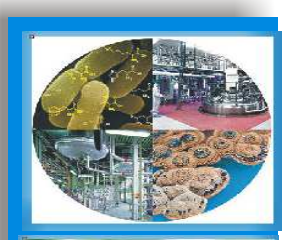

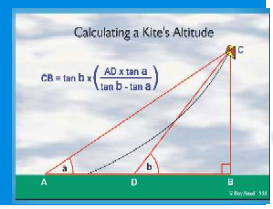

JNU-MCA

MOCK TEST PAPER

- *Attempt all the questions*
- *This paper consists of 120 objective type questions.*
- *Each question carries 4 marks. 1 mark will be deducted for each wrong answer.*
- *Pattern of questions : MCQs*
- *Total marks : 480*
- *Duration of test : 3 Hours*

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1. Let A,B C be 2 × 2 matrices with entries from the set of real numbers. Operation '*' is defined as follows

$$A * B = \frac{1}{2}(AB + BA), \text{then}$$

(A) A * I = A

(B) A * A = A^2

(C) A * B = B * A

(D) All of the above

2. Two persons 'A' and 'B' have respectively n + 1 and n coins which they toss simultaneously. Then the probabilty that A will have more heads than B is

(A) $\frac{1}{2}$

(B) $> \frac{1}{2}$

(C) $< \frac{1}{2}$

(D) None of these

3. Let λ and α be real. The set of all values of λ for which the system of linear equations.

$\lambda x = (\sin \alpha)\, y + (\cos \alpha)\, z = 0$

$x + (\cos \alpha)\, y + (\sin \alpha)\, z = 0$

$x + (\sin \alpha)\, y - (\cos \alpha)\, z = 0$

has a non - trivial solution, is

(A) $[0, \sqrt{2}]$

(B) $[-\sqrt{2}, 0]$

(C) $[-\sqrt{2}, \sqrt{2}]$

(D) none of these

4. For any two independent events E_1 and E_2, $P\{(E_1 \cup E_2) \cap (\bar{E}_1 \cap \bar{E}_2)\}$ is

(A) $< \frac{1}{4}$

(B) $> \frac{1}{4}$

(C) $\geq \frac{1}{2}$

(D) None of these

5. There are 11 points on a plane with 5 lying on one straight line and another 5 lying on a second straight line which is parallel to the first line. The remaining point is not collinear with any two of the previous 10 points. The number of triangles that can be formed with vertices chosen from these 11 points is

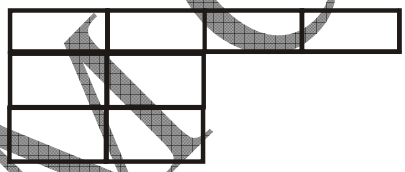
(A) 85

(B) 105

(C) 125

(D) 145

6. The number of different ways the letters of the word VECTOR can be placed in 8 boxes given below such that no row is empty is equal to



(A) 26

(B) 26 × 6!

(C) 6!

(D) 2! × 6!

7. Let G be a group and $\alpha, \beta \in G$. Then $(\alpha^{-1}\beta)^{-1}$ is-

(A) $\alpha\ \beta^{-1}$

(B) $\beta^{-1}\alpha$

(C) $\alpha^{-1}\beta^{-1}$,

(D) $\beta^{-1}\alpha^{-1}$

8. The transformation defined below

$I:(x,y)\to(x,y)$

$T_1:(x,y)\to(x-y,x)$

$T_2:(x,y)\to(-y,x-y)$

$T_3:(x,y)\to(-x,-y)$

$T_4:(x,y)\to(y-x,-x)$

$T_5:(x,y)\to(y,y,-x)$ form a cyclic group, whose generator is-

(A) T_2

(B) T_3

(C) T_4

(D) T_5

9. If the sum of the roots of the equation $x^2-px+q=0$ be m times their difference, then –

(A) $p^2(m^2-1)=4m^2q$

(B) $p^2=m^2q$

(C) $p^2=q$

(D) None.

10. The area enclosed between the circles

r = 2a cos θ and r = 4a cos θ is

(A) πa^2

(B) $3\pi a^2$

(C) $3a^2$

(D) None of these

11. $\int\int\sqrt{a^2-x^2-y^2}\,dx\,dy$ over the area in the first quadrant of the circle $x^2+y^2=a^2$ **is**

(A) πa^3

(B) $\frac{\pi}{6}a^3$

(C) $\frac{\pi}{12}a^3$

(D) $\frac{a^3}{6}$

12. Evaluate $I=\int\int\int z\,dx\,dy\,dz$ over the volume enclosed between the cone $x^2+y^2=z^2$ and the sphere $x^2+y^2+z^2=1$ above z = 0.

(A) $\frac{\pi}{4}$

(B) $\frac{\pi}{6}$

(C) $\frac{\pi}{8}$

(D) $\frac{\pi}{2}$

13. The volume of the solid obtained by revolving the loop of the curve $a^2y^2=x^2(2a-x)(x-a)$ about x-axis is,

(A) $\frac{23}{60}\pi a^3$

(B) $23\pi a^3$

(C) $60\pi a^3$

(D) $\frac{60}{23}a^3$.

14. For the L.P. Problem Min z = 2x + y subject to $5x+10y\le 50,\ x+y\ge 1,\ y\le 4$ and $x,\ y\ge 0$, then z =

(A) 0

(B) 1

(C) 2

(D) 1/2

15. For the L.P. problem Min $z=2x_1+3x_2$ such that $-x_1+2x_2\le 4,\ x_1+x_2\le 6,\ x_1+3x_2\ge 9$ and $x_1, x_2\ge 0$, then

(A) $x_1=1.2$

(B) $x_2=2.6$

(C) $z=10.2$

(D) All of these

16. A vertex of the linear inequalities $2x+3y\le 6, x+4y\le 4$ and $x, y\ge 0$, is

(A) (1, 0)

(B) (1, 1)

(C) $\left(\frac{12}{5}, \frac{2}{5}\right)$

(D) $\left(\frac{2}{5}, \frac{12}{5}\right)$

17. The probability of solving a question by three students are $\frac{1}{2}, \frac{1}{4}, \frac{1}{6}$ respectively. Probability of question being solved will be

(A) $\frac{33}{48}$

(B) $\frac{35}{48}$

(C) $\frac{31}{48}$

(D) $\frac{37}{48}$

18. In a college, 25% of the boys and 10% of the girls offer Mathematics. The girls constitute of 60% of the total number of students. If a students is selected at random and is found to be studying Mathematics, the probability that the student is a girl, is

