Solved Paper 2014

NIMCET

Mathematics

1. A password consists of two alphabets from English followed by three digits chosen from 0 to 3. Repetitions are allowed. The number of different passwords is

(a) ${}^{25}P_1, {}^{25}P_2, {}^{4}P_1, {}^{3}P_1, {}^{2}P_1$ (b) $({}^{26}P_1)^2, ({}^{4}P_1)^3$

(c) ${}^{26}P_1, {}^{26}P_2, {}^{4}P_1, {}^{4}P_2, {}^{4}P_3$ (d) $({}^{26}P_1 \cdot {}^{4}P_1)^2$

2. An equilateral triangle is inscribed in the parabola $y^2 = 4ax$ such that one of the vertices of the triangle coincides with the vertex of the parabola. The length of the side of the triangle is

(a) $a\sqrt{3}$ (b) $2a\sqrt{3}$

(c) $4a\sqrt{3}$ (d) $8a\sqrt{3}$

3. A chain of video stores sells three different brands of DVD players. Of its DVD player sales 50% are brand 1, 30% are brand 2 and 20% are brand 3. Each manufacturer offers one year warranty on parts and labour. It is known that 25% of brand 1 DVD players require warranty repair work, whereas the corresponding percentage for brands 2 and 3 are 20% and 10% respectively. The probability that a randomly selected purchaser has a DVD player that will need repair while under warranty, is

(a) 0.795 (b) 0.205

(c) 0.1250 (d) 0.060

4. The locus of intersection of two lines $\sqrt{3}x - y = 4k\sqrt{3}$ and $k(\sqrt{3}x + y) = 4\sqrt{3}$ for different values of k is a hyperbola. The eccentricity of the hyperbola is

(a) 1.5 (b) $\sqrt{3}$ (c) 2 (d) $\frac{\sqrt{3}}{2}$

5. Constant forces $\mathbf{P} = 2\hat{i} - 5\hat{j} + 6\hat{k}$ and $\mathbf{Q} = -\hat{i} + 2\hat{j} - \hat{k}$ act on a particle. The work done when the particle is displaced from A whose position vector is $4\hat{i} - 3\hat{j} - 2\hat{k}$ to B whose position vector is $6\hat{i} + \hat{j} - 3\hat{k}$, is

(a) 10 units (b) – 15 units

(c) – 50 units (d) 25 units

6. The value of $\int \sqrt{x}\, e^{\sqrt{x}} dx$ is equal to

(a) $2\sqrt{x} - e^{\sqrt{x}} - 4\sqrt{xe^{\sqrt{x}}} + C$ (b) $(2x - 4\sqrt{x} + 4)e^{\sqrt{x}} + C$

(c) $(2x + 4\sqrt{x} + 4)e^{\sqrt{x}} + C$ (d) $(1 - 4\sqrt{x})\, e^{\sqrt{x}} + C$

7. For the vector $\mathbf{a} = -4\hat{i} + 2\hat{j}$, $\mathbf{b} = 2\hat{i} + \hat{j}$ and $\mathbf{c} = 2\hat{i} + 3\hat{j}$, if $\mathbf{c} = m\,\mathbf{a} + n\,\mathbf{b}$, then the value of $m + n$ is

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

(c) $\frac{5}{2}$ (d) $\frac{7}{2}$

8. The value of $\int_0^{\pi/4} \log\,(1 + \tan x)dx$ is equal to

(a) $\frac{\pi}{4}\log 2$ (b) $\frac{\pi}{6}\log 2$

(c) $\frac{\pi}{8}\log 2$ (d) $\frac{\pi}{2}\log 2$

9. The number of ways in which 5 days can be chosen each of the 12 months of a non-leap year, is

(a) $({}^{30}C_5)^4({}^{31}C_5)^7({}^{28}C_5)$ (b) $({}^{30}C_5)^6({}^{28}C_5)^6$

(c) $({}^{30}C_5)^7({}^{31}C_5)^4({}^{28}C_5)$ (d) $({}^{30}C_5)^6({}^{31}C_5)^6({}^{28}C_5)$

10. If $[x]$ represents the greatest integer not exceeding x, then $\int_0^8 [x]dx$ is

(a) 32 (b) 36

(c) 40 (d) 28

11. In a group of 200 students, the mean and standard deviation of scores were found to be 40 and 15, respectively. Later on it was found that two scores 43 and 35 were misread as 34 and 53, respectively. The corrected mean of scores is

(a) 40.95 (b) 39.0

(c) 39.95 (d) 43

12. If the matrix $\begin{bmatrix} -1 & 3 & 2 \\ 1 & K & -3 \\ 1 & 4 & 5 \end{bmatrix}$ has an inverse matrix, then the value of K is

(a) K is any real number (b) $K \neq -4$

(c) $K = -4$ (d) $K \neq 4$

13. The mean deviation from the mean of the AP a, $a + d$, $a + 2d$, ..., $a + 2nd$ is

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

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

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14. If (x_0, y_0) is the solution of the following equations:

$(2x)^{\ln 2} = (3y)^{\ln 3}$

$3^{\ln x} = 2^{\ln y}$

Then, x_0 is

(a) $\frac{1}{6}$ (b) $\frac{1}{3}$

(c) $\frac{1}{2}$ (d) 6

15. The value of $\tan 1^\circ \tan 2^\circ \tan 3^\circ \ldots \tan 89^\circ$ is

(a) 0 (b) $\frac{1}{\sqrt{2}}$

(c) 1 (d) 2

16. If α and β are the roots of the equation $2x^2 + 2px + p^2 = 0$ where, p is a non-zero real number and α^4 and β^4 are the roots of $x^2 - rx + s = 0$, then the roots of $2x^2 - 4p^2x + 4p - 2r = 0$ are

(a) real and unequal

(b) equal and zero

(c) imaginary

(d) equal and non-zero

17. The number of ways to arrange the letters of the English alphabet, so that there are exactly 5 letters a and b, is

(a) ${}^{24}P_5$ (b) ${}^{24}P_5 20!$

(c) ${}^{24}P_5 20! 2$ (d) ${}^{24}P_5 24! 2$

18. Suppose, the system of linear equations

$$-2x + y + z = l$$

$$x - 2y + z = m$$

$$x + y - 2z = n$$

is such that $l + m + n = 0$. Then, the system has

(a) a non-zero unique solution (b) trivial solution

(c) infinitely many solutions (d) no solution

19. $\mathbf{A} = 4\hat{\mathbf{i}} + 3\hat{\mathbf{j}} + \hat{\mathbf{k}}$, $\mathbf{B} = 2\hat{\mathbf{i}} - \hat{\mathbf{j}} + 2\hat{\mathbf{k}}$, then the unit vector $\hat{\mathbf{N}}$ perpendicular to vector $\mathbf{A}$ and $\mathbf{B}$ such that $\mathbf{A}$, $\mathbf{B}$, $\hat{\mathbf{N}}$ form a right handed system, is

(a) $\frac{1}{\sqrt{165}}[7\hat{\mathbf{i}} - 6\hat{\mathbf{j}} - 10\hat{\mathbf{k}}]$ (b) $\frac{1}{7}[6\hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 3\hat{\mathbf{k}}]$

(c) $\frac{1}{\sqrt{21}}[2\hat{\mathbf{i}} + 4\hat{\mathbf{j}} - \hat{\mathbf{k}}]$ (d) $\frac{1}{\sqrt{21}}[-2\hat{\mathbf{i}} - 4\hat{\mathbf{j}} + \hat{\mathbf{k}}]$

20. The value of $\int \frac{(x+1)}{x(xe^x + 1)}\,dx$ is equal to

(a) $\log \frac{1 + xe^x}{xe^x} + C$ (b) $\log[xe^x(1 + xe^x)] + C$

(c) $\log\left[\frac{1}{1 + xe^x}\right] + C$ (d) $\log\left|\frac{xe^x}{1 + xe^x}\right| + C$

21. The sum of two vectors $\mathbf{a}$ and $\mathbf{b}$ is a vector $\mathbf{c}$ such that $|\mathbf{a}| = |\mathbf{b}| = |\mathbf{c}| = 2$. Then, the magnitude of $\mathbf{a} - \mathbf{b}$ is equal to

(a) $2\sqrt{3}$ (b) 2

(c) $\sqrt{3}$ (d) 0

22. If x and y are positive real numbers satisfying the system of equations

$x^2 + y\sqrt{xy} = 336$, $y^2 + x\sqrt{xy} = 112$, then $x + y$ is

(a) $\sqrt{448}$ (b) $\sqrt{224}$

(c) 20 (c) 40

23. From three collinear points A, B and C on a level ground which can be on the same side of a tower, the angles of elevation of the top of the tower are 30°, 45° and 60°, respectively. If $BC = 60$ m, then AB is

(a) $15\sqrt{3}$ m (b) $30\sqrt{3}$ m

(c) $45\sqrt{3}$ m (d) $60\sqrt{3}$ m

24. If $x = 1$ is the directrix of the parabola $y^2 = kx - 8$, then k is

(a) $\frac{1}{8}$ (b) 8 (c) 4 (d) $\frac{1}{4}$

25. If $\sin x + a\cos x = b$, then $|a \cdot \sin x - \cos x|$ is

(a) $\sqrt{a^2 + b^2 + 1}$ (b) $\sqrt{a^2 - b^2 + 1}$

(c) $\sqrt{a^2 + b^2 - 1}$ (d) None of the above

26. A condition that $x^3 + ax^2 + bx + c$ may have no extremum is

(a) $a^2 \geq 3b$ (b) $b^2 < 3a$ (c) $a^2 < 3b$ (d) $b^2 \geq 3a$

27. If n and r are integers such that $1 \leq r \leq n$, then the value of $n({}^{n-1}C_{r-1})$ is

(a) ${}^nC_r$ (b) $r({}^nC_r)$

(c) $n({}^nC_r)$ (d) $(n-1)({}^nC_r)$

28. If the foci of the ellipse $b^2x^2 + 16y^2 = 16b^2$ and the hyperbola $81x^2 - 144y^2 = \frac{81 \times 144}{25}$ coincide, then the value of b is

(a) 1 (b) $\sqrt{5}$ (c) $\sqrt{7}$ (d) 3

29. There are 8 students appearing in an examination of which 3 have to appear in Mathematics paper and the remaining 5 in different subjects. Then, the number of ways they can be made to sit in a row, if the candidates in Mathematics cannot sit next to each other is

(a) 2400 (b) 16200

(c) 4200 (d) 14400

30. If x is so small that x^2 and higher powers of x can be neglected, then $\frac{(9 + 2x)^{1/2}(3 + 4x)}{(1 - x)^{1/5}}$ is approximately equal to

(a) $9 + \frac{74}{15}x$ (b) $9 + \frac{74}{5}x$

(c) $3 + \frac{74}{15}x$ (d) $3 + \frac{74}{5}x$

31. If the sets A and B are defined as $A = \{(x, y) \mid y = 1/x, 0 \neq x \in R\}$, $B = \{(x, y) \mid y = -x \in R\}$ then

