option (b),

AGOT $\Rightarrow$ O (3rd)

EPST $\Rightarrow$ S (3rd)

AWTT $\Rightarrow$ T (3rd)

AMRY $\Rightarrow$ R (3rd)

$\therefore$ Meaningful word = SORT

From option (c),

AELM $\Rightarrow$ L (3rd)

DFIN $\Rightarrow$ I (3rd)

LOST $\Rightarrow$ S (3rd)

AHTT $\Rightarrow$ T (3rd)

$\therefore$ Meaningful word = LIST

From option (d),

JMPU $\Rightarrow$ P (3rd)

EILM $\Rightarrow$ L (3rd)

BDMU $\Rightarrow$ M (3rd)

EMOS $\Rightarrow$ O (3rd)

No meaningful word can be formed from P, L, M and O.

55. *(b)* Distance covered by Navjivan Exp. in $\frac{1}{2}$hr

$= \text{Speed} \times \text{Time} = 50 \times \frac{1}{2} = 25\text{ km}$

According to the question,

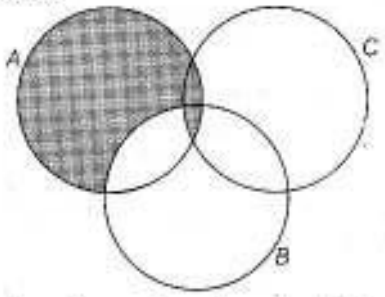
$$\text{Relative speed} = \frac{\text{Remaining distance}}{\text{Time}}$$

$$\Rightarrow \quad (50 + 40) = \frac{(100 - 25)}{\text{Time}}$$

$$\therefore \text{Time} = \frac{75}{90} = \frac{5}{6}\text{ h or } \frac{5}{6} \times 60 = 50\text{ min}$$

Hence, required time to avert a head on collision between the two trains = 50 – 30 = 20 min

56. *(a)* If A, B, and C are sets, then they can be represented as



From the above figure, the only option that can be satisfied is option (a). i.e. $(A - B) \cup (A \cap C)$

57. *(d)* Let the number of friends and share of each person be x and y respectively. Then,

Total money $= x \times y = xy$

According to the question,

$$(x - 2) \times (y + 1) = xy$$

$$\Rightarrow \quad xy + x - 2y - 2 = xy \Rightarrow x - 2y = 2$$

From option (d), $x = 46$

then, $\quad 46 - 2y = 2 \Rightarrow 44 = 2y$

$$\therefore \quad y = 22$$

Hence, price of CD player $= 46 \times 22 = ₹\,1012$

$(\because ₹\,1000 < ₹\,1012 < ₹\,1100)$

58. *(d)* Let both container mixed in $x : 1$. Then

According to the question,

$$\frac{\frac{5x}{6} + \frac{1}{4}}{\frac{x}{6} + \frac{3}{4}} = \frac{1}{1} \Rightarrow \frac{5x}{6} + \frac{1}{4} = \frac{x}{6} + \frac{3}{4}$$

$$\Rightarrow \quad \frac{5x}{6} - \frac{x}{6} = \frac{3}{4} - \frac{1}{4} \Rightarrow \frac{4x}{6} = \frac{2}{4}$$

$$\therefore \quad x = \frac{12}{16} = \frac{3}{4}$$

$\therefore$ Required ratio $= x : 1 = \frac{3}{4} : 1 = 3 : 4$

59. *(d)* The order is as follows

4th → IAS officer

3rd → MLA

2nd → Doctor

1st → Engineer/Professor

Ground → Professor/Engineer

But from the given options, only option (d) follows, i.e. from ground floor to top floor, order is professor, engineer, doctor, MLA, IAS officer.

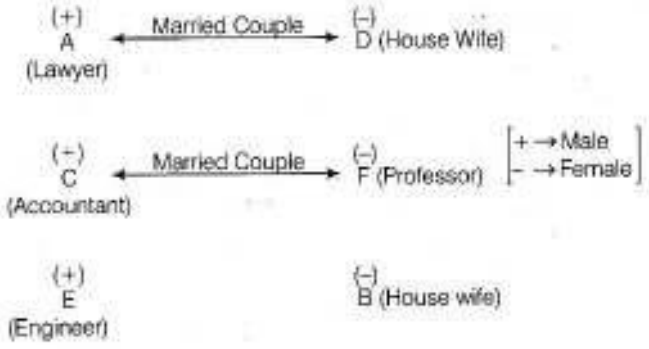
60. *(a)* Total quantity of grapes = 20 kg