(A) $\frac{1}{6}$

(B) $\frac{3}{8}$

(C) $\frac{5}{8}$

(D) $\frac{5}{6}$

19. The chance of an event happening is the square of the chance of a second event but the odds against the first are the cube of the odds against the second. The chances of the events are

(A) $\frac{1}{9}, \frac{1}{3}$

(B) $\frac{1}{16}, \frac{1}{4}$

(C) $\frac{1}{4}, \frac{1}{2}$

(D) None of these

20. If $u = r^m$ where $r^2 = x^2 + y^2 + z^2$, then

$\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}+\frac{\partial^2 u}{\partial z^2}$ is equal to-

(A) r^{m-2}

(B) $m(m-1)r^{m-2}$

(C) $m(m+1)r^{m-2}$

(D) $(m^2-1)r^{m-}$

21. The maximum value of $f(x)=2|x-1|+3|x-2|$ for all $x \in R$ is -

(A) 1

(B) 2

(C) 3

(D) None of these

22. The area bounded by the curve $y=\tan^{-1}x$, $0 \le y < \frac{\pi}{2}$ from x = 0 to x = 1, the x - axis and the ordinate at x = 1 is

(A) $\frac{\pi}{4}-\frac{1}{2}\log 2$

(B) $\frac{\pi}{4}-\log\sqrt{2}$

(C) $\frac{\pi}{4}$

(D) $\log 2$

23. The area bounded by the curves $y^2=9x, x-y+2=0$ is given by-

(A) 1

(B) $\frac{1}{2}$

(C) $\frac{3}{2}$

(D) $\frac{5}{4}$

24. The line y = x + 1 is revolved about x - axis. The volume of solid of revolution formed by revolving the area covered by the given curve, x - axis and the lines x = 0 x = 2 is -

(A) $\frac{19\pi}{3}$

(B) $\frac{17\pi}{3}$

(C) $\frac{13\pi}{3}$

(D) $\frac{26\pi}{3}$

25. The solution of the differential equation $\left(x\cos\frac{y}{x}+y\sin\frac{y}{x}\right)y = \left(y\sin\frac{y}{x}-x\cos\frac{y}{x}\right)x.\frac{dy}{dx}$ is given by-

(A) xy sin $\frac{x}{y}$ = C

(B) xy cos $\frac{x}{y}$ = C

(C) xy sin $\frac{y}{x}$ = C

(D) xy cos $\frac{y}{x}$ = C

26. If cot y cosec y $\frac{dy}{dx}$ + $\frac{1}{x}$ cosec y = $\frac{1}{x^{2,}}$ then-

(A) sec y sec x = sin x + C

(B) cosec y sec x = sin x + C

(C) cosec y cosec x = cos x + C

(D) None of these

27. The general solution of the differential equation $(D^2 + D - 2)y = e^x$ is given by -

(A) $y = C_1e^x + C_2e^{-2x} + \frac{1}{3}xe^x$

(B) $y = C_1e^x + C_2e^{-2x}$

(C) $y = C_1e^x + C_2e^{-2x} + \frac{1}{6}x^2e^x$

(D) $y = \frac{1}{3}xe^x + (C_1 + C_2x)e^{-2x}$

28. If $D = \frac{d}{dx}$, then $\frac{1}{D^2 + D + 1}$ sin x equals -

(A) – cos x

(B) cos x

(C) cos x – sin x

(D) sin x

29. The degree of the differential equation $\left[y + x\left(\frac{d^2y}{dx^2}\right)^2\right]^{\frac{1}{4}} = \frac{d^3y}{dx^3}$ is given by-

(A) 2

(B) 3

(C) 4

(D) 1

30. Let V be the vector space of all 2 × 2 matrices over the field F, then the dimension of V is-

(A) 2

(B) n

(C) 4

(D) Arbitrary

31. If $\vec{a} + \vec{b} + \vec{c} = 0$ then $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$, this means that -

(A) Vectors $\vec{a}, \vec{b}, \vec{c}$ are collinear

(B) Vectors $\vec{a}, \vec{b}, \vec{c}$ are non-collinear

(C) Vector $\vec{a}, \vec{b}, \vec{c}$ are coplanar

(D) None of these

32. The mean and variance of a binomial distribution are 6 and 4. The parameter n is

(A) 18

(B) 12

(C) 10

(D) 9

33. Let $f : R \to R$ be a defined by f(x) = 3x – 4 then f^{-1} is

(A) 1/3(x + 4)

(B) (x/3) + 4

(C) 3x + 4

(D) not defined

34. The solution of the differential equation $(x+y)^2 \frac{dy}{dx} = a^2$ is given by-

(A) $(y + x) = a \tan\left(\frac{y-c}{a}\right)$

(B) (y - x) = a tan (y - c)

(C) $(y - x) = \tan\left(\frac{y-c}{a}\right)$

(D) $a (y - x) = \tan\left(\frac{y-c}{a}\right)$

35. The transformation which will transform the differential equation

$\frac{dz}{dx} + \frac{2zx}{x^2+1}\log z = \frac{xz}{x^2+1}(\log z)^3$ to the form

$\frac{dy}{dx} + P(x)y = Q(x)$ is-

(A) y = log z

(B) $y = \frac{1}{(\log z)^2}$

(C) $y = \frac{z}{(\log z)^2}$

(D) $y = (\log z)^2$

36. If A is a square matrix, then A^{-1} exist iff-

(A) $|A| = 0$

(B) $|A| \neq 0$

(C) $|A| > 0$

(D) $|A| < 0$

37. The square matrix A is nilpotent if-

(A) $A^m = I$, m be any positive integer

(B) $A^m = 0$

(C) $A^m = A$

(D) None of these

38. The value of $\int \int_R xy\,(x+y)\,dx\,dy$ over the area between $x = y^2$ and y = x is,

(A) $\frac{5}{56}$

(B) $\frac{9}{56}$

(C) $\frac{13}{56}$

(D) $\frac{3}{56}$

39. The value of $I = \int_{\sqrt{2}/2}^{1} \int_{\sqrt{1-x^2}}^{x} \frac{1}{\sqrt{x^2+y^2}}\,dy\,dx.$ is

(A) $\ln(\sqrt{2}+1)-\frac{\pi}{4}$

(B) $\ln(\sqrt{2}+1)+\frac{\pi}{4}$

(C) $\ln(\sqrt{2}-1)-\frac{\pi}{4}$

(D) $\ln(\sqrt{2}-1)+\frac{\pi}{4}$

40. The value of $\int_C$ [(cos x sin y - xy) dx + sin x cos y dy], where C is the circle $x^2 + y^2 = 1$ is,

(A) 0

(B) 1

(C) 2

(D) none

41. Let U be an arbitrary non–empty set and S denote the set of all subsets of U. For X, Y $\in$ S, if we define

X + Y = {x : x$\in$X or x$\in$Y but x$\notin$Y$\cap$Y}

and X_0 Y = X $\cap$Y, then :

(A) (S, +, 0) is a commutative ring without unity

(B) (S, +, 0) is a commutative ring with unity and X_0X = X for all X$\in$S

(C) For X, Y, Z $\in$ S. $X_0(Y + X) \neq X_0Y + X_0Z$ and so (S, +, 0) is not a ring

(D) S can be made a ring, if U and the null set ϕ are added to S.