(a) $A \cap B = \phi$ (b) $A \cap B = B$

(c) $A \cap B = A$ (d) None of these

32. If A, B and C is three angles of a ΔABC, whose area is Δ. Let a, b and c be the sides opposite to the angles A, B and C respectively. If $s=\frac{a+b+c}{2}=6$, then the product $\frac{1}{3}s^2(s-a)(s-b)(s-c)$ is equal to

(a) 2Δ (b) $2\Delta^2$ (c) $\sqrt{2}\Delta$ (d) Δ^2

33. A normal to the curve $x^2=4y$ passes through the point (1,2). The distance of the origin from the normal is

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

34. Suppose r integers, $0<r<10$, are chosen from (0, 1, 2 ...,9) at random and with replacement. The probability that no two are equal, is

(a) $\frac{10!}{10!\,r!}$ (b) $\frac{10!}{10!(10-r)!}$

(c) $\frac{10!}{r!(10-r)!}$ (d) $\frac{10!}{10^r!(10-r)!}$

35. If $x^2+2ax+10-3a>0$ for all $x\in IR$, then

(a) $-5<a<2$ (b) $a<-5$

(c) $a>5$ (d) $2<a<5$

36. A box contains 3 coins, one coin is fair, one coin is two headed and one coin is weighted, so that the probability of heads appearing is $\frac{1}{3}$. A coin is selected at random and tossed, then the probability that head appears, is

(a) $\frac{11}{18}$ (b) $\frac{7}{18}$ (c) $\frac{1}{8}$ (d) $\frac{1}{4}$

37. If a vector a makes an angle with the coordinate axes and has magnitude 3, then the angle between a and each of the three coordinate axes is

(a) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (b) $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

(c) $\frac{\pi}{6}$ (d) $\frac{\pi}{3}$

38. If $f(x)=\begin{cases}\frac{\sin[x]}{[x]}, & [x]\neq 0\\ 0, & [x]=0\end{cases}$, where $[x]$ is the largest integer but not larger than x, then $\lim_{x\to 0} f(x)$ is

(a) –1 (b) 0

(c) 1 (d) Does not exist

39. If $\tan A-\tan B=x$ and $\cot B-\cot A=y$, then $\cot(A-B)$ is equal to

(a) $\frac{1}{x}+\frac{1}{y}$ (b) $\frac{1}{x}-\frac{1}{y}$

(c) $-\frac{1}{x}+\frac{1}{y}$ (d) $-\frac{1}{x}-\frac{1}{y}$

40. If $a=\log_{12}18$, $b=\log_{24}54$, then $ab+5(a-b)$ is

(a) 1 (b) 0

(c) 2 (d) $\frac{3}{2}$

41. A student takes a quiz consisting of 5 multiple choice questions. Each question has 4 possible answers. If a student is guessing the answer at random and answer to different are independent, then the probability of atleast one correct answer is

(a) 0.237 (b) 0.00076

(c) 0.7623 (d) 1

42. The condition that the line $lx+my+n=0$ becomes a tangent to the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, is

(a) $a^2l+b^2m+n=0$ (b) $al^2-bm^2=n^2$

(c) $al+bm=n$ (d) $a^2l^2+b^2m^2=n^2$

43. The value of $\sin 20^\circ \sin 40^\circ \sin 80^\circ$ is

(a) $\frac{1}{2}$ (b) $\frac{\sqrt{3}}{2}$ (c) $\frac{\sqrt{3}}{8}$ (d) $\frac{1}{8}$

44. Two non-negative numbers whose sum is 9 and the product of the one number and square of the other number is maximum, are

(a) 5 and 4 (b) 3 and 6

(c) 1 and 8 (d) 7 and 2

45. The median AD of ΔABC is bisected at E and BE is produced to meet the side AC at F. Then, $AF:FC$ is

(a) 2 : 1 (b) 1 : 2

(c) 3 : 1 (d) 1 : 3

46. If PQ is a double ordinate of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ such that OPQ is an equilateral triangle, where O is the centre of the hyperbola, then which of the following is true?

(a) $b^2>\frac{-a^2}{\sqrt{3}}$ (b) $b^2>\frac{a^2}{3}$

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

47. In ΔABC, if $a=2$, $b=4$ and $\angle C=60^\circ$, then A and B are respectively equal to

(a) 90°, 30° (b) 45°, 75°

(c) 60°, 60° (d) 30°, 90°

48. If $\int \frac{xe^x}{\sqrt{1+e^x}}dx=f(x)\sqrt{1+e^x}-2\log\frac{\sqrt{1+e^x}}{\sqrt{1+e^x}}+C$, then $f(x)$ is

(a) $2x-1$ (b) $2x-4$ (c) $x+4$ (d) $x-4$

49. The average marks of boys in a class is 52 and that of girls is 42. The average marks of boys and girls combined is 50. The percentage of boys in the class is

(a) 80% (b) 60% (c) 40% (d) 20%

50. How many even integers between 4000 and 7000 have four different digits?

(a) 672 (b) 840

(c) 504 (d) 728

Analytical Ability & Logical Reasoning

51. A road network has parallel roads, which are equidistant from each other and running North-South or East-West only. The road junctions A, B, C, H and X are such that A is East of B and West of C. H is South-West of C and South-East of B. B is South-East of X. Which of the junctions are the farthest South. and the farthest East?

(a) H, B (b) H, C (c) C, H (d) B, H

52. Four players A, B, C and D have to form into two pairs, however, no pair can play together more than seven times in a row A and B have played seven games in a row. C and D have three in a row. C does not to work with A. Who should play with B?

(a) A (b) D
(c) C (d) Cannot be determined

53. If ROSE is coded as 6821, CHAIR is coded as 73456 and PREACH is coded as 961473, then the code for SEARCH is

(a) 216473 (b) 214673 (c) 214763 (d) 246173

Directions [Q. Nos. 54 to 56]

Cricket clubs in five towns A, B, C, D and E have one team each named P, Q, R, S and T, not necessarily in the same order.

The team in A has beaten R, P and S, Q has beaten the teams in E, C and A. Team R is in B and the team in C is not S.

54. Where is the team Q?

(a) A (b) B (c) C (d) D

55. Where is the team P?

(a) A (b) B (c) C (d) D

56. Which team is in A?

(a) P (b) Q (c) S (d) T

57. Find the number that comes next in the series

120, 99, 80, 63, 48, ...

(a) 35 (b) 38 (c) 39 (d) 40

58. In a certain school, the number of students in each section was 24. After admitting some students, three new sections have been started and now there are 16 sections with 21 students in each. What is the number of newly admitted students?

(a) 14 (b) 24
(c) 16 (d) 26

59. The nine alphabets L, M, N, O, P, Q, R, S and T are assigned to nine integers 1 to 9 not necessarily in the same order 4 is assigned to P. The difference between P and T is 5. The difference between N and T is 3.

What is the integer assigned to N?

(a) 7 (b) 6
(c) 5 (d) 4

Directions [Q. Nos. 60 to 63]

Five boys A, B, C, D, E and five girls P, Q, R, S, T are standing in two rows facing each other not necessarily in the order. E is not at any ends. C is to the immediate right of B and D is to the immediate left of A, who is facing P. There are as many girls between P and Q as between R and S. A is second to the left of B.S and R are not facing either B or D.

60. Which pair of boys are standing at the ends of the row?

(a) C and D (b) C and B
(c) D and B (d) None of these

61. Which of the following is definitely true?

(a) C is third to the right of D (b) D is facing P
(c) C is facing S (d) None of these

62. Who is standing to the immediate right of A?

(a) E (b) C
(c) D (d) B

63. Who is facing B?

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

64. The sum of ages of a daughter and mother is 63 yr. Four years back mother's age was 4 times that of daughter's age at that time. What is present age of mother?

(a) 46 yr (b) 48 yr
(c) 50 yr (d) 59 yr

65. A watch gains 10 s in 5 min was set correct at 9.00 am. When the watch indicated 20 min past 7.00 pm in the same evening, the correct time is

(a) 7.00 pm (b) 7.40 pm
(c) 7.10 pm (d) 8.00 pm

66. Father is aged three times more than the age of his son Rohit. After 8 yr, he would be two and a half times of Rohit's age. After further 8 yr, how many times would he be of Rohit's age?

(a) 2 times (b) 3 times
(c) 2.5 times (d) 3.5 times

67. What is the number that comes next in the series?

1, 2, 3, 6, 11, 20, 37, 68,

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

Directions [Q. Nos. 68 to 69]

Six friends A, B, C, D, E and F are sitting round a hexagonal table. F, who is sitting exactly opposite A, is to be immediate right of B, D is between A and B and is exactly opposite to C.

68. Who are sitting next to A?

(a) D and E (b) D and F
(c) C and E (d) B and D

69. Who is sitting opposite to B?

(a) A (b) C
(c) E (d) F

70. The arithmetic mean of 2^{10} and 2^{20} is

(a) 2^{15}
(b) $2^5 + 2^{10}$
(c) $2^9 + 2^{20}$
(d) $2^9 + 2^{19}$

71. There are five different boxes of different unknown weights each less than 100 kg. These boxes were weighted in pairs and the weights obtained are 110, 112, 113, 114, 115, 116, 117, 118, 120 and 121 kg. What is the weight in kg of the heaviest box?

(a) 60 (b) 62
(c) 64 (d) 61

Directions [Q. Nos. 72 to 76]

All the roads of a city are either perpendicular or parallel to one another. The roads are all straight. Roads A, B, C, D and E are parallel to one another. Roads F, G, H, I, J, K, L and M are parallel to one another.
Road A is 1 km East of road B.
Road B is 1/2 km West of road C.
Road D is 1 km West of road E.
Road G is 1/2 km South of road H.
Road I is 1 km North of road J.
Road K is 1/2 km North of road L.
Road K is 1 km South of road M.

72. Which of the following is necessarily true?

(a) E and B intersect
(b) D is 2 km West of B
(c) D is atleast 2 km West of A
(d) M is 1.5 km North of L

73. If E is between B and C, then which of the following is false?

(a) D is 2 km West of A
(b) C is less than 1.5 km from D
(c) Distance from E to B added to distance of E to C is 1/2 km
(d) E is less than 1 km from A

74. If road E is between B and C, then the distance between A and D is

(a) less than 1 km
(b) C is 1 km West of D
(c) between 1/2 km and 2 km
(d) more than 2 km

75. Which of the following possibilities would make two roads coincide?

(a) L is 1/2 km North of I
(b) C is 1 km West of D
(c) I is 1/2 km North of K
(d) E and B are 1/2 km apart

76. If K is parallel to I, K is 1/2 km South of J and 1 km North of G, then which of the following two roads would be 1/2 km apart?