According to the question,

$$\therefore \text{ Total quantity of dry grapes} = 20 \times \frac{(100 - 90)}{100} \times \frac{100}{(100 - 20)}$$

$$= 20 \times \frac{10}{100} \times \frac{100}{80} = 2.5 \text{ kg}$$

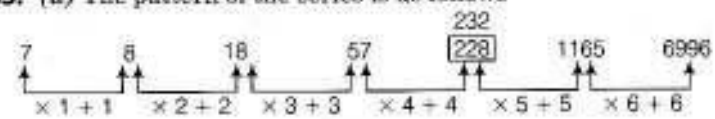
Sol. (61 and 62) According to the question,



61. *(d)* E is an Engineer.

62. *(b)* Three members of the group are males.

63. *(a)* The pattern of the series is as follows



Hence, 228 is the wrong term.

64. *(d)* From statement I and II,

Let the leak empties full tank in x h, then part emptied in 1h by leak $= \frac{1}{x}$

According to the question,

$$\frac{1}{9} - \frac{1}{x} = \frac{1}{9+1} \Rightarrow \frac{1}{x} = \frac{1}{9} - \frac{1}{10}$$

$$\frac{1}{x} = \frac{10 - 9}{90} = \frac{1}{90}$$

Hence, leak will empty the full tank is 90h.

65. *(c)* From statement I and II,

Part filled by pipe P_1 alone in 1 min $= \frac{1}{16}$

Part emptied by pipe P_2 alone in 1 min $= \frac{1}{8}$

According to the question, $\frac{1}{16} - \frac{1}{8} = \frac{1-2}{16} = -\frac{1}{16}$

[–ve sign means P_2 empties the tank]

Hence, the full tank will empty in 16 min.

66. *(d)* Prime factorization of $210 = 2 \times 3 \times 5 \times 7$

So, four digit numbers with combinations of the digits {1, 6, 5, 7} and {2, 3, 5, 7} and three digit numbers with combinations of digits {6, 5, 7} will have the product of their digits equal to 210.

Combination of four digits {1, 6, 5, 7} $= 4! = 4 \times 3 \times 2 \times 1 = 24$

Combination of four digits {2, 3, 5, 7} $= 4! = 4 \times 3 \times 2 \times 1 = 24$

Combination of three digits {6, 5, 7} $= 3! = 3 \times 2 \times 1 = 6$

Hence, total combinations $= 24 + 24 + 6 = 54$

67. *(a)* According to the question,

$$L > Q > K > P > M \text{ or } L > P > K > Q > M$$

Clearly, M is the lightest.

68. *(b)* If we consider John's first statement as true and second statement as false, then John won Gold Medal and Johny won silver medal. But this make Johny's both statements false. Now, we consider John's first statement as false and second statement as true.

So, according to this, John won silver medal Johny won Bronze Medal and Janardan won Gold Medal.

Now, from above, Johny's first statement is true and second statement is false.

Also Janardan's first statement is false and second statement is true.

69. *(c)* If $A = 1$, then

$$\begin{array}{r} 1\,B\,1 \\ \times\ 1\,1 \\ \hline 1\,B\,1 \\ 1\,B\,1\times \\ \hline 1(B+1)(B+1)1 \end{array}$$

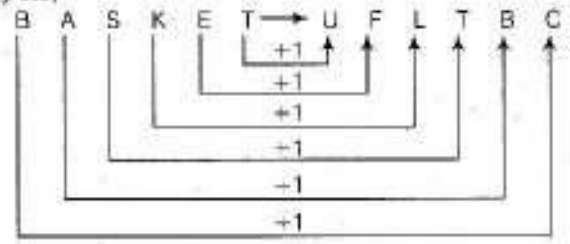
$\therefore \quad B + 1 = C$

So, different combinations of values of A, B and C

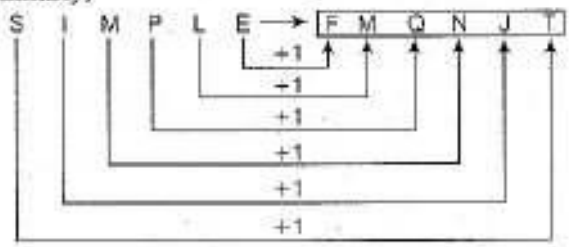
$= (1, 2, 3), (1, 3, 4), (1, 4, 5), (1, 5, 6), (1, 6, 7), (1, 7, 8), (1, 8, 9)$

Hence, 7 different values of the sum of A, B and C are possible.