42. Given

$$3\frac{dy}{dx}+\sqrt{y}=e^{0.1x}, y(0.3)=5$$

and using a step size of h = 0.3 the best estimate of $\frac{dy}{dx}(0.9)$ using Euler's method is most nearly

(A) – 0.37319

(B) – 0.36288

(C) –0.35381

(D) –0.34341

43. Which vector is perpendicular to the plane containing the three points P(2, 1, 5), Q(–1, 3, 4), and R(3, 0, 6)?

(A) $2\hat{i} - \hat{j} + \hat{k}$

(B) $\hat{i} + 2\hat{j} + 2\hat{k}$

(C) $2\hat{i} + 2\hat{j} - \hat{k}$

(D) $\hat{i} + 2\hat{j} + \hat{k}$

44. In how many ways can the letters of the word "PROBLEM" be rearranged to make 7 letter words such that none of the letters repeat?

(A) 7!

(B) ${}^{7}C_{7}$

(C) 7^{7}

(D) 49

45. Let L be the set of all straight lines in the Euclidean plane. Two lines ℓ_1 and ℓ_2 are said to be related by the relation R iff ℓ_1 is parallel to ℓ_2. Then the relation R is

(A) Only reflexive

(B) Only symmetric

(C) Only transitive

(D)Equivalence

46. If I is the greatest of the definite integrals

$I_1 = \int_0^1 e^{-x} \cos^2 x\,dx,\ I_2 = \int_0^1 e^{-x^2} \cos^2 x\,dx$

$I_3 = \int_0^1 e^{-x^2} dx\ I_4 = \int_0^1 e^{-x^2/2} dx,$ then

(A) $I = I_1$

(B) $I = I_2$

(C) $I = I_3$

(D) $I = I_4$

47. Let f(x) be a function satisfying f'(x) = f(x) with f(0) = 1 and g(x) be the function satisfying f(x) + g(x) = x^2. The value of integral $\int_0^1 f(x)g(x)dx$ is equal to

(A) $\frac{1}{4}(e-7)$

(B) $\frac{1}{4}(e-2)$

(C) $\frac{1}{2}(e-3)$

(D) None of these

48. Which one of the following is the incorrect statement?

(A) If a Linear programming problem (LPP) is infeasible, then its dual is also infeasible

(B) If an LPP is infeasible, then its dual always has unbounded solution

(C) If an LPP has unbounded solution, then its dual also has unbounded solution

(D) If an LPP has unbounded solution, then its dual is infeasible

49. A biased coin with probability P, 0 < P < 1 of heads is tossed until a head appears for the first time. If the probability that the number of tosses required is even is $\frac{2}{5}$, then p equals

(A) $\frac{1}{3}$

(B) $\frac{2}{3}$

(C) $\frac{2}{5}$

(D) $\frac{3}{5}$

50. The number 1, 2, 3, ..., n are arranged in a random order. The probability that the digits 1, 2, 3, ..., k (k < n) appears as neighbours in that order, is

(A) $\frac{1}{n!}$

(B) $\frac{k!}{n!}$

(C) $\frac{(n-k)!}{n!}$

(D) none of these

51. Five horses are in a race. Mr. A selects two of the horses at random and bets on them. The probability that Mr. A selected the winning horse is

(A) $\frac{4}{5}$

(B) $\frac{3}{5}$

(C) $\frac{1}{5}$

(D) $\frac{2}{5}$

52. A fair coin is tossed 100 times. The probability of getting tails an odd number of times is

(A) $\frac{1}{2}$

(B) $\frac{1}{8}$

(C) $\frac{3}{8}$

(D) None of these

53. Finding the Lagrange interpolating polynomial of degree 2 by approximating the function y = ln x defined by the following table of values, the value of ln 2.7 will be

x	2	2.5	3.0
y = ln x	0.69315	0.91629	1.09861

(A) 0.9941162

(B) 0.9941164

(C) 0.9941165

(D) 0.9941166

54. Using initial approximation $x_0 = -1$, zero x = –2 of polynomial $P(x) = x^5 + 5x^4 - 40x^2 - 80x - 48$ is obtained by newton's method

Determine its order of convergence

(A) 1

(B) 2

(C) 3

(D) none

55. By false positioning the second approximation of a root of equation f(x) = 0 is (where x_0, x_1 are initial and first approximation respectively)

(A) $x_0 - \frac{f(x_0)}{f(x_1) - f(x_0)}$

(B) $\frac{x_0 f(x_1) - x_1 f(x_0)}{f(x_1) - f(x_0)}$

(C) $\frac{x_0 f(x_0) - x_1 f(x_1)}{f(x_1) - f(x_0)}$

(D) $x_1 \frac{f(x_0)}{f(x_1) - f(x_0)}$

56. The error in Simpson's rule when approximating $\int_1^3 \frac{dx}{x}$ is less than

(A) $\frac{1}{20}$

(B) $\frac{1}{80}$

(C) $\frac{1}{70}$

(D) $\frac{1}{60}$

57. If for n = 4 the approximate value of integral $\int_1^9 x^2\,dx$ by trapezoidal rule is $2\left[\frac{1}{2}\left(1+9^2\right)+\alpha^2+\beta^2+7^2\right]$, then :

(A) $\alpha = 1, \beta = 3$

(B) $\alpha = 2, \beta = 4$

(C) $\alpha = 3, \beta = 5$

(D) $\alpha = 4, \beta = 6$

58. For finding real root of the equation $x^2 - x = 2$ by Newton-Raphson method, choose $x_0 = 1$, then value of x_2 is :

(A) –1

(B) 3

(C) $\frac{11}{5}$

(D) None of these

59. If $u = (x^2 + y^2 + z^2)^{3/2}$, then $\left(\frac{\partial u}{\partial x}\right)^2 + \left(\frac{\partial u}{\partial x}\right)^2 + \left(\frac{\partial u}{\partial z}\right)^2 =$