(a) I and K (b) J and G (c) I and G (d) J and K

77. The students in three classes are in the ratio 2 : 3 : 5. If 20 students are increased in each class, the ratio changes to 4 : 5 : 7. The total number of students before the increase were

(a) 10 (b) 90
(c) 100 (d) None of these

78. Ajith is three times older than Babita. Chetu is half the age of Das. Babita is older than Chetu. Which of the following additional information is needed to estimate the age of Ajith?

I. Chetu is 10 yr old.
II. Both Babita and Das are older than Chetu by the same number of years.

(a) Only I (b) Only II
(c) I and II (d) None of these

Directions [Q. Nos. 79 to 82]

Six friends P, Q, R, S, T and U are standing in two rows facing one another. P is the middle of one row. U is to the left to S and facing R, Q and T are not in the same row. Only one person is in between R and T.

79. Which of the following are in the same row?

(a) U, S and T (b) R, P and T
(c) U, Q and P (d) U, R, and Q

80. Who is to the left of S?

(a) P (b) U (c) S (d) Q

81. Who faces P?

(a) Q (b) T (c) S (d) U

82. Which of the following pairs are facing each other?

(a) RS (b) TU
(c) PU (d) TQ

Directions [Q. Nos. 83 to 87]

Six members of a family A, B, C, D, E and F are Psychologist, Manager, Advocate, Jeweller, Doctor and Engineer but not necessarily in same order.
Doctor is the grandfather of F, who is Psychologist.
Manager D is married to A.
Jeweller C is married to Advocate.
B is the mother of F and E.
There are two married couples in the family.

83. Which is the profession of A?

(a) Manager (b) Engineer
(c) Can't be determined (d) None of these

84. What is the profession of E?

(a) Manager (b) Engineer
(c) Doctor (d) None of these

85. How is A related to E?

(a) Grandmother (b) Wife
(c) Grandfather (d) None of these

86. How many male members are there in the family?

(a) Two (b) Three
(c) Four (d) Can't be determined

87. Who are the two couples in the family?

(a) AD and CB (b) AB and CD
(c) AC and BD (d) None of these

Directions [Q. Nos. 88 to 90]

At a small company, parking spaces are reserved for the top executives: CEO, President, Vice-President, Secretary and Treasurer with the spaces lined up in that order. The parking lot guard can tell at a glance, if the cars are parked correctly by looking at the colour of the cars. The cars are yellow, green, purple, red and blue and the executive names are Alice, Bert, Cheryl, David and Enid.

The car in the first space is red.
A blue car is parked between the red car and the green car.
The car in the last space is purple.
The secretary drives a yellow car.
Alice's is parked next to David's.
Enid drives a green car.
Bert's car is parked between Cheryl's and Enid's.
David's car is parked in the last space.

88. Who is the secretary?

(a) Enid (b) David
(c) Cheryl (d) Alice

89. Who is the CEO?

(a) Alice (b) Bert (c) Cheryl (d) David

90. What colour is the Vice-President car?

(a) Green (b) Yellow (c) Blue (d) Purple

General English

91. Fill in the blank with a correct word.

The kitten was soaked to the skin from the _____.

(a) craven (b) storm (c) abyss (d) wind

92. Fill in the blank with the correct word.

The ship was attacked by _____ near a deserted Island.

(a) burglars (b) gangsters (c) pirates (d) thieves

93. From the given alternatives, chosen the one which best express the given sentence in indirect/direct speech. The boy said, 'Who dare call you a thief ?'

(a) The boy enquired who dared call him a thief
(b) The boy asked who called him a thief
(c) The boy told that who dared call him a thief
(d) The boy wondered who dared call him a thief

94. Choose the one which can be substituted for the sentence. 'The study of ancient societies'.

(a) Anthropology (b) Archeology
(c) History (d) Etnology

Directions [Q. Nos. 95 to 96]

Population explosion, malnutrition and ill health are the problems that modern scientists examine for solutions. The agriculture scientists are required to concentrate not only on large production, but also more on improved varieties and protein-rich foods to ward off the ills of malnutrition. The medical scientists responsibilities is not limited to the manufacture of drugs to cure diseases, they must invent medicines to prot zumanity from epidemics. UoJess important is the area of war and weapons.
The large scale devastation in Japan by the atom bomb is a stigma on the lair name of scientist. The modem scientist must make a point not to help in the proliferation of atomic weapons. They should rather devote their energies to the peaceful uses of atomic energy for the emancipation of humanity from hunger and diseases. They must realise that the benefit of their researches and inventions should reach the hands of all, the rich and poor alike.

95. Modern scientists must make point not to help.

(a) In the peaceful use of atomic energy
(b) In the prevention of malnutrition
(c) In the proliferation of atomic weapons
(d) In the removal of ill health

96. What does the expression 'malnutrition' used in the passage mean?

(a) Excessive nourishment (b) Prevention of epidemics
(c) Proliferation of diseases (d) Lack of proteins

97. Change the voice,

Why did your brother write such a letter?

(a) Why was such a letter written by your brother?
(b) Why did your brother write such a letter?
(c) Why was such a letter wrote by your brother?
(d) Why does your brother write such a letter?

98. The first and the last parts of a sentence are numbered as 1 and 6. The rest of the sentence is split into four parts named P, Q, R, S. These four parts are not given in their proper order. Read the sentence and find out which of the four combinations in correct.

1. Let's never
P. that food
Q. virtually impossible
R. forget
S. is seductive and
6. to resist

(a) SRPQ (b) PSRQ (c) QSRP (d) RPSQ

99. Arrange the given words to form a meaningful sentence

(a) dejected (b) students
(c) lot (d) of
(e) a (f) were

(a) dbfeac (b) abfecd (c) ecdbfa (d) afebcd

100. Fill in the blank with appropriate question tag.

She lives in Chennai now, _____

(a) lives she ? (b) doesn't she?
(c) does she ? (d) she does?

101. Pick out the correct word that best expresses the meaning of 'prudent'.

(a) Skillful (b) Efficient
(c) Wise (d) Profitable

102. Choose the correct article for the sentence below.

"Many _____ flower is born to blush unseen."

(a) an (b) the
(c) a (d) No article

103. The synonym of 'stupendous' is

(a) astounding (b) horrible
(c) appealing (d) comforting

104. Select the pair with same relationship AFTER : BEFORE

(a) FIRST : SECOND
(b) CONTEMPORARY : HISTORIC
(c) PRESENT : PAST
(d) SUCCESSOR : PREDECESSOR

105. Choose the one which can be substituted for the phrase "A person who insists on something"?

(a) Disciplinarian (b) Stickler
(c) Instantaneous (d) Boaster

106. Choose the correct form of verb for the sentence below.

I propose that the meeting _____ put off till sunday next.

(a) will be (b) is to be
(c) should be (d) be

107. Fill in the blank with correct preposition.

The policeman told me to keep _____ the left.

(a) for (b) of
(c) to (d) by

108. Choose the most suitable synonym for the word "Amicable".

(a) Just (b) Pleasant
(c) Peaceful (d) Complete

109. Choose the most suitable antonym for the word Rude.

(a) Sweet (b) Polite
(c) Decent (d) Gentle

110. Choose the word that matches suitably with the word underlined in the given sentence.

"Developing indigenous technology is important to lead the nation to self-sufficiency."

(a) Intelligent (b) Native
(c) Capitalistic (d) Wise

Computer Awareness

111. The decimal equivalent of the hexadecimal operation A10 + B21 is

(a) 5425 (b) 5246 (c) 2849 (d) 5344

112. What is the 2's complement of 00110101 1001 1100?

(a) 1100 1010 1100 1011 (b) 1100 1010 0110 0011
(c) 1100 1010 0110 0100 (d) 1100 1010 1111 1111

113. Multiplication of 111_2 by 101_2 is

(a) 110011_2 (b) 100011_2 (c) 111100_2 (d) 000101_2

114. What is the 8 bit 2's complement representation of the negative integer-93?

(a) 1010011 (b) 10100010
(c) 0XA2 (d) None of these

115. Consider the values $A = 2.0 \times 10^{30}$, $B = -2.0 \times 10^{30}$, $C = 1.0 \times 10^{30}$. Assume, that the floating point numbers are represented with 32 bits. What are the values of X and Y, when the following sequence of operations are executed on a computer?

$X = A + B$ $Y = A + C$
$X = X + C$ $Y = Y + B$

(a) $X = 1.0, Y = 1.0$ (b) $X = 1.0, Y = 0.0$
(c) $X = 0.0, Y = 1.0$ (d) $X = 0.0, Y = 0.0$

116. The Boolean expression $X \cdot (X + Y)$ is same as

(a) $X \cdot (1 + Y)$ (b) X
(c) $X \cdot 1$ (d) All of these

117. How many bytes are there in a nibble?

(a) one-fourth (b) half
(c) 2 (d) 4

118. The number of bit strings of length 8, that start with the bit 0 or end with the bits 11 is

(a) 132 (b) 180 (c) 256 (d) 160

119. The result of multiplication of the numbers $(10101)_2$ and $(11101)_2$ in hexadecimal form is

(a) 609 (b) 216
(c) 261 (d) 906

120. The binary equivalent of $(531.53125)_{10}$ is

(a) $(1001010011.100001)_2$ (b) $(1000010011.10011)_2$
(c) $(1010010011.11001)_2$ (d) $(1000010011.10001)_2$

Answer *with* Explanations

1. (*b*) Total alphabet in English = 26

Two words can be selected from 26 alphabet in ${}^{26}P_1 \times {}^{26}P_1$ ways.

Now, next three digits from 0 to 3

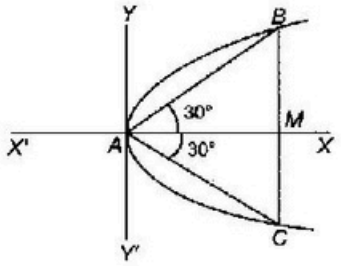
i.e. 0, 1, 2, 3 are selected.

$$= {}^4P_1 \times {}^4P_1 \times {}^4P_1 \times {}^4P_1 = ({}^4P_1)^3$$

$\therefore$ Password $= {}^{26}P_1 \times {}^{26}P_1 \times ({}^4P_1)^3$

$$= ({}^{26}P_1)^2 \times ({}^4P_1)^3$$

2. (*d*) Let length of side of ΔABC be l.



i.e. $AB = l$

Then, $\cos 30° = \dfrac{AM}{AB}$

$$AM = x \cos 30°$$

$$AM = l\frac{\sqrt{3}}{2}$$

and $\dfrac{BM}{AB} = \sin 30°$

$$BM = \frac{l}{2}$$

$\therefore$ The coordinate of B are $\left(\dfrac{l\sqrt{3}}{2}, \dfrac{l}{2}\right)$

B lies on the parabola $y^2 = 4ax$

$\therefore$ $\dfrac{l^2}{4} = 4al\dfrac{\sqrt{3}}{2}$

$$l = 8a\sqrt{3}$$

3. (*b*) Let probability of sale of brand 1 is $P(A)$.