70. *(a)* As,



Similarly,



71. *(b)* It is better to solve this question from the last. As per the given condition after selling half an egg more than half the number of eggs to Shivani, the grocer was left with 7 eggs. Therefore before selling eggs to shivani the grocer had $\left(7+\frac{1}{2}\right)2$ i.e. 15 eggs.

So, after selling half an egg more than half the number of eggs to Deepak, the grocer was left with 15 eggs.

Therefore, before selling eggs to Deepak, the grocer had $\left(15+\frac{1}{2}\right)2$ i.e. 31 eggs.

Similarly, before selling eggs to Anurag (i.e. at the start) the grocer had $\left(31+\frac{1}{2}\right)2$ i.e. 63 eggs.

72. *(b)* Ancient - O, P, Q, R

Modern - S, U, V, W

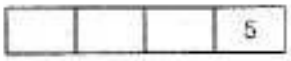
Last year question was asked on U i.e. on Modern.

So, this year the question will be asked on Ancient. The examiner who sets questions like S but S is a modern poet. Hence, the question on R is most likely to be asked this year because the one who likes S also likes R.

73. *(c)* The maximum persons in the team could be 6 i.e. G, F, J, A, D, E or G, F, J, A, D, B

74. *(b)* Here, it is mentioned that repetition of digits, is not allowed.

Now, for any number of four digits to be divisible by 5, its unit place must be occupied by 5.



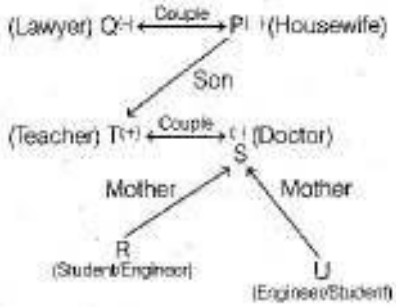
So, the number of ways to fill last place = 1

and the number of ways to fill remaining two places = ${}^4P_2$

$\therefore$ Required number = $1 \times {}^4P_2$

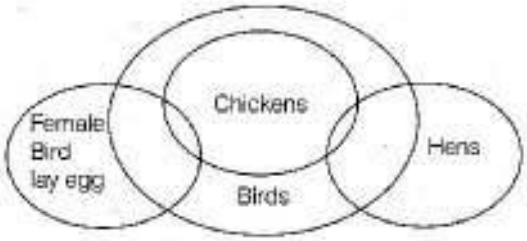
$= 1 \times \frac{5!}{(5-3)!} = 1 \times \frac{5 \times 4 \times 3 \times 2!}{2!} = 60$

75. *(c)* According to the given information, arrangement is also follows



So, the granddaughter of the family is a student and either R or U is a student.

76. *(b)*



(i) All birds lay eggs. (✗)

(ii) Some hens are birds. (✓)

(iii) Some hens are chickens. (✓)