(A) 9u

(B) $9u^{4/3}$

(C) $9u^2$

(D) $u^{4/3}$

60. A minimum value of $\int_0^x te^{-t^2}dt$ is

(A) 1

(B) 2

(C) 3

(D) 0

61. If f(x + y) = f(x). f(y) for all x and y and f(5) = 2, f'(0) = 3, then f'(5) will be

(A) 2

(B) 4

(C) 6

(D) 8

62. $\int_0^{1000} e^{x=[x]}dx$ is

(A) $e^{1000} - 1$

(B) $\frac{e^{1000}-1}{e-1}$

(C) 1000(e – 1)

(D) $\frac{e-1}{1000}$

63. $\int_0^{\pi/2} \frac{dx}{\sqrt{\tan x}-\sqrt{\cot x}}$ is equal to

(A) $\frac{\pi}{2}$

(B) $\frac{\pi}{4}$

(C) 0

(D) None of these

64. The value of the integral $\int_0^{2|x|}(x-[x])dx$ is

(A) [x]

(B) 1/2[x]

(C) 3[x]

(D) 2[x]

65. The area bounded by the curves y = ℓn x, y = ℓn |x|, y = |ℓn x| and y = |ℓn|x|| is

(A) 4 sq. unit

(B) 6 sq. unit

(C) 10 sq. unit

(D) None of these

66. The area bounded by curves y = cos x and y = sin x and ordinates x = 0 and $x = \frac{\pi}{4}$ is

(A) $\sqrt{2}$

(B) $\sqrt{2}+1$

(C) $\sqrt{2}-1$

(D) $\sqrt{2}\left(\sqrt{2}-1\right)$

67. Area enclosed between the curve y^2 (2a – x) = x^3 and line x = 2a above x-axis is

(A) πa^2

(B) $\frac{3\pi a^2}{2}$

(C) $2\pi a^2$

(D) $3\pi a^2$

68. Calculate the volume of the solid bounded by the following surfaces –

z = 0, $x^2 + y^2 = 1$, x + y + z = 3

(A) π

(B) 2π

(C) 3π

(D) 4π

69. Find the volume bounded by the cylinder $x^2 + y^2 = 4$ and the planes y + z = 3 and z = 0.

(A) 9π

(B) 12π

(C) 16π

(D) 20π

70. Solve x sin (y/x) (dy/dx) = y sin (y/x) – x.

(A) $Ce^{\cos(y/x)}$

(B) $Ce^{\sin(y/x)}$

(C) $Ce^{y/x}$

(D) none

71. Solve $\frac{dy}{dx}+\left(\frac{2x+1}{x}\right)y=e^{-2x}$.

(A) $y=\frac{1}{3}x\,e^{-2x}+\frac{c}{x}e^{-x}$

(B) $y=\frac{1}{2}x^2\,e^{-2x}+\frac{c}{x}e^{-2x}$

(C) $y=\frac{1}{2}x\,e^{-2x}+\frac{c}{x}e^{-2x}$

(D) None of these

72. The solution of the differential equation

$x\left\{y\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^2\right\}=y\frac{dy}{dx}$ is :

(A) ax + by = c

(B) $ax^2 + by = 0$

(C) $ax^2 + by^2 = 1$

(D) $ax + by^2 = 0$

73. A particular integral of

$\frac{d^2y}{dx^2}-(a+b)\frac{dy}{dx}+aby=Q(x)$ is :

(A) $e^{ax}\int\left[e^{(a-b)x}\left(\int Q\,e^{bx}dx\right)\right]dx$

(B) $e^{ax}\int\left[e^{(b-a)x}\left(\int Q\,e^{-bx}dx\right)\right]dx$

(C) $e^{-ax}\int\left[e^{(b-a)x}\left(\int Q\,e^{bx}dx\right)\right]dx$

(D) $e^{-ax}\int\left[e^{(b-a)x}\left(\int Q\,e^{-bx}dx\right)\right]dx$

74. **Assertion (A) :** The differential equation $\frac{d^2y}{dx^2}+x\frac{dy}{dx}+\left(x^2+5\right)y=e^x$ is a linear equation.

Reason (R) : Every first degree equation is a linear equation.

(A) Both A and R are true and R is the correct explanation of A

(B) Both A and R are true and R is not a correct explanation of A

(C) A is true but R is false

(D) A is false but R is true

75. Find the P.I. of the differential equation

$$(D^3 + 3D^2 + 2D)y = x^2$$

(A) $\frac{x^3}{3}$

(B) $\frac{1}{2}\frac{x^3}{3}$

(C) $\frac{x^2}{6}$

(D) None

76. Solve $\frac{d^2y}{dx^2}+2\frac{dy}{dx}+10y+37$ sin 3x = 0, and find the value of y when $x=\pi/2$ if it is given that y = 3 and dy/dx = 0 when x = 0.

(A) 6 cos 3x – sin 3x

(B) 3 cos 3x – 3 sin 3x

(C) 4 cos 3x – 2 sin 3x

(D) None of these

77. Find unit normal vector to xyz = 2 at (1, –1, 2)

(A) $\frac{1}{3}\left(2\hat{i}-2j-k\right)$

(B) $\left(3x^2+2x-1\right)\hat{i}$

(C) $x^3 + x^2 - x + 2$

(D) $(x-1)(x-2)$

78. If $\phi = xz$, then its gradient is

(A) $z\hat{j} + y\hat{k}$

(B) $z\hat{k} + y\hat{i}$

(C) $\hat{i}z + x\hat{k}$

(D) 0

79. Find the directional derivative of $f = x^2y + xz$ at (1, 2, –1) in the direction

$$\vec{A} = 2\hat{i} - 2\hat{j} + \hat{k}.$$

(A) $\frac{5}{3}$

(B) $\frac{5}{4}$

(C) $\frac{5}{6}$

(D) $\frac{5}{7}$

80. The function f satisfies the functional equation $3f(x) + 2f\left(\frac{x+59}{x-1}\right) = 10x + 30$ for all real $x \neq 1$.

The value of f(7) is

(A) 8

(B) 4

(C) -8

(D) 11

81. **Direction :** In each of the following questions, some letters or groups of letters are given all of which except one, share a common similarity while one is different. Choose the odd one out.

(A) DH6

(B) UO18

(C) XP20

(D) NB10

82. **Direction :** In each of the following questions, a number series is given with one term missing. Choose the correct alternative that will continue the same pattern and replace the question mark in the given series.