Similarly, for brand 2 is $P(B)$

and brand 3 is $P(C)$

Given, $P(A) = \dfrac{50}{100} = \dfrac{1}{2}$

$$P(B) = \frac{30}{100} = \frac{3}{10} \quad \text{...(i)}$$

$$P(C) = \frac{20}{100} = \frac{1}{5}$$

and also let the probability of required warranty work of brand (1) is $P(A)$.

Similarly, for brand 2 is $P(B)$

and for brand 3 is $P(C)$.

$\therefore$ $P(A) = \dfrac{25}{100} = \dfrac{1}{4}$

$$P(B) = \frac{20}{100} = \frac{1}{5}$$

$$P(C) = \frac{10}{100} = \frac{1}{10}$$

Now, required probability

$$= \frac{1}{2} \times \frac{1}{4} + \frac{3}{10} \times \frac{1}{5} + \frac{1}{5} \times \frac{1}{10}$$

$$= \frac{1}{8} + \frac{3}{50} + \frac{1}{50} = \frac{50 + 24 + 8}{400}$$

$$= \frac{82}{400}$$

$$= 0.205$$

4. (*c*) Given, lines are

$$\sqrt{3}x - y = 4k\sqrt{3} \quad \text{...(i)}$$

and $k(\sqrt{3}x) + ky = 4\sqrt{3}$

$\Rightarrow$ $\sqrt{3}x + y = \dfrac{4\sqrt{3}}{k}$ ...(ii)

From Eqs. (i) and (ii),

$$3x^2 - y^2 = 48$$

$$\frac{x^2}{16} - \frac{y^2}{48} = 1$$

which is a hyperbola.

$\therefore$ $a = 4, b = 4\sqrt{3}$

$$e = \sqrt{1 + \frac{b^2}{a^2}} = \sqrt{\frac{16 + 48}{16}} = \sqrt{\frac{64}{16}} = 2$$

5. (*b*) We have,

$$\mathbf{P} = 2\hat{\mathbf{i}} - 5\hat{\mathbf{j}} + 6\hat{\mathbf{k}}$$

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

Position vector of

$$\mathbf{A} = 4\hat{\mathbf{i}} - 3\hat{\mathbf{j}} - 2\hat{\mathbf{k}}$$

and $\mathbf{B} = 6\hat{\mathbf{i}} + \hat{\mathbf{j}} - 3\hat{\mathbf{k}}$

$$\mathbf{d} = \mathbf{AB} = 2\hat{\mathbf{i}} + 4\hat{\mathbf{j}} - \hat{\mathbf{k}}$$

$\therefore$ $\mathbf{F} = \mathbf{P} + \mathbf{Q} = \hat{\mathbf{i}} - 3\hat{\mathbf{j}} + 5\hat{\mathbf{k}}$

Work done $= \mathbf{F} \cdot \mathbf{d}$

$$= (\hat{\mathbf{i}} - 3\hat{\mathbf{j}} + 5\hat{\mathbf{k}}) \cdot (2\hat{\mathbf{i}} + 4\hat{\mathbf{j}} - \hat{\mathbf{k}})$$

$$= 2 - 12 - 5 = -15 \text{ units}$$

6. (*b*) We have,

$$I = \int \sqrt{x} e^{\sqrt{x}} dx \quad \text{...(i)}$$

Put $\sqrt{x} = t$

$\Rightarrow$ $\dfrac{1}{2\sqrt{x}} dx = dx$

$\Rightarrow \quad dx = 2\sqrt{x}\,dt$

$\therefore \quad I = 2\int \sqrt{x} e^t t\,dt = 2\int t^2 \cdot e^t\,dt$

$= 2[t^2 \cdot e^t - 2\int t e^t\,dt]$

$= 2[t^2 e^t - 2\{t e^t - e^t\}] + C$

$= 2e^t[t^2 - 2t + 2] + C$

$= e^{\sqrt{x}}[2x - 4\sqrt{x} + 4] + C$

7. (c) We have,

$\mathbf{a} = -4\hat{\mathbf{i}} + 2\hat{\mathbf{j}} \quad \ldots(i)$

$\mathbf{b} = 2\hat{\mathbf{i}} + \hat{\mathbf{j}} \quad \ldots(ii)$

$\mathbf{c} = 2\hat{\mathbf{i}} + 3\hat{\mathbf{j}} \quad \ldots(iii)$

$\mathbf{c} = m\mathbf{a} + n\mathbf{b} \quad \ldots(iv)$

From Eqs. (i), (ii), (iii) and (iv),

$2\hat{\mathbf{i}} + 3\hat{\mathbf{j}} = m(-4\hat{\mathbf{i}} + 2\hat{\mathbf{j}}) + n(2\hat{\mathbf{i}} + \hat{\mathbf{j}})$

$\Rightarrow \quad 2 = -4m + 2n \quad \ldots(v)$

$\Rightarrow \quad 3 = 2m + n \quad \ldots(vi)$

$\Rightarrow \quad 2 = -4m + 2(3 - 2m)$

$\Rightarrow \quad 2 = -4m + 6 - 4m$

$\Rightarrow \quad 8m = 4 \Rightarrow m = \frac{1}{2}$

From Eq. (v),

$2 = -2 + 2n$

$\Rightarrow \quad n = 2$

$\therefore \quad m + n = \frac{1}{2} + 2$

$\Rightarrow \quad m + n = \frac{5}{2}$

8. (c) We have, $\int_0^{\pi/4} \log(1 + \tan x)dx$

Let $I = \int_0^{\pi/4} \log(1 + \tan x)dx$

$= \int_0^{\pi/4} \log\left[1 + \tan\left(\frac{\pi}{4} - x\right)\right]dx$

$= \int_0^{\pi/4} \log\left(1 + \frac{\tan\pi/4 - \tan x}{1 + \tan\pi/4 \tan x}\right)dx$

$= \int_0^{\pi/4} \log\left(1 + \frac{1 - \tan x}{1 + \tan x}\right)dx$

$= \int_0^{\pi/4} \log\left(\frac{1 + \tan x + 1 - \tan x}{1 + \tan x}\right)dx$

$= \int_0^{\pi/4} \log\left(\frac{2}{1 + \tan x}\right)dx$

$= \int_0^{\pi/4} \log 2\,dx - \int_0^{\pi/4} \log(1 + \tan x)\,dx$

$\Rightarrow \quad 2I = \log 2[x]_0^{\pi/4}$

$\Rightarrow \quad I = \log 2[\pi/4]$

$\therefore \quad I = \frac{\pi}{8}\log 2$

9. (a) In a leap year,

7 months have 31 days

4 months have 30 days

and 1 month (Feb) has 28 days

Total numbers of ways

$= ({}^{31}C_5)^7 ({}^{30}C_5)^4 ({}^{28}C_5)^1$

10. (b) We have,

$I = \int_1^9 [x]dx$

$= \int_1^2 1dx + \int_2^3 2dx + \int_3^4 3dx + \int_4^5 4dx$

$+ \int_5^6 5dx + \int_6^7 6dx + \int_7^8 7\,dx + \int_8^9 8\,dx$

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

$+ 6(7 - 6) + 7(8 - 7) + 8(9 - 8)$

$= 1 + 2 + \ldots + 8$

$= \frac{8 \times 9}{2} = 36$

11. (c) We have,

Total number of students, $n = 200$

Combined mean, $\bar{x} = 40$

Misread data, $(x_1, x_2) = 34, 53$

Correct data, $(x_3, x_4) = (43, 35)$

$\therefore \quad$ Correct mean $= \frac{\bar{x}n - (34 + 53) + (43 + 35)}{200}$

$= \frac{200 \times 40 - 87 + 78}{200}$

$= \frac{7991}{200} = 39.95$

12. (b) If given matrix $A = \begin{bmatrix} -1 & 3 & 2 \\ 1 & k & -3 \\ 1 & 4 & 5 \end{bmatrix}$ is

invertible, then $|A| \neq 0$.

$\therefore \quad |A| = -1(5k + 12) - 3(3 + 5) + 2(4 - k)$

$= -5k - 12 - 24 + 8 - 2k$

$= -28 - 7k$

$\because \quad |A| \neq 0$

$\therefore \quad 7k \neq -28$

$\Rightarrow \quad k \neq -4$

13. (b) Given, AP is

$a, a + d, a + 2d, \ldots, a + 2nd$

Mean of the AP,

$\bar{x} = \frac{1}{2n + 1}[a + a + d + \ldots + a + 2nd]$

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

$= a + nd$

$\therefore$ Mean deviation from the mean

$= \frac{1}{2n + 1}\sum_{r=0}^{2n} |(a + rd) - (a + nd)|$

$$= \frac{1}{2n+1}\sum_{r=0}^{2n}|(r-n)d|$$

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

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

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

14. (c) We have,

$$(2x)^{\log 2} = (3y)^{\log 3} \quad \ldots(i)$$

and $$3^{\log x} = 2^{\log y} \quad \ldots(ii)$$

If x_0, y_0 are the solution of these equations.

Now, $$(2x_0)^{\log 2} = (3y_0)^{\log 3}$$

Taking log on both sides,

$$\log 2 \log(2x_0) = \log 3 \log(3y_0)$$

$$\Rightarrow \frac{\log 2}{\log 3}\log(2x_0) = \log(3y_0)$$

$$\frac{\log 2}{\log 3}(\log 2 + \log x_0) = \log 3 + \log y_0 \quad \ldots(iii)$$

Taking log on both sides of Eq. (ii)

$$\log x_0 \log 3 = \log y_0 \log 2$$

$$\Rightarrow \log y_0 = \frac{\log 3}{\log 2}\cdot\log x_0 \quad \ldots(iv)$$

From Eqs. (iii) and (iv),

$$\frac{\log 2}{\log 3}(\log 2 + \log x_0) = \log 3 + \frac{\log 3}{\log 2}\cdot\log x_0$$

$$\Rightarrow \log x_0\left[\frac{\log 2}{\log 3} - \frac{\log 3}{\log 2}\right] = \log 3 - \log 2\cdot\frac{\log 2}{\log 3}$$

$$\Rightarrow \log x_0\left[\frac{\log 2}{\log 3} - \frac{\log 3}{\log 2}\right] = \log 2\left[\frac{\log 3}{\log 2} - \frac{\log 2}{\log 3}\right]$$

$$\Rightarrow \log x_0 = -\log 2$$

$$\Rightarrow \log x_0 = \log 2^{-1}$$

or $$x_0 = \frac{1}{2}$$

15. (c) We have,

$$\tan 1^\circ \tan 2^\circ \ldots \tan 89^\circ$$

$$= \tan(90^\circ - 89^\circ)\tan 89^\circ \tan(90^\circ - 88^\circ)\tan 88^\circ \ldots$$

$$= \cot 89^\circ \tan 89^\circ - \tan 88^\circ \cot 88^\circ \ldots$$

$$= 1\cdot 1$$

$$= 1$$

16. (d) We have, $2x^2 + 2px + p^2 = 0$

$$\alpha + \beta = -p$$

$$\alpha\beta = \frac{p^2}{2} \quad \ldots(i)$$

and α^4 and β^4 are the roots of $x^2 - rx + s = 0$.

$$\alpha^4 + \beta^4 = r$$

$$\alpha^4\beta^4 = s \quad \ldots(ii)$$

Now, $2x^2 - 4p^2x + 4p - 2r = 0$

$\because$ $$D = B^2 - 4AC$$

$\therefore$ $$D = 16p^4 - 4[2(p^4 - 2r)]$$

$$= 16p^4 - 8p^4 + 16r$$

$$= 8(p^4 + 2r)$$

$$= 8[4\alpha^2\beta^2 + 2(\alpha^4 + \beta^4)]$$

$$= 16[(\alpha+\beta)^2 - 2\alpha\beta]^2$$

$$= 16(p^2 - p^2)$$

$$= 0$$

Hence, the roots of the equation

$2x^2 - 4p^2x + 4p - 2r = 0$ are equal.