77. *(c)* The pattern of the series is as follows

$1 + 2 = 3$

$1 + 2 + 3 = 6$

$2 + 3 + 6 = 11$

$3 + 6 + 11 = 20$

$6 + 11 + 20 = 37$

$11 + 20 + 37 = 68$

$20 + 37 + 68 = \boxed{125}$

78. *(c)* For 78 paise, $1\times 50 + 2\times 10 + 4\times 2 = 7$ coins

For 69 paise,

$1\times 50 + 1\times 10 + 1\times 5 + 2\times 2 = 5$ coins

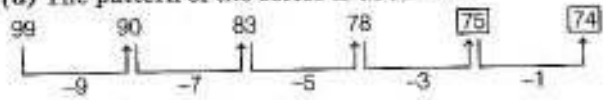
For 101 paise,

$1\times 50 + 1\times 25 + 2\times 10 + 3\times 2 = 7$ coins

Hence, required total number of coins

$= 7 + 5 + 7 = 19$

79. *(a)* The pattern of the series is as follows



80. *(a)* Let the CP of the article = ₹ x

Then, the SP of the article $= x\times\frac{(100+20)}{100} = ₹\ 1.2x$

∵ He incurs loss because, he allows 16 articles to 12 articles,

loss % $= \frac{16-12}{16}\times 100 = \frac{4}{4}\times 25 = 25\%$

∴ His SP = SP $\times\frac{(100-25)}{100} = ₹\ 0.75$ SP

Hence, $0.75\ SP = 1.2x$

$\Rightarrow SP = ₹\ 1.6\ x$

This SP is come after giving a discount of 20% on MP

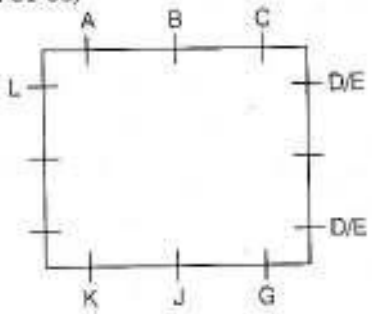
$\therefore MP\times\frac{(100-80)}{100} = SP$

$\Rightarrow \quad MP\times\frac{20}{100} = 1.6x$

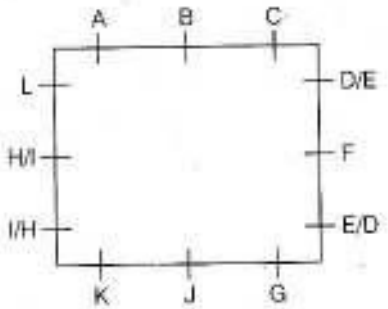
$\therefore \quad MP = 2x$

It means that the article has been marked 100% above the cost price.

Sol. for (Q. Nos. 81-83)

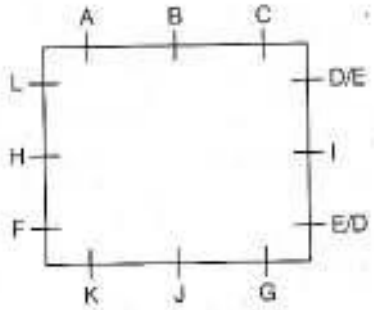


81. *(c)*



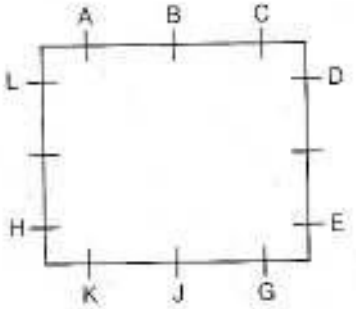
Clearly, either I or H is sitting to the left of K.

82. *(d)*



Clearly, H will be facing I.

83. *(a)*



Clearly, the neighbours of K are H and J.

84. *(b)* The difference between both 34041 and 32506

$= 34041 - 32506 = 1535$

So, n should be a factor of 1535.

Factors of 1535 = 1, 5, 307, 1535

Here, 307 is a three digit factor of 1535.

So, $n = 307$

34041 and 32506 divided by 307 leaves remainder 271.

85. *(d)* According to the question,

$n\times$ volume of sphere = Volume of cylinder

$\Rightarrow \quad n\times\frac{4}{3}\pi r_1^3 = \pi r_2^2 h \quad \Rightarrow \quad n\times\frac{4}{3}\times\left(\frac{3}{2}\right)^3 = (2)^2\times 54$

$\Rightarrow \quad n = \frac{4\times 54\times 3\times 8}{4\times 27}$

$\therefore \quad n = 48$

86. *(b)* Time from 5 AM of a particular day to 10 PM on the 4th day is 89 hr. Now, the clock loses 16 min in 24 hr or in other words, we can say that 23 hr 44 min of this clock is equal to 24 hr of the correct clock.

$\left(23+\frac{44}{60}\right) = \frac{356}{15}$ hr of this clock = 24 hr of the correct clock.

$\therefore$ 89 hr of this clock $= \left(\frac{24\times 15}{356}\times 89\right)$ hr of the correct clock

= 90 hr of the correct clock

or 89 hr of this clock = 90 hr of the correct clock.

Therefore, it is clear that in 90 hr this clock loses 1 hr and hence, the correct time is 11 PM when this clock shows 10 PM.