The last 4 missing fractions in the series :

$\frac{1}{2}, \frac{1}{6}, \frac{1}{12}, \frac{1}{20}, \frac{1}{30}, ?, ?, ?, ?,$ are

(A) $\frac{1}{40}, \frac{1}{50}, \frac{1}{60}, \frac{1}{70}$

(B) $\frac{1}{42}, \frac{1}{56}, \frac{1}{62}, \frac{1}{90}$

(C) $\frac{1}{44}, \frac{1}{58}, \frac{1}{74}, \frac{1}{92}$

(D) $\frac{1}{41}, \frac{1}{55}, \frac{1}{72}, \frac{1}{90}$

83. In the word 'CONTRACTUAL', the positions of the first and the eleventh letters are interchanged. Similarly, the positions of the second and the tenth letters are interchanged, and so on, up to the positions of fifth and seventh letters are interchanged. Which letter will be the third to the right of the sixth letter from the left end?

(A) U

(B) N

(C) T

(D) A

84. In a shop, the items were arranged in a shelf consisting of six rows, Biscuits were arranged above the tins of chocolates but below the rows of packets of chips. Cakes were at the bottom and the bottles of peppermints were below the chocolates the topmost row had the display of jam bottles. Where exactly were the bottles of peppermints ? Mention the place from the top.

(A) 2nd

(B) 3rd

(C) 4th

(D) 5th

85. In a certain code BREAKTHROUGH is written as EAOUHRBRGHKT. How is DISTRIBUTION written in that code?

(A) RISTTIBUDION

(B) TISTBUONDRII

(C) STTIBUONRIDI

(D) STTIBUDIONRI

86. If 'black' means 'pink', 'pink' means 'blue', 'blue' means 'white', 'white' means 'yellow', 'yellow' means 'red' and 'red' means 'brown', then what is the colour of clear sky?

(A) Brown

(B) Red

(C) Blue

(D) Pink

87. What will be the correct mathematical signs that can be inserted in the following equation?

$$45\_5\_9\_3\_2\_6 = 0$$

(A) ×, –, +, ÷

(B) ÷, ÷, ×, +, –

(C) +, +, ÷, ×, –

(D) ÷, +, ÷, –, ×

88. An airline has a certain free luggage allowance and charges for excess luggage at a fixed rate per kg. Two passengers Digvijay and Sankalp have 60 kg of luggage between them, and are charged Rs. 1,200 and Rs. 2,400 respectively for excess luggage. Had the entire luggage belonged to one of them, the excess luggage charge would have been Rs. 5,400. What is the weight of Sankalp's luggage?

(A) 20 kg

(B) 25 kg

(C) 30 kg

(D) 35 kg

89. It takes 50 days to fill a laboratory dish with bacteria. If the size of the bacteria doubles each day, how long did it take for the bacteria to fill one half of the dish?

(A) 48 days

(B) 24 days

(C) 25 days

(D) 49 days

90. The tyre of automobile is inflated to lesser pressure in summer than in winter

(A) Because the pressure of gas decreases on increase in temperatures.

(B) Because the pressure of gas increases on decrease in temperatures.

(C) in order to avoid puncture.

(D) Because the pressure of gas increases on increase in temperature.

91. A Man was standing at the centre of a circular field. he go down south to the edge of the field and then turning the left he walks along the boundary of the field equal to three-eights of its length. Then he turn west and go right across to the opposite point on the boundary. In which direction he is from the starting point?

(A) North-west

(B) North

(C) South-west

(D) West

92. Pointing to a lady in the photograph Seema said, "Her son's father is the son-in-law of my mother." How is Seema related to that lady?

(A) Aunt

(B) Cousin

(C) Mother

(D) Sister

93. Mrs. Ranga has three children and has difficulty remembering their ages and the months of their birth. The clues below may help her remember

• The boy, who was born in June, is 7 years old
• Vaibhav is older than Suprita
• Suprita's brithday is in April
• One of the children is 4 years old, but it is not Anshuman
• One of the children was born in September, but it was not
• The youngest child is only 2 years old.

Based on the above clues, which one of the following Statements is true?

(A) Vaibhav is the oldest, followed by Anshuman who was born in September and the youngest is Suprita who was born in April.

(B) Anshuman is the oldest being born in June, followed by Suprita who is 4 years old and the youngest is Vaibhav who is 2 years old

(C) Vaibhav is the oldest being 7 years old, followed by suprita who was born in April, and the youngest is Anshuman who was born in September.

(D) Suprita is the oldest who was born in April, followed Vaibhav who was born in June, and Anshuman who was born in September.

94. A man can row 30 km upstream and 44 km downstream in 10 hours. It is also known that he can row 40 km upstream and 55 km downstream in 13 hours. Find the speed of the man in still water.

(A) 4 km/h (B) 6 km/h (C) 8 km/h (D) 12 km/h

95. A lent Rs. 600 to B for 2 years and Rs. 150 to C for years and received altogether from both Rs. 90 as interest. Find the rate of interest, simple interest being calculated.

(A) 5%
(B) 16%
(C) 6%
(D) 4.5%

96. A and B together can complete a piece of work in 35 days while A alone can complete the same work in 60 days. In how many days, B alone will be able to complete the same work ?

(A) 84 days

(B) 83 days

(C) 85 days

(D) 90 days

97. Find the next term in the series, 210, 195, 175, 150, 120,

(A) 90

(B) 75

(C) 80

(D) 85

98. Find the next term in the series, 2, 5, 26, 677,

(A) 17803

(B) 13576

(C) 458329

(D) 458330

99. Find the missing term from the following series –

256, 512, 1024, ..., 4096, 8192

(A) 3528

(B) 2786

(C) 2882

(D) 2048

100. By selling an article for Rs 200 a man gains Rs 20, what is his gain % ?

(A) $11\frac{1}{8}$ %

(B) $11\frac{1}{9}$ %

(C) $12\frac{1}{9}$ %

(D) $11\frac{4}{9}\%$

101. main( )

```
{
        float a = 5, b = 2 ;
        int c ;
        c = a % b ;
        printf ("%d", c)
}
```

O/P of the above program is

(A) 2·5

(B) 1

(C) 1.0000

(D) Error

102. If there are 32 segments each at size 1kb, logical address will have

(A) 11 bits

(B) 13 bits

(C) 15 bits

(D) 14 bits

103. Using the Octal notation write the BCD coding for the **G.** in reference to word DIGIT

(A) 64

(B) 71

(C) 67

(D) 23

104. The character ch = 'z' would store in ch

(A) The character z

(B) ASCII of z

(C) z along with single inverted comma

(D) Both A & B

105. The binary code of $(73)_{10}$ is

(A) 1010001

(B) 1000100

(C) 1100101

(D) 1001001

106. The operation which is commutative but not associative is

(A) AND

(B) OR

(C) EX-OR

(D) NAND

107. Minimize the Boolean function $y = \bar{A}.\bar{B}.\bar{C}.\bar{D} + \bar{A}.\bar{B}.\bar{C}.D + \bar{A}.B.\bar{C}.\bar{D} + A.\bar{B}.\bar{C}.D$

(A) $\bar{B}.\bar{C}$

(B) $\bar{A}.\bar{C}$

(C) A and B both

(D) None of them

108. Converting $42_{(10)}$ into BCD

(A) 01000010

(B) 000010

(C) 01010100

(D) 00010001

109. Match the following

List I

(a) Data dictionary contains details of

(b) Actigram represents

(c) Primary tool in structured design

(d) Graphic representation of information system

List II

(1) DFD

(2) Structure chart

(3) Processor activities, methods & procedures in DFD.