17. (c) Total number of English alphabet = 26

Total number of arrangements = ${}^{24}P_5\, 20!\cdot 2$

18. (c) We have,

$$-2x + y + z = l \quad \ldots(i)$$

$$x - 2y + z = m \quad \ldots(ii)$$

$$x + y - 2z = n \quad \ldots(iii)$$

Given, $$l + m + n = 0$$

Coefficient matrix will be

$$[A_k] = \begin{bmatrix} -2 & 1 & 1 & l \\ 1 & -2 & 1 & m \\ 1 & 1 & -2 & n \end{bmatrix}$$

Applying $R_1 \to R_1 + R_2 + R_3$

$$= \begin{bmatrix} 0 & 0 & 0 & l+m+n \\ 1 & -2 & 1 & m \\ 1 & 1 & -2 & n \end{bmatrix}$$

$$[A_k] = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 1 & -2 & 1 & m \\ 1 & 1 & -2 & n \end{bmatrix} \quad [\because l+m+n=0]$$

$\therefore$ $$p[A_k] = 2$$

i.e. $p[A_k] <$ number of variables.

Hence, it has infinitely many solutions.

19. (a) We have

$$\mathbf{A} = 4\hat{\mathbf{i}} + 3\hat{\mathbf{j}} + \hat{\mathbf{k}}$$

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

$\mathbf{N}$ is perpendicular to both $\mathbf{A}$ and $\mathbf{B}$.

i.e. $$\hat{\mathbf{N}} = \lambda(\mathbf{A} \times \mathbf{B})$$

$\therefore$ $$\hat{\mathbf{N}} = \lambda\begin{bmatrix} \hat{\mathbf{i}} & \hat{\mathbf{j}} & \hat{\mathbf{k}} \\ 4 & 3 & 1 \\ 2 & -1 & 2 \end{bmatrix}$$

$$= \lambda[\hat{\mathbf{i}}(6+1) - \hat{\mathbf{j}}(8-2) + \hat{\mathbf{k}}(-4-6)]$$

$\because$ $$= \lambda[7\hat{\mathbf{i}} - 6\hat{\mathbf{j}} - 10\hat{\mathbf{k}}]$$

$\therefore$ $$|\hat{\mathbf{N}}| = 1 \quad \text{[given]}$$

$$|\hat{\mathbf{N}}| = \lambda\sqrt{185} = 1$$

$\Rightarrow$ $$\lambda = \frac{1}{\sqrt{185}}$$

$\therefore$ $$\hat{\mathbf{N}} = \frac{1}{\sqrt{185}}(7\hat{\mathbf{i}} - 6\hat{\mathbf{j}} - 10\hat{\mathbf{k}})$$

20. (d) Let $I = \int \frac{(x+1)}{x(xe^x+1)}dx$

Put $xe^x = t$

$\Rightarrow (xe^x + e^x)dx = dt$

$\therefore I = \int \frac{dt}{t(t+1)} = \int \left(\frac{1}{t} - \frac{1}{t+1}\right)dt$

$= \log t - \log(t+1) + C$

$= \log \frac{t}{t+1}$

$= \log\left(\frac{xe^x}{xe^x+1}\right) + C$

21. (a) We have,

$\mathbf{c} = \mathbf{a} + \mathbf{b}$ and $|\mathbf{a}| = |\mathbf{b}| = |\mathbf{c}| = 2$

$|\mathbf{c}|^2 = |\mathbf{a}|^2 + |\mathbf{b}|^2 + 2|\mathbf{a}|\cdot|\mathbf{b}|\cos\theta$

$\Rightarrow 4 = 4 + 4 + 2\cdot 2\cdot 2\cos\theta$

$\Rightarrow -4 = 8\cos\theta$

$\Rightarrow \cos\theta = -\frac{1}{2}$

$|\mathbf{a} - \mathbf{b}|^2 = |\mathbf{a}|^2 + |\mathbf{b}|^2 - 2|\mathbf{a}||\mathbf{b}|\cos\theta$

$= 4 + 4 - 8\cos\theta = 8 + 8\times\frac{1}{2}$

$\Rightarrow |\mathbf{a} - \mathbf{b}|^2 = 12$

$\Rightarrow |\mathbf{a} - \mathbf{b}| = 2\sqrt{3}$

22. (c) We have,

$x^2 + y\sqrt{xy} = 336$

$\Rightarrow \sqrt{x}(x\sqrt{x} + y\sqrt{y}) = 336$ ...(i)

and $y^2 + x\sqrt{xy} = 112$

$\Rightarrow \sqrt{y}(y\sqrt{y} + x\sqrt{x}) = 112$ ...(ii)

Dividing Eq. (i) by Eq. (ii), we get

$\frac{\sqrt{x}}{\sqrt{y}} = 3$ or $x = 9y$

From Eq. (i), $81y^2 + y\sqrt{9y^2} = 336$

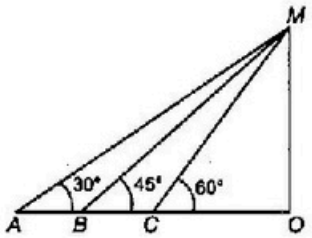
or $81y^2 + 3y^2 = 336$

$\Rightarrow y^2 = 4, \quad y = 2$

$\Rightarrow x = 18$

$\therefore x + y = 18 + 2 = 20$

23. (d)



$BC = 60$ m [given]

Let $AB = x, OC = d, OM = h$

Now, in ΔAOM,

$\tan 30° = \frac{OM}{AO}$

$\Rightarrow OA = \sqrt{3}OM$ ...(i)

In ΔBOM,

$\tan 45° = \frac{OM}{60+d}$

$\Rightarrow OM = 60 + d$

$\Rightarrow h = 60 + d$ ...(ii)

In ΔMOC,

$\tan 60° = \frac{OM}{OC}$

$\Rightarrow \sqrt{3} = \frac{h}{d}$

$\Rightarrow \sqrt{3} = \frac{60+d}{d}$

$d = 30(\sqrt{3} + 1)$ ...(iii)

From Eq. (i)

$x + 60 + d = \sqrt{3}h$

$\Rightarrow x + 60 + 30(\sqrt{3}+1) = \sqrt{3}[60 + 30(\sqrt{3}+1)]$

$\Rightarrow x = 60\sqrt{3} + 90 + 30\sqrt{3} - 60 - 30\sqrt{3} - 30$

$\Rightarrow x = 60\sqrt{3}$

$\therefore AB = 60\sqrt{3}$

24. (c) We have,

$y^2 = kx - 8$

$\Rightarrow y^2 = k(x - \frac{8}{k})$

which is a form of $y^2 = 4AX$

So, $X = x - 8/k, A = k/4$

$\therefore$ Equation of directrix, $X = -A$

$\Rightarrow x - \frac{8}{k} = -\frac{k}{4}$

$\Rightarrow x = \frac{8}{k} - \frac{k}{4}$

$\Rightarrow 1 = \frac{8}{k} - \frac{k}{4}$

$\Rightarrow 4k = 32 - k^2$

$\Rightarrow k^2 + 4k - 32 = 0$

$\Rightarrow k^2 + 8k - 4k - 32 = 0$

$\Rightarrow (k+8)(k-4) = 0$

$k = 4, -8$

25. (b) We have,

$\sin x + a\cos x = b$

On squaring both sides, we get

$\sin^2 x + a^2\cos^2 x + 2a\sin x\cos x = b^2$

$\Rightarrow 1-\cos^2 x + a^2 - a^2\sin^2 x + 2a\sin x\cos x = b^2$

$\Rightarrow a^2\sin^2 x + \cos^2 x - 2a\sin x\cos x = 1 + a^2 - b^2$

$\Rightarrow (a\sin x - \cos x)^2 = 1 + a^2 - b^2$

$\Rightarrow |a\sin x - \cos x| = \sqrt{1+a^2-b^2}$

26. (c) We have,

$$f(x) = x^3 + ax^2 + bx + c$$

$$\Rightarrow f'(x) = 3x^2 + 2ax + b$$

Condition for no extremum

$$b^2 - 4ac < 0$$

$$\Rightarrow 4a^2 - 4\times 3b < 0$$

$$\Rightarrow a^2 - 3b < 0$$

$$\Rightarrow a^2 < 3b$$

27. (b) We have,

$$^{n-1}C_{r-1} = n\cdot\frac{(n-1)!}{(r-1)!(n-1-r+1)!}$$

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

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

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

$$= r\cdot(^nC_r)$$

28. (c) Since, foci coincide,

$$\therefore 16 - b^2 = \frac{144}{25} + \frac{81}{25}$$

$$\Rightarrow 16 - b^2 = \frac{225}{25}$$

$$\Rightarrow b^2 = 16 - \frac{225}{25}$$

$$= \frac{400-225}{25}$$

$$= \frac{175}{25} = 7$$

$$\therefore b = \sqrt{7}$$

29. (d) Total number of students = 8

Those who appear in Mathematics = 3

and other subjects = 5

$\therefore$ Total number of ways $= {}^6C_3 \times 5! \times 3$

$= 14400$

30. (b) We have,

$$\frac{(9+2x)^{1/2}(3+4x)}{(1-x)^{1/5}} = \frac{9\left(1+\frac{2}{9}x\right)^{1/2}\left(1+\frac{4}{3}x\right)}{(1-x)^{1/5}}$$

$$= \frac{9\left[1+\frac{2}{9}\cdot\frac{1}{2}x+\ldots\right]\left[1+\frac{4}{3}x\right]}{(1-x)^{1/5}}$$

$$= \frac{9\left[1+\frac{x}{9}+\frac{4}{3}x\right]}{(1-x)^{1/5}}$$

$$= \frac{9\left[1+\frac{13x}{9}\right]}{(1-x)^{1/5}}$$

$$= \frac{9(1-x)^{-13/9}}{(1-x)^{1/5}}$$

$$= 9(1-x)^{-\frac{13}{9}-\frac{1}{5}}$$

$$= 9(1-x)^{-74/45}$$

$$= 9\left(1+\frac{74}{45}x\right)$$

[neglecting higher powers of x]

$$= 9 + \frac{74x}{5}$$

31. (a) We have,

$$A = \{(x, y) / y = \frac{1}{x}, 0 \neq x \in R\} \quad \ldots(i)$$

and $B = \{(x, y) / y = -x \in R\}$ ...(ii)