87. *(c)* Let the speed and length of train be v and d respectively. Then

$$v - 2 = \frac{d}{9} \quad ...(i) \left[\because \text{Speed} = \frac{\text{Distance}}{\text{Time}}\right]$$

$$v - 4 = \frac{d}{10} \quad ...(ii)$$

From Eqs. (i) and (ii),

$$\Rightarrow \quad \frac{v-2}{v-4} = \frac{10}{9}$$

$$\Rightarrow \quad 9v - 18 = 10v - 40$$

$$\therefore \quad v = 22 \text{ km/h}$$

From Eqs. (i) and (ii), we get

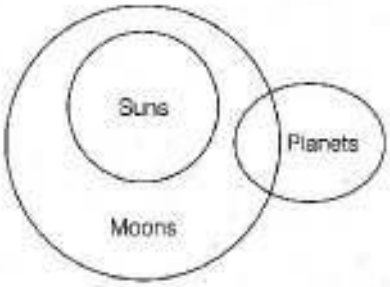
$$(22 - 2) \times \frac{5}{18} = \frac{d}{9}$$

$$20 \times \frac{5}{2} = d$$

$$\therefore \quad d = 50 \text{ m}$$

Hence, length of train = 50 m

88. *(d)*



Conclusions I–×

II–✓

89. *(c)* We can get the triangles in two different ways taking two points from the line having 10 points (in ${}^{10}C_2$ ways i.e. 45 ways) and one point from the line consisting of 11 points (in 11 ways).

So, the number of triangle = $45 \times 11 = 495$

Now, taking two points from the line having 11 points (in ${}^{11}C_2$, i.e. 55 ways) and one point from the line consisting of 10 points (in 10 ways), the number of triangle here is $55 \times 10 = 550$

Hence, required number of triangle = 495 + 550

= 1045

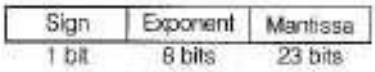
90. *(b)* HCF of (1657 – 6 = 1651) and (2037 – 5 = 2032)

1651)2032(1
1651
381)1651(4
1524
127)381(3
381
×

∴ Required greatest number = 127

Computer Awareness

91. *(c)* The corresponding single precision floating number can be represented as shown below,



The exponent field needs to represent both positive and negative exponents. To do this, a bias is added to the actual exponent in order to get the stored exponent.

For IEEE single-precision floats, this value is 127. Thus, to express an exponent of zero, 127 is stored in the exponent field.

92. *(b)* 4-bit 2's complement can represent numbers from – 8 to 7. When two unsigned numbers are added, overflow occurs, if there is a carry out of the leftmost bit.

In option (b) 5 bit number is added with 4-bit number, so overflow occurs.

93. *(c)* For n independent boolean variables, each taking one particular boolean value, there are 2^n different possible combinations. A boolean function has to assign one boolean value to each one of these combinations. This brings the number of different possible boolean functions of n variables to a total of 2^{2^n}.

When $n = 1$, we have only one boolean variable that can take either boolean value, so we have only $2^1 = 2$ different cases. This produces $2^2 = 4$ boolean functions of one boolean variable.

94. *(d)* Given binary number = $(011010)_2$

One's complement = 100101

Two's complement = 100101

$$\begin{array}{r} + \quad 1 \\ \hline 100110 \end{array}$$

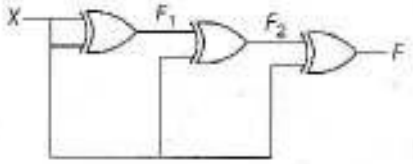
Converting this two's complement to hexadecimal form,

$$\underset{\downarrow}{[0\ 0\ 1\ 0]} \quad \underset{\downarrow}{[0\ 1\ 1\ 0]}$$
$$2 \qquad 6$$

We get $(26)_{16}$

95. *(a)* Output of first XOR gate is $F_1 = x \oplus x = 0$

Output of second XOR gate



$$F_2 = x \oplus 0 = x$$

Note if $x = 1$, then output is 1

if $x = 0$, then output is 0

$$F_2 = 0$$

Output of third XOR gate $F = 0 \oplus x = 0$

96. *(a)* $N = (F87B)_{16}$ is 1111 1000 0111 1011 in binary. Note that most significant bit in the binary representation is 1, which implies that the number is negative.

To get the value of the number perform the 2's complement of the number. We get N as -1925 and $8N$ as -15400. Since $8N$ is also negative, we need to find 2's complement of it (-15400).

Binary of 15400 = 0011110000101000

2's complement = 1100001111011000 = $(C3D8)_{16}$

97. *(c)* Let 'x' be the base or radix of the number system.