(4) Data structures

	(a)	(b)	(c)	(d)
(A)	(3)	(2)	(1)	(4)
(B)	(3)	(1)	(2)	(2)
(C)	(2)	(3)	(4)	(1)
(D)	(4)	(3)	(2)	(1)

110. Find a's complement of decimal number. 2059.84 .

(A) 9470.51

(B) 4970.51

(C) 9740.15

(D) 7940.15

111. What is the output for the following 'c' code ?

```
int p = 51;
p = p << 2;
printf ("%d", p);
```

(A) 200

(B) 204

(C) 208

(D) 280

112. What will be the output for the following 'c' code

```
void main( )
{
 int a = 10, b = 20;
 char x = 1, y = 0;
 if (a, b, x, y)
 {
  printf ("xyz");
```

```
        }
      }
```

(A) XYZ is printed

(B) Compiler error

(C) Nothing is printed

(D) Semantic error

113. Minimization of $AB + \overline{AC} + A\bar{B}C(AB + C)$ is

(A) 0

(B) 1

(C) X

(D) XY

114. Binary value for the multiplication of (7) and (7) will be :–

(A) 100011_2

(B) 110101_2

(C) 110001_2

(D) 111001_2

115. The equivalent decimal number of the hexadecimal number 5A9 is .

(A) 1449

(B) 1280

(C) 1472

(D) None of these

116. The Boolean expression

A'BE + BCDE + BC'D'E + A'B'DE' + B'C'DE'

can be simplified to BE + B'DE', if the don't care conditions are

(A) ABCDE + AB'CDE'

(B) ABCD + AB'CDE' + ABCD'E

(C) ABC'DE + AB'CDE' + ABCD'E

(D) None of these

117. How many NAND gate are required to form NOR gates?

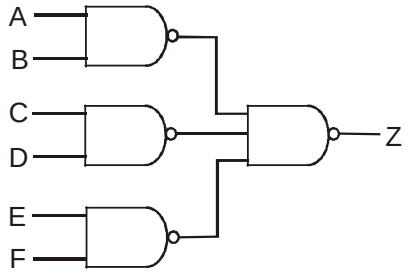
(A) 2 units

(B) 3 units

(C) 4 units

(D) 5 units

118. Z = ?



(A) $(\bar{A}+\bar{B})(\bar{C}+\bar{D})(E+F)$

(B) AB + CD + EF

(C) (A + B)(C + D)(E + F)

(D) $\overline{AB}+\overline{CD}+\overline{EF}$

119. What will be the output for the following 'c' fragment?

```
int a = 10, b = 20;
printf ("%d" , a = b);
```

(A) Outputs on error message

(B) Prints 0

(C) Prints 1

(D) None of the above

120. What will be the values for 'g' & 'z' atleast for the following given 'c' code ?

```
main ( )
{
   int x, y, z ;
   x = 10;
   y = 3 * ( x++) ;
   z = 3 * (++x) ;
}
```

(A) y = 33 , z = 36

(B) y = 30 , z = 33

(C) y = 30 , z = 36

(D) y = 33 , z = 39

ANSWER KEY

[redacted]

HINTS AND SOLUTION

1.(D) $A * I = \frac{1}{2}(AI + IA) = \frac{1}{2}(A + A)$

$= \frac{2A}{A} = A$

$\therefore$ A * I = A $\therefore$ (a) holds .

$A * A = \frac{1}{2}(AA + AA) = \frac{1}{2}(A^2 + A^2) = A^2$

$\therefore$ (b) holds.

(c) $A * B = \frac{1}{2}(AB + BA)$

$B * A = \frac{1}{2}(BA + AB) = \frac{1}{2}(AB + BA)$

[$\therefore$ addition is commutative]

$\therefore$ A * B = B * A $\therefore$ (c) holds.

$A * (B + c) = \frac{1}{2}(A(B + C) + (B + C)A)$

$= \frac{1}{2}(AB + AC + BA + CA)$

$= \frac{1}{2}(AB + BA) + \frac{1}{2}(AC + CA)$

= A * B + A * C

2.(A) Let λ, μ and λ', μ' be the number of heads and tails thrown by A and B respectively, so that $\lambda + \lambda' = n + 1$ and $\mu + \mu' = n$.

The required probability P is the probability of the inequality $\lambda > \mu$. The probability 1 – P of the opposite event $\lambda \le \mu$ is at the same time the probability of the inequality $\lambda' > \mu'$ i.e., 1 – P is the probability that A will throw more tails than B.

[**Reason** : $\lambda \le \mu \Rightarrow n + 1 - \lambda' \le n - \mu' \Rightarrow 1 - \lambda' \le -\mu' \Rightarrow \lambda' - 1 \ge \mu' \Rightarrow \lambda' \ge \mu' + 1 > \mu'$]

By symmetry 1 – P = P or $P = \frac{1}{2}$.

3.(C) Since the system has a non - trivial solution.

$$\therefore \quad \begin{vmatrix} \lambda & \sin\alpha & \cos\alpha \\ 1 & \cos\alpha & \sin\alpha \\ -1 & \sin\alpha & -\cos\alpha \end{vmatrix} = 0$$

$$\Rightarrow \quad \left(-\cos^2\alpha - \sin^2\alpha\right) - \left(-\sin\alpha\cos\alpha - \sin\alpha\cos\alpha\right) - 1\left(\sin^2\alpha - \cos^2\alpha\right) = 0$$

$$\Rightarrow \quad -\lambda + 2\sin\alpha\cos\alpha + \cos 2\alpha = 0$$

$$\Rightarrow \quad \lambda = \cos 2\alpha + \sin 2\alpha = 0$$

$$= \sqrt{2}\cos\left(2\alpha - \frac{\pi}{4}\right)$$

Since $\quad -1 \le \cos\left(2\alpha - \frac{\pi}{4}\right) \le 1 \quad \forall \alpha \in R$

$\therefore \quad -\sqrt{2} \le \lambda \le \sqrt{2}$ i.e $\lambda \in \left[-\sqrt{2}, \sqrt{2}\right]$

$\therefore$ (c) is the correct answer.