It is clear that from Eqs. (i) and (ii),

$$A \cap B = \phi$$

32. (b) We have, $s = \frac{a+b+c}{2}$

$$2s = a + b + c \quad \ldots(i)$$

and $\frac{1}{3}s^2(s-a)(s-b)(s-c)$

$$= \frac{1}{3}s[s(s-a)(s-b)(s-c)]$$

$$= \frac{1}{3}s[\Delta^2]$$

$$[\because \Delta = \sqrt{s(s-a)(s-b)(s-c)}]$$

$$= \frac{1}{3}\times 6\times\Delta^2$$

$$= 2\Delta^2$$

33. We have,

$$x^2 = 4y$$

On differentiating, $2x = 4\frac{dy}{dx}$

or $\frac{dy}{dx} = x/2$

Slope of normal $= -2/x$

Let the common point of curve and normal be (h, k)

Then, $h^2 = 4k$ ...(i)

Equation of normal, $\frac{y-k}{x-h} = \frac{-2}{h}$

Normal passes through (1, 2),

$$\therefore \quad \frac{2-k}{1-h} = \frac{-2}{h}$$

$$2h - kh = -2 + 2h$$

From Eq. (i), $2h - \frac{h^3}{4} = -2 + 2h$

or $\frac{h^3}{4} = 2 \Rightarrow h = 2$

$k = 1$, Equation of normal $x + y - 3 = 0$

Now, distance form origin (0, 0)

$$= \left|\frac{0+0-4}{\sqrt{1+1}}\right| = \left|\frac{-2}{\sqrt{(2)}}\right| = \sqrt{2} \text{ units}$$

34. (d) We have,

0, 1, 2, ..., 9

Total number of digits = 10

Now, total number of ways when r integers are taken from these digits, is ${}^{10}C_r$.

$\therefore$ Required probability $= \frac{10!}{10^r!(10-r)!}$

35. (a) $f(x) = x^2 + 2ax + 10 - 3a > 0$

$f(x) > 0, \forall\ x \in R$

Then, $D < 0$

$\Rightarrow \quad b^2 - 4ac < 0$

$\Rightarrow \quad 4a^2 - 4(10 - 3a) < 0$

$\Rightarrow \quad 4a^2 - 40 + 12a < 0$

$\Rightarrow \quad a^2 + 3a - 10 < 0$

$\Rightarrow \quad a^2 + 5a - 2a - 10 < 0$

$\Rightarrow \quad a(a+5) - 2(a+5) < 0$

$\Rightarrow \quad (a+5)(a-2) < 0$

$\Rightarrow \quad -5 < a < 2$

36. (a) Probability of choosing fair coin $= \frac{1}{3}$

Probability of choosing two headed coin $= \frac{1}{3}$

Probability of choosing weighted coin $= \frac{1}{3}$

$\therefore$ Required probability

$$= \frac{1}{3} \times \frac{1}{2} + \frac{1}{3} \times 1 + \frac{1}{3} \times \frac{1}{3}$$

$$= \frac{1}{6} + \frac{1}{3} + \frac{1}{9} = \frac{3+6+2}{18} = \frac{11}{18}$$

37. (a) We have, $|\mathbf{a}| = 3$

Let α, β and γ be the angles between the given vector and coordinate axes respectively.

Let $\mathbf{a} = \hat{i} + \hat{j} + \hat{k}$

$\therefore \quad \cos\alpha = \cos\beta = \cos\gamma = \frac{1}{\sqrt{3}}$

$\therefore \quad \alpha = \beta = \gamma = \cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

38. (d) If $f(x) = \begin{cases} \frac{\sin(-1)}{-1} = \sin, & \text{when } -1 \le x < 0 \\ 0 \Rightarrow\ , & \text{when } 0 \le x < 1 \end{cases}$

$\Rightarrow \quad \lim\limits_{(x \to 0^-)} f(x) = \sin 1$ and $\lim\limits_{(x \to 0^+)} f(x) = 0$

$\therefore \quad$ LHS $\neq$ RHS

So, limit does not exist.

39. (a) We have,

$$\tan A - \tan B = x \quad \ldots(i)$$

and $$\cot B - \cot A = y \quad \ldots(ii)$$

Then, $$\cot(A - B) = \frac{\cot A \cot B + 1}{\cot B - \cot A}$$

$$= \frac{1 + \cot A \cot B}{y} \quad \ldots(iii)$$

From Eq. (i),

$$\frac{1}{\cot A} - \frac{1}{\cot B} = x$$

$$\Rightarrow \quad \frac{\cot B - \cot A}{\cot A \cot B} = x$$

$$\Rightarrow \quad \cot A \cot B = \frac{y}{x}$$

From Eq. (iii),

$$\cot(A - B) = \frac{1 + \frac{y}{x}}{y} = \frac{1}{x} + \frac{1}{y}$$

40. (a) We have,

$$a = \log_{12} 18,$$

$$\Rightarrow \quad b = \log_{24} 54$$

$\therefore \quad ab + 5(a - b)$

$$= (\log_{12} 18)(\log_{24} 54) + 5[\log_{12} 18 - \log_{24} 54]$$

$$= \frac{\log_e 9 \times 2}{\log_e 4 \times 3} \cdot \frac{\log_e 9 \times 6}{\log_e 8 \times 3} + 5\left[\frac{\log_e 9 \times 2}{\log_e 4 \times 3} - \frac{\log_e 9 \times 6}{\log_e 8 \times 3}\right]$$

Solving this, we get

$$ab + 5(a - b) = 1$$

41. (c) Let probability of guessing be A.

$\therefore$ Probability guessing correct answer,

$$P(A) = \frac{1}{4}$$

Answer is not correct $= P(\bar{A}) = 1 - \frac{1}{4}$

$$P(\bar{A}) = \frac{3}{4}$$

$\therefore$ Required probability $= 1 - P$ (no answer is correct)

$$= 1 - {}^5C_0[\{P(A)\}^0 \{P(\bar{A})\}^5]$$

$$= 1 - {}^5C_0\left(\frac{1}{4}\right)^0\left(\frac{3}{4}\right)^5$$

$$= 1 - \frac{243}{1024} = 1 - 0.2370$$

$$= 0.7623$$

42. (*d*) We have equation of line,

$$lx + my + nz = 0$$

and $$y = \frac{-l}{m}x + \left(\frac{-n}{m}\right)z \quad \ldots(i)$$

We know that, if the line $y = mx + c$ touches the ellipse

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

Then,

$$c^2 = a^2m^2 + b^2$$

$\therefore$ $$\frac{n^2}{m^2} = a^2\frac{l^2}{m^2} + b^2$$

$\Rightarrow$ $$n^2 = a^2l^2 + b^2m^2$$

43. (*c*) We have,

$$\sin 20^\circ \sin 40^\circ \sin 80^\circ$$

$$= \sin 20^\circ \sin(60^\circ - 20^\circ)\sin(60^\circ + 20^\circ)$$

$$= \sin 20^\circ (\sin^2 60^\circ - \sin^2 20^\circ)$$

$$= \sin 20^\circ\left[\frac{3}{4} - \sin^2 20^\circ\right]$$

$$= \frac{1}{4}[3\sin 20^\circ - \sin^3 20^\circ]$$

$$= \frac{1}{4}\sin 3 \times 20^\circ = \frac{1}{4}\frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{8}$$

44. (*b*) Let two numbers be x and y, where $x > 0$, $y > 0$.

Given, $$x + y = 9 \quad \ldots(i)$$

and $$z = x - y^2 \quad \ldots(ii)$$

$\Rightarrow$ $$z = x(9 - x)^2$$

$$= x(81 + x^2 - 18x) = x^3 - 18x^2 + 81x$$

$\therefore$ $$\frac{dz}{dx} = 3x^2 - 36x + 81$$

$$= 3(x^2 - 12x + 27)$$

$\because$ $$\frac{dz}{dx} = 0$$

$\Rightarrow x^2 - 9x - 3x + 27 = 0$

$\Rightarrow$ $(x - 9)(x - 3) = 0$

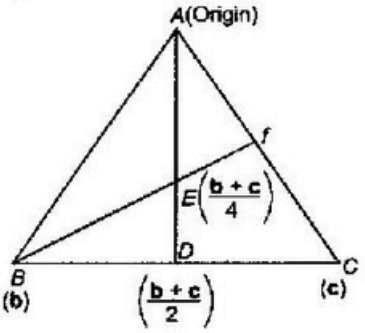
$\Rightarrow$ $x = 3, x = 9$

$x = 3$ [$\because x = 9$ not possible]

and $y = 6$

$\therefore$ So, numbers are 3 and 6.

45. (*d*) Let the position vector of B and C are $\mathbf{b}$ and $\mathbf{c}$ respectively.



Equation of AC

i.e. $$\mathbf{r} = \mathbf{b} + \lambda\left(\frac{\mathbf{b} + \mathbf{c}}{4} - \mathbf{b}\right)$$

and $$\mathbf{r} = 0 + \mu\mathbf{C}$$

$\Rightarrow$ $$1 - \frac{3\lambda}{4} = 0 \text{ and } \frac{\lambda}{4} = \mu$$

$\Rightarrow$ $$\lambda = \frac{4}{3} \text{ and } \mu = \frac{1}{3}$$

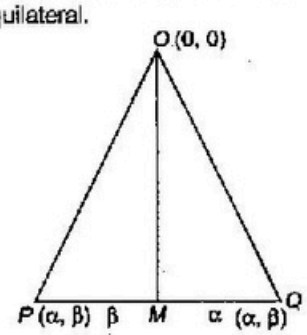
Therefore, the positive vector of $\mathbf{F}$ is

$$\mathbf{r} = \frac{1}{3}\mathbf{c}$$

$$AF = \frac{c}{3} \quad \Rightarrow \quad AF = \frac{1}{3}AC$$

$\Rightarrow$ $$AF : AC = 1 : 3$$

46. (*b*) Let the vertex P be (α, β), so that Q is $(\alpha, -\beta)$ such that ΔOPQ is equilateral.



$$OP = OQ = PQ = 2\beta$$

$$\sqrt{\alpha^2 + \beta^2} = 2\beta$$

or $$\alpha^2 = 3\beta^2 \quad \ldots(i)$$

Hence, point (α, β) lies on hyperbola.