The equation is $\frac{3 \cdot x^2 + 1 \cdot x^1 + 2 \cdot x^0}{2 \cdot x^1 + 0 \cdot x^0}$

$$= 1 \cdot x^1 + 3 \cdot x^0 + 1 \cdot x^{-1}$$

$$\frac{3x^2 + x + 2}{2 \cdot x} = x + 3 + 1/x$$

$$\frac{3x^2 + x + 2}{2x} = \frac{x^2 + 3x + 1}{x}$$

$$3x^2 + x + 2 = 2x^2 + 6x + 2$$

$$x^2 + (-5x) = 0$$

$$x(x - 5) + 0$$

$$x = 0, x = 5$$

As base or radix of a number system cannot be zero, here $x = 5$.

98. *(b)* From option (b),

Binary representation of $(14E)_{16}$ = 000101001110

Binary representation of $(7A)_{16}$ = − 000001111010

000011010100

Hexadecimal form of $(000011010100)_2 = (D4)_{16}$

So, $(14E)_{16} - (7A)_{16} = (D4)_{16}$

99. *(d)* For three boolean variables ($n = 3$), there are $2^3 = 8$ different cases, giving us a total of $2^8 = 256$ boolean functions of 3 variables.

100. *(a)* Decimal number 47 has tobe subtracted from 3

So, $38 - 47 = -9$

We start with positive version of the number $1 - 91 = 9$

In bit representation, binary form of 9

= 00001001

1's complement = 11110110

2's complement = 11110110

\+ −

11110111

General English

101. *(b)* Hurry up is the correct answer as phrasal verb 'hurry up' means 'showing haste or urgency' which implies the required meaning : be quick.

102. *(c)* Left is the correct answer as the first clause in the sentence is referring to immediate (recent) past, so second form of the verb is appropriate here.

103. *(c)* Dotage is the correct answer as 'dotage' means 'a state or period of decay marked by decline of poise and alertness' which is similar to the state of a child.

104. *(b)* Persevere is the correct answer as 'persevere' means 'to continue despite difficulties', opposition or discouragement' which is similar to the required meaning in the sentence.

105. *(c)* House was in pandemonium is the correct answer as the phrase 'at sixes and sevens' means 'in state of total confusion and disarray or disorder' which is similar to pandimonium.

106. *(a)* Mythical is the correct answer as the phoenix is believed to be associated with the sun and obtains new life by arising from the ashes of its predecessor according to Egyptian Mythology.

107. *(c)* The apples have been eaten by John is the correct answer as passive form of a present perfect tense sentence is : passive subject (object) + has/have+been+V(III)+ by active object (subject) + others.

108. *(b)* Compensate for loss is correct as 'Indemnify' means 'to provide (someone) with a just payment for loss or injury which is similar to compensation.

109. *(a)* Tendency is correct as 'propensity' means an established pattern of behaviour' which implies tendency.

110. *(c)* Archaic is correct as 'antidiluvian' means 'dating or suriving from distant past' which is similar to 'archaic'.

111. *(d)* Turbulence is correct as 'sangfroid' means evenness of 'emotions or temper' while 'turbulence' means 'a state of violence, agitation and disorder' which implies opposite to the given word.

112. *(d)* You can't pin the blame at anyone without verifying facts is correct as 'pin at' is no meaningful phrasal verb while 'pin on' and 'pin against' are meaningful. To blame someone 'pin on' is correct.

113. *(a)* Conclusive is correct as 'incontrovertible' means 'not capable of being challenged or proved wrong' which implies conclusive.

114. *(d)* More by passion in the hearts of people than by laws i correct as 'stirrings' means passion and legislation means 'law'. So, a nation is not merely built by laws rather by passion in the hearts of its people.

115. *(b)* Adamant is correct as 'implacable' means 'sticking to an opinion, purpose or course of action inspite of reason, arguments or persuasion' which is similar to 'adamant'.

116. *(d)* Investing and raised is correct as 'investing in agriculture' gives a meaning which results in 'raised the spectre of land grabs. So, the two are apt and inter-related.

117. *(b)* Evening out is correct as 'evening out' means 'gaining or regaining balance, stability and uniformity, which makes the sentence a meaningful statement.

118. *(a)* Handle a crisis successfully is correct as passage is about dealing with the hardships with confidence, determination and hope.

119. *(c)* Control is correct as 'subjugate' means 'to bring under one's control by force of arms' which is similar to 'control'.

120. *(d)* Fight the Nazis is correct as the concluding lines of th passage clearly highlight that the French are determined to fight and not flag or fall.