4.(A) Since $\bar{E}_1 \cap \bar{E}_2 = \overline{E_1 \cup E_2}$ and $\left(\bar{E}_1 \cap \bar{E}_2\right) \cap \left(\overline{E_1 \cup E_2}\right) = \phi$

$P\left\{(E_1 \cup E_2) \cap \left(\bar{E}_1 \cap \bar{E}_2\right)\right\} = P(\phi) = 0$

0 < 1/4 implies that it can have value in that inverval.

5.(A) From the given conditions we can make a triangle in 3 ways :

(i) Taking any two points from the first straight line and the remaining one point from the remaining 6 points.

(ii) Taking any two points from the second straight line and the remaining one point from the remaining 6 points.

(iii) Taking the isolated point and any one from the first straight line and any one from the second straight line.

Now calculate and add the number of ways in three cases to get the final answer.

6.(B) Total ways = $({}^8C_2 - 2) \times \lfloor 6$

$= (28 - 2) \times \lfloor 6$

$= 26 \times \lfloor 6$

7.(B) $\left(\alpha^{-1}\beta\right)^{-1} = \beta^{-1}\left(\alpha^{-1}\right)^{-1}$

$= \beta^{-1}\ \alpha\ \left[\text{because } \left(\alpha^{-1}\right) = \alpha\right]$

8.(D) $T_5^2 = T_5.T_5 = T_5(y, y-x) = (y-x, -x) = T_4$

$T_5^3 = T_4.T_5 = T_4(y, y-x) = (-x, -y.) = T_3$

$T_5^4 = T_3.T_5 = T_3(y, y-x) = (-y, x-y) = T_2$

$T_5^5 = T_2.T_5 = T_2(y, y-x) = (x-y, x,) = T_1$

$T_5^6 = T_1.T_5 = T_1(y, y-x) = (x, y) = I$

$\therefore \quad G = \{I, T_1, T_2, T_3, T_4, T_5\}$

$= \left\{T_5^6, T_5^5, T_5^4, T_5^3, T_5^2, T_5^1\right\}$

$\therefore\ T_5$ is the generator of the given transformations.

9.(A) If α, β are the roots of the given equation, then

$$\alpha + \beta = p \text{ and } \alpha\beta = q$$

By the given condition,

$$\alpha + \beta = m(\alpha - \beta)$$

$$\Rightarrow \quad (\alpha+\beta)^2 = m^2(\alpha-\beta)^2$$

$$\Rightarrow \quad (\alpha+\beta)^2 = m^2\left[(\alpha+\beta)^2 - 4\alpha\beta\right]$$

$$\Rightarrow \quad p^2 = m^2\left[p^2 - 4q\right] = p^2m^2 - 4m^2q$$

$$\therefore \quad p^2\left(m^2 - 1\right) = 4m^2q.$$

10.(B) The circles pass through the pole and have their centres on the initial line and have diameters of lengths 2a and 4a. The answer to the question will be

$$\pi\left(r_2^2 - r_1^2\right) = \pi(4-1)a^2 = 3\pi a^2.$$

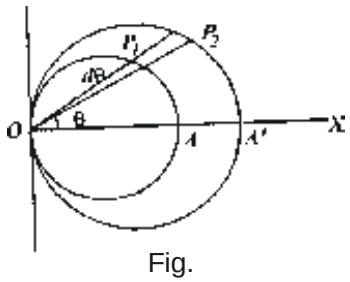


Fig.

Finding it by integration, using the polar formula for area

$$A = 2\frac{1}{2}\int_0^{\pi/2}\left(r_2^2 - r_1^2\right)d\theta$$

(As there is symmetry about initial line)

$$A = a^2\int_0^{\pi/2} 4(4-1)\cos^2\theta\, d\theta$$

$$= 12a^2\int_0^{\pi/2}\frac{1+\cos 2\theta}{2}d\theta = \frac{12a^2}{2}\left[\theta + \frac{\sin 2\theta}{2}\right]_0^{-\pi/2}$$

$$= \frac{12a^2}{2}\left[\frac{\pi}{2} - 0\right] = 3\pi a^2.$$

11.(B) $$I = \int_{x=0}^{a}\int_{y=0}^{\sqrt{a^2-x^2}}\sqrt{a^2-x^2-y^2}\ dx\ dy$$

$$I = \int_{x=0}^{a}\left[y\frac{\sqrt{a^2-x^2-y^2}}{2} + \frac{a^2-x^2}{2}\sin^{-1}\frac{y}{\sqrt{a^2-x^2}}\right]_0^{\sqrt{a^2-x^2}} dx$$

$$= \int_{x=0}^{a} 0 + \frac{a^2-x^2}{2}\ \frac{\pi}{2}\ dx = \frac{\pi}{4}\left[a^2x - \frac{x^3}{3}\right]_0^a = \frac{\pi}{6}\ a^3.$$

12.(C) The projection of the cone of the z = 0 plane is $x^2+y^2=0 \Rightarrow$ (0, 0). The projection of the sphere is the circle $x^2+y^2=1$

So $$I = 4\int_0^1 \int_{y=0}^{\sqrt{1-x^2}} \int_{z=\sqrt{x^2+y^2}}^{\sqrt{1-(x^2+y^2)}} z\,dx\,dy\,dz$$

$$= 4\int_0^1 \int_{y=0}^{\sqrt{1-x^2}} \left[\frac{z^2}{2}\right]_{\sqrt{x^2+y^2}}^{\sqrt{1-(x^2-y^2)}} dx\,dy$$

$$= 2\int_0^1 \int_0^{\sqrt{1-x^2}} \left(1-x^2-y^2-x^2-y^2\right) dx\,dy$$

$$= 2\int_0^1 \left[\left(1-2x^2\right)y-\frac{y^3}{3}\right]_0^{\sqrt{1-x^2}} dx$$

$$= 2\int_0^1 \sqrt{1+x^2}\left\{1-2x^2-\frac{1-x^2}{3}\right\} dx \text{ Let } x = \sin$$

$$= \frac{2}{3}\int_0^{\pi/2} \cos\theta\left(2-5\sin^{2\theta}\right)\cos\theta\,d\theta$$

$$= \frac{2}{3}\left[\frac{2\Gamma\left(\frac{3}{2}\right)\Gamma\left(\frac{1}{2}\right)}{2\Gamma(2)}-\frac{\Gamma\left(\frac{3}{2}\right)\Gamma\left(\frac{3}{2}\right)}{2\Gamma(3)}\right] = \frac{3}{2}\left[\frac{\pi}{2}-\frac{5\pi}{16}\right] = \frac{\pi}{8}.$$

13.(A) The curve is symmetrical about x-axis, as the power of y is even. Also putting y = 0 we find that the loop extends from x = a to x = 2a.