$\therefore$ $$\frac{\alpha^2}{a^2} - \frac{\beta^2}{b^2} = 1$$

$\Rightarrow$ $$\frac{3\beta^2}{a^2} - \frac{\beta^2}{b^2} = 1$$ [from Eq. (i)]

$\Rightarrow$ $$\frac{3\beta^2}{a^2} - 1 = \frac{\beta^2}{b^2} = \pm 1 + \text{ve} > 0,$$

$\Rightarrow$ $$\frac{b^2}{a^2} > \frac{1}{3} \Rightarrow b^2 > \frac{a^2}{3}$$

47. (a) In ΔABC,

$$a = 2,\ b = 4,\ \angle C = 60^\circ$$

$$\because \quad \cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

$$\because \quad \cos 60^\circ = \frac{4 + 16 - c^2}{2 \times 2 \times 4}$$

$$\Rightarrow \quad \frac{1}{2} = \frac{20 - c^2}{16}$$

$$\Rightarrow \quad c^2 = 12$$

$$\Rightarrow \quad c = 2\sqrt{3}$$

Now, $$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

$$\Rightarrow \quad \frac{\sin A}{a} = \frac{\sin C}{c}$$

$$\Rightarrow \quad \frac{\sin A}{2} = \frac{\sin 60^\circ}{2\sqrt{3}}$$

$$\Rightarrow \quad \sin A = \frac{1}{2}$$

$$\Rightarrow \quad \angle A = 30^\circ$$

Now $\angle A + \angle B + \angle C = 180^\circ$

$$\Rightarrow \quad 30^\circ + \angle B + 60^\circ = 180^\circ$$

$$\Rightarrow \quad \angle B = 90^\circ$$

$$\therefore \quad \angle A = 30^\circ$$

and $$\angle B = 90^\circ$$

48. (b) Let $I = \int \frac{x e^x}{\sqrt{1 + e^x}} dx$

Put $1 + e^x = t^2$

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

$$x = \log(t^2 - 1)$$

$$\therefore \quad I = 2\int \log \frac{(t^2 - 1)}{t} t\, dt = 2\int \log(t^2 - 1) dt$$

$$= 2\left[t \log(t^2 - 1) - 2\int \frac{t^2}{t^2 - 1} dt\right]$$

$$= 2\left[t \log(t^2 - 1) - 2t\int \left(1 + \frac{1}{t^2 - 1}\right) dt\right]$$

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

$$= 2x\sqrt{1 + e^x} - 4\sqrt{1 + e^x} - 2\log\left(\frac{\sqrt{1 + e^x} - 1}{\sqrt{1 + e^x} + 1}\right) + C$$

$$= (2x - 4)\sqrt{1 + e^x} - 2\log\left(\frac{\sqrt{1 + e^x} - 1}{\sqrt{1 + e^x} + 1}\right) + C$$

Hence, $f(x) = 2x - 4$

49. (a) Given, combined average of class is 50. Let number of boys in class be x and number of girls in class be y

By combined average formula,

$$50 = \frac{52 \times x + 42 \times y}{x + y}$$

$$\Rightarrow \quad 50x + 50y = 52x + 42y$$

$$\Rightarrow \quad 8y = 2x$$

$$\Rightarrow \quad \frac{x}{y} = \frac{4}{1}$$

$$\Rightarrow \quad \frac{x}{x + y} = \frac{4}{5}$$

Hence, ratio of boys to total number of students is $\frac{4}{5}$

and percentage $= \frac{4}{5} \times 100 = 80\%$.

50. (d) Between 4000 to 5000, choose unit digit in 4 ways (0, 2, 6, 8) = 4.

Choose tenth place of remaining 8 numbers = 8 (because 2 even number out of 10 numbers are already taken)

Choose hundred place by remaining 7 numbers = 7 ways

Total number ways between 4000 to 5000

$$= 4 \times 8 \times 7 = 224$$

Similarly, for 5000 to 6000,

Unit digit is chosen in 5 ways

$$(0, 2, 6, 8, 4) = 5$$

Tenth digit is chosen in 8 ways = 8

Thousandth digit is chosen by remaining 7 numbers = 7 ways

Total number ways $= 5 \times 8 \times 7 = 280$

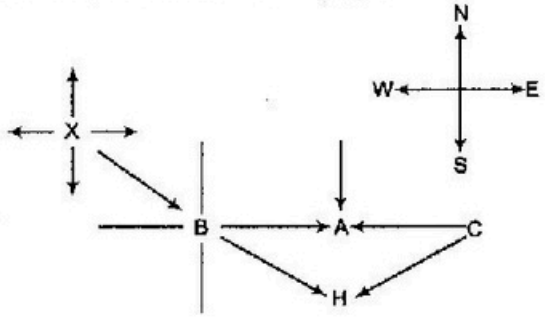
Similarly, for 6000 to 7000

Total number ways $4 \times 8 \times 7 = 224$

Hence, total number ways for 4000 to 7000

$$= 224 + 280 + 224 = 728$$

51. (b) On the basis of the given information regarding directions, we have the following figure.



It is clear from the figure that H is at the farthest South and C is at the farthest East.

So, option (b) is correct.

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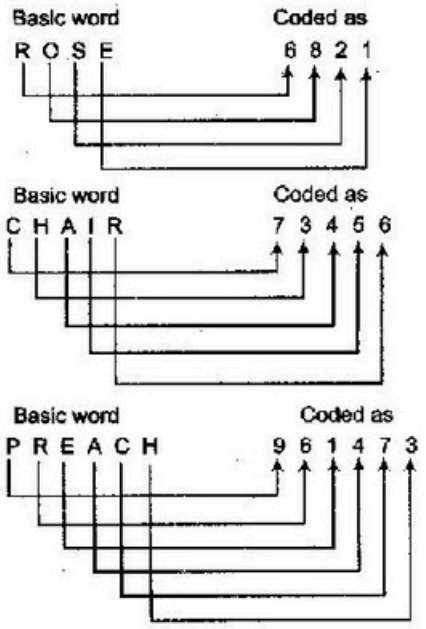
52. (c) It is very clear from the given information that C does not work with A, therefore C should be the partner with B as they can form pairs i.e. AD and CB.

So, according to the question,

Number of possibility for each player is

	A	B	C	D
A	×	×	×	✓
B	×	×	✓	×
C	×	×	×	✓
D	✓	×	×	×

53. (b)



Therefore, the coding for word SEARCH will be 214673
Hence, option (b) is the correct choice.

Solutions [Q. Nos. 54 to 56]

A table is drawn on the basis of the given information.

Town	A	B	C	D	E
Team	T	R	P	Q	S

54. (d) Team Q is from town D, according to the above table.

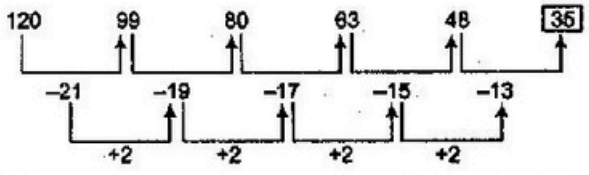
55. (c) Team P is from the town C, according to the above table.

56. (d) Team T is from the town A, according to the above table.

57. (a) Given series

120, 99, 80, 63, 48, ...

We have the following pattern



Hence, the number that comes next in the series is 35.

58. (b) Total number of students when there were 24 students in each of 13 sections = 13×24 = 312

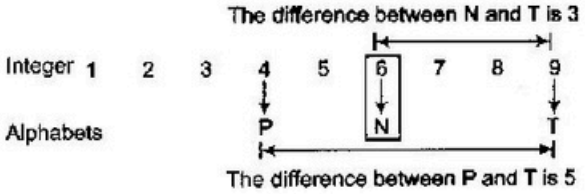
Total number of students when three new section were added with 21 students in each of 16 sections

= 21×16 = 336

Number of newly admitted students = 336 − 312 = 24

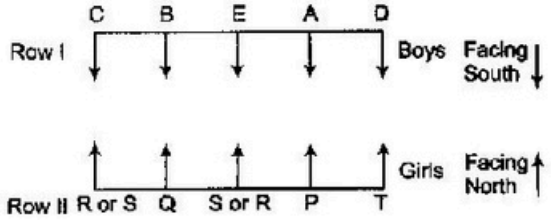
59. (b) On the basis of the given information, the Integer assigned to N is 6.

This is explained below



Solutions [Q. Nos. 60 to 63]

On the basis of the given information, we have the standing arrangement as shown below.



60. (a) C and D are standing at the ends of the row.

61. (d) None of the option is correct.

62. (a) E is standing to the immediate right of A.

63. (c) Q is facing B.

64. (b) Let the present age of daughter = x yr

and present age of mother = y yr

According to the question,

$$x + y = 63 \quad \text{....(i)}$$

4yr back,

Daughter's age = $(x - 4)$ yr

Mother's age = $(y - 4)$ yr

$$\therefore \quad 4(x - 4) = y - 4$$

$$4x - 16 = y - 4$$

$$4x - y = 12 \quad \text{.....(ii)}$$

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

$$x + y = 63$$

$$\Rightarrow \quad 4x - y = 12$$

$$\therefore \quad x = 15 \text{ yr}$$

$$\because \quad x + y = 63$$

$$\Rightarrow \quad 15 + y = 63$$

$$\Rightarrow \quad y = 48 \text{ yr}$$

Hence, present age of mother = 48 yr.

65. (a) Time gained in 5 min = 10 s

So, time gained in 60 min = $\frac{10}{5} \times 60$

= 120 s = 2 min

So, time gained in 1 h = 2 min

Time gained in 10 h = 2 × 10 min = 20 min

Now,

Present time = 7:20 pm

So, correct time is 7 pm.

66. (a) Let the present age of Rohit = x yr

and present age of Rohit's father = $x + 3x = 4x$ yr

After 8 yr,

Rohit's age = $x + 8$ yr

Rohit's father's age = $4x + 8$ yr

According to the question,

$\Rightarrow \quad \frac{5}{2}(x + 8) = 4x + 8$

$\Rightarrow \quad \frac{5x}{2} + 20 = 4x + 8$

$\therefore \quad x = 8$

i.e. Rohit age after 8 yr = 16 yr

Rohit's father age after 8 yr = 40 yr

Now, after further 8 yr

Rohit age = 16 + 8 = 24 yr

Rohit's father = 40 + 8 = 48 yr

Hence, Rohit's father age will be two times of Rohit age.

67. (c) 1, 2, 3, 6, 11, 20, 37, 68,...