$\therefore$ The required volume $= \int_{x=a}^{2a} \pi y^2\,dx = \frac{\pi}{a^2}\int_a^{2a} x^2(2a-x)(x-a)\,dx$

$$= \frac{\pi}{a^2}\int_a^{2a} x^2\left(-x^2+3ax-2a^2\right)dx = \frac{\pi}{a^2}\int_0^{2a}\left(-x^4+3ax^3-2a^2x^2\right)dx$$

$$= \frac{\pi}{a^2}\left[-\tfrac{1}{5}x^5+\tfrac{3}{4}ax^4-\tfrac{2}{3}a^2x^3\right]_a^{2a}$$

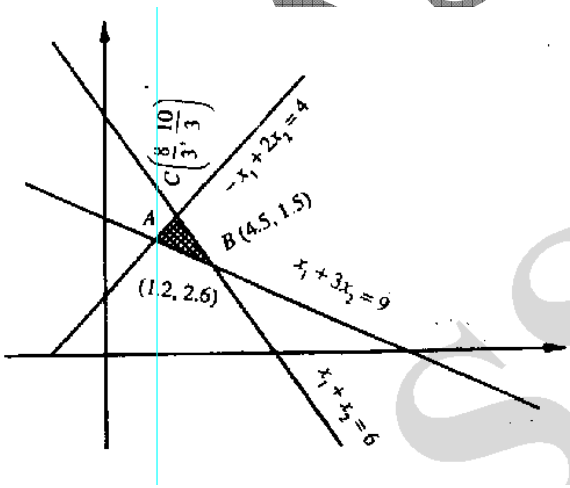
$$= \left(\pi/a^2\right)\left[\left\{(-32/5)a^5+12a^5-(16/3)a^5\right\}-\left(-\tfrac{1}{5}a^5+\tfrac{3}{4}a^5-\tfrac{2}{3}a^5\right)\right]$$

$$= \pi a^3\left[(-32/5)+12-(16/3)+\tfrac{1}{5}-\tfrac{3}{4}+\tfrac{2}{3}\right] = (23/60)\pi a^3.$$

14.(B) After drawing a graph we get the vertices of feasible region as (1, 0), (10, 0), (2, 4), (0, 4) and (0, 1).

Thus minimum value of the objective function is at (0, 1). Hence z = $0\times2+1\times1=1$

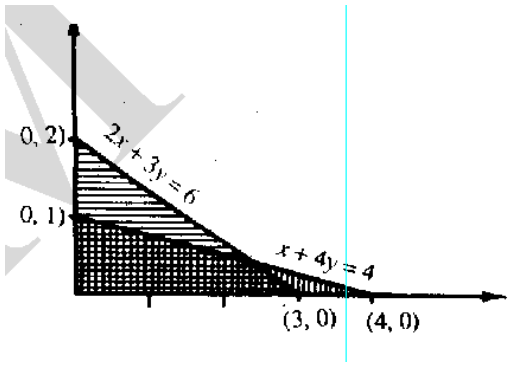
15.(D) The graph of linear programming problem is as given below



Hence the required feasible region is given by the graph whose vertices are A (1.2, 2.6), B (4.5, 1.5) and C. $\left(\frac{8}{3},\frac{10}{3}\right)$

Thus objective function is minimum at A(1.2, 2.6) so $x_1=1.2, x_2=2.6$ and z = $2\times1.2+3\times2.6=10.2$

16.(C) Solving 2x + 3y = 6 and x + 4y = 4, we get . $x = \frac{12}{5}$, $y \ \frac{2}{5}$



Hence a vertex is $\left(\frac{12}{5}, \frac{2}{5}\right)$.

17.(A) (i) This question can be also be solved by one student

(ii) This question can be also be solved by two students simultaneously

(iii) This question can be also be solved by three students all together.

$P(A) = \frac{1}{2}$, $P(B) = \frac{1}{4}$, $P(C) = \frac{1}{6}$

$P(A \cup B \cup C)$ = *P(A)* + *P(B)* + *P(C)* - [*P(A). P(B)* + P(B). P(C) + P(C). P(A)] + [*P(A). P(B).P(C)*]

$$\frac{1}{2} + \frac{1}{4} + \frac{1}{6} - \left[\frac{1}{2} \times \frac{1}{4} + \frac{1}{4} \times \frac{1}{6} + \frac{1}{6} \times \frac{1}{2}\right] + \left[\frac{1}{2} \times \frac{1}{4} \times \frac{1}{6}\right] = \frac{33}{48}$$

18.(B) Let 100 students are studying in which 60 % are Girls and 40 % are Boys.

Boys = 40, Girls = 60

25% of Boys offer Maths $= \frac{25}{100} \times 40 = 10$ Boys

10% of girls offer Maths $= \frac{10}{100} \times 60 = 6$ Girls

It means, 16 students offer maths.

$\therefore$ Required probability $= \frac{6}{16} = \frac{3}{8}$.

19.(A) Let p_1, p_2 be the chances of happening of the first and second events respectively, then according to the given conditions, we have

$$p_1 = p_2^2 \text{ and } \frac{1-p_1}{p_1} = \left(\frac{1-p_2}{p_2}\right)^3$$

$$\Rightarrow \quad p_2 = \frac{1}{3} \text{ and so } p_1 = \frac{1}{9}.$$

20.(C) Given that $u = r^m$ .....(i)

and $r^2 = x^2 + y^2 + z^2$ .....(ii)

$$\frac{\partial u}{\partial x} = \frac{\partial u}{\partial r} \cdot \frac{\partial r}{\partial x} = mr^{m-1}\frac{x}{r} = mxr^{m-2}$$

Again $\frac{\partial^2 u}{\partial x^2} = \frac{\partial}{\partial x}\left(\frac{\partial u}{\partial x}\right) = \frac{\partial}{\partial x}(mxr^{m-2}) = m.\left(1.r^{m-2} + x(m-2)r^{m-3}\frac{\partial r}{\partial x}\right)$

$\frac{\partial^