The above series is showing the following pattern. We have to the sum the three numbers

i.e. $1 + 2 + 3 = 6$

$2 + 3 + 6 = 11$

$3 + 6 + 11 = 20$

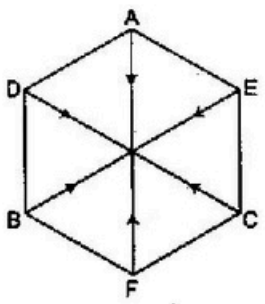
$11 + 20 + 37 = 68$

$20 + 37 + 68 = 125$

So, the number that comes next in the series, is 125.

Solutions [Q. Nos. 68 to 69]

On the basis of the given information, sitting arrangement is shown below :



68. (a) D and E are sitting next to A.

69. (c) E is sitting opposite to B.

70. (d) Arithmetic mean of 2^{10} and $2^{20} = \frac{2^{10} + 2^{20}}{2}$

$= \frac{2(2^9 + 2^{19})}{2} = 2^9 + 2^{19}$

71. (b) Let the weights of the five boxes, in increasing order be A, B, C, D and E.

i.e. $A < B < C < D < E$.

Each of the boxes can be paired up with another box in a total of 4 ways.

If we sum up all the given weights, we get

$4(A + B + C + D + E) = (110 + 112 + 113 + 114 + 115 + 116 + 117 + 118 + 120 + 121)$

$= 1156$ kg

$\Rightarrow \quad A + B + C + D + E = 289$ kg ...(i)

Now, 121 kg is the sum of the weight of the boxes D and E and 110 is the sum of the weights of the boxes A and B.

i.e. $A + B = 110$ kg

and $D + E = 121$ kg

$\therefore \quad A + B + D + E = 231$ kg ...(ii)

Subtracting Eq. (ii) from Eq. (i), we get

$C = 289 - 231 = 58$ kg

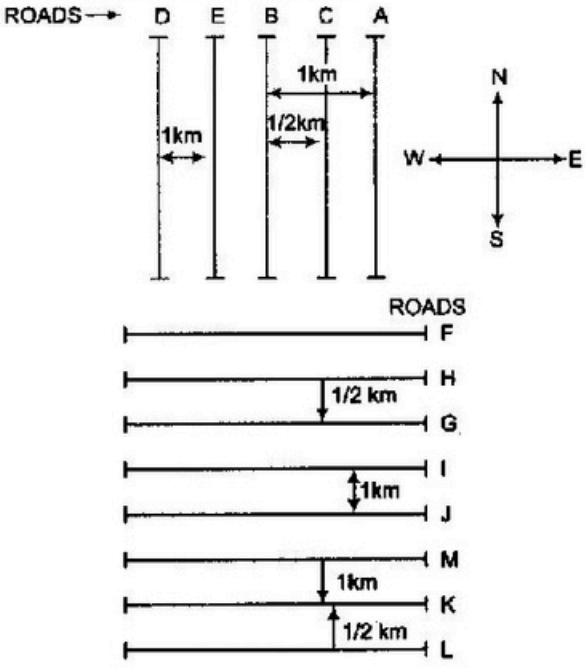
Now, 120 kg is the sum of the weights of the boxes C and E

i.e. $C + E = 120$ kg

$\Rightarrow \quad E = (120 - 58)$ kg = 62 kg

Solutions [Q. Nos. 72 to 76]

On the basis of the given information in the question, we have the figure as shown below.



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72. (d) M is 1.5 km North of L.

73. (a) "D is 2 km West of A" is not true.

74. (c) The distance between A and D lies between $\frac{1}{2}$ and 2 km.

75. (c) If I is 1/2 km North of (b), there is possibility of coinciding of the roads J and L.

76. (d) J and K would be 1/2 km apart.

77. (c) Let the students in three classes be $2x$, $3x$ and $5x$.

On increasing the students in each classes by 20, the students will be $2x + 20$, $3x + 20$ and $5x + 20$.

Now, according to the question,

$2x + 20 : 3x + 20 : 5x + 20 :: 4 : 5 : 7$

$\because \quad \frac{2x + 20}{3x + 20} = \frac{4}{5}$

$10x + 100 = 12x + 80$

$x = 10$

Total number of students before increase were

$= 2x + 3x + 5x = 10x = 10(10) = 100$

78. (c) Let the ages of Ajith, Babita, Chetu, Das are A, B, C, D yr.

Age of Ajith is three times that of Babita i.e. $A = 3B$

Chetu is half the age of Das i.e. $C = \frac{D}{2}$

Babita is older than Chetu i.e. $B > C$.

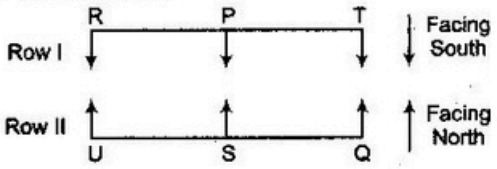
Statement I Chetu is 10 yr old. This statement is necessary to find the age of Ajith.

Statement II This statement is again necessary to find the age of Ajith.

Hence, both statements I and II are necessary to estimate the age of Ajith.

Solutions (Q. Nos. 79 to 82)

On the basis of the information given for the questions, we have the following standing arrangement of six friends i.e. P, Q, R, S, T, U.



79. (b) R, P and T are in the same row.

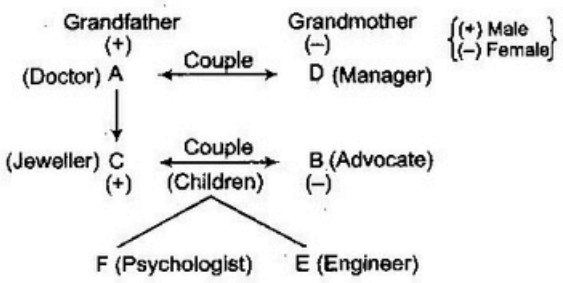
80. (b) U is standing to the left of S.

81. (c) S is facing P.

82. (d) T is standing opposite to Q, i.e. TQ are facing each other.

Solutions (Q. Nos. 83 to 87)

On the basis of the given information, we have the following relationship diagram.



83. (d) Profession of A is doctor. But it is not given in any of the options.

84. (b) Profession of E is engineer.

85. (c) A is grandfather of E.

86. (d) This cannot be determined.

87. (a) AD and CB are the two couples in the family.

Solutions [Q. Nos. 88 to 90]

Based on the given information, following table is drawn.

Executive	CEO	President	Vice -President	Secretary	Treasurer
Executive names	Cheryl	Bert	Enid	Alice	David
Cars	Red	Blue	Green	Yellow	Purple
Order	1	2	3	4	5

88. (d) Alice is the secretary.

89. (c) Cheryl is the CEO.

90. (a) Vice-President's car is of green colour.

91. (b) In the context of the sentence 'storm' fits the blank appropriately.

92. (c) 'Pirate' means a person who attacks ships at sea in order to steal from them.

93. (a) Other three options are clearly in appropriate.

94. (a) Anthropology means 'the study of ancient societies'.

95. (c) Clearly stated in the passage.

96. (d) Easy choice from among the given options.

97. (a) Why was such a letter written by your brother?

98. (d) The correct sequence is RPSQ.

99. (c) A lot of students were dejected.

100. (b) The appropriate question tag is 'doesn't she?'

101. (c) 'Prudent' means 'sensible and careful when you make judgements'.

102. (c) *Many a* is used.

103. (a) Stupendous means 'extremely large or impressive'.

104. (d) Easy choice from among the given options.

105. (b) A person who insists on something is called stickler.

106. (c) 'Should be' fits the blank appropriately.

107. (c) Keep to side/path/road is used.

108. (b) 'Amicable' means polite or friendly.

109. (b) 'Rude' means 'impolite'.

110. (b) 'Native' is the correct match.

111. (a) The hexadecimal operation A10 + B21

A10 = 101000010000

B21 = 101100100001

Now, we add these two binary numbers

$$\begin{array}{r} 101000010000 \\ +\ 101100100001 \\ \hline 1010100110001 \end{array}$$

Decimal number of 1010100110001 is 5425.

112. (c) The given number is 0011010110011100.

Now, change this number into one's complement as,

$$\begin{array}{ll} & 0\,0\,1\,1\,0\,1\,0\,1\,1\,0\,0\,1\,1\,1\,0\,0 \\ 1\text{'s} & \downarrow\downarrow\downarrow\downarrow\downarrow\downarrow\downarrow\downarrow\downarrow\downarrow\downarrow\downarrow\downarrow\downarrow\downarrow\downarrow \\ & 1\,1\,0\,0\,1\,0\,1\,0\,0\,1\,1\,0\,0\,0\,1\,1 \end{array}$$

Now add 1 to the one's complement to obtain two's complement representation of the given number as

$$\begin{array}{ll} & 1100101001100011 \\ 2\text{'s} & \underline{\qquad\qquad +1} \\ & 1100101001100100 \end{array}$$

113. (b) Multiplication of two binary numbers, which are given as $111_2 \times 101_2$

$$\begin{array}{r} 111 \\ 101 \\ \hline 111 \\ 000\times \\ 111\times\times \\ \hline 100011 \end{array}$$

So, the output is $(100011)_2$.

114. (d) The given number is –93.

The equivalent binary representation of 93 in byte is 01011001.

Now change it into 1's complement.

$$\begin{array}{l} 0\,1\,0\,1\,1\,0\,0\,1 \\ \downarrow\downarrow\downarrow\downarrow\downarrow\downarrow\downarrow\downarrow \\ 1\,0\,1\,0\,0\,1\,1\,0 \end{array}$$

Therefore, the one's complement representation of –93 is 10100110

Now found 2's complement.

$$\begin{array}{r} 10100110 \\ +\ 1 \\ \hline 10100111 \end{array}$$

This value does not match with other options. So, the answer is none of these.

115. (a)

116. (b) The Boolean expression $X \cdot (X + Y)$

$$\begin{aligned} & X \cdot (X + Y) \\ &= (X \cdot X) + (X \cdot Y) && \text{[using distributive law]} \\ &= X + (X \cdot Y) && [\because X \cdot X = X] \\ &= X && \text{[using absorption law]} \end{aligned}$$

So, the expression $X \cdot (X + Y)$ is equal to X.

117. (b) A nibble is equal to half byte

As we know, 1 byte = 2 nibble

118. (a)

119. (c) The result of multiplication of the numbers $(10101)_2$ and $(11101)_2$.

$(10101)_2 = (21)_{10}$

$(11101)_2 = (29)_{10}$

Multiplication of $(21)_{10} \times (29)_{10} = (609)_{10}$

$(609)_{10}$ is equivalent to hexadecimal

16	609	
16	33	1
	2	6

$= (261)_{16}$

So, the output of the $(10101)_2 \times (11101)_2$ in hexadecimal = 261

120. (b) $(531.53125)_{10}$

$$\begin{array}{lcccccccccc} & 512 & 256 & 128 & 64 & 32 & 16 & 8 & 4 & 2 & 1 \\ 531 \text{ binary number is} = & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \end{array}$$

.53125 binary number is = .10011

$(53153125)_{10} = (1000010011.10011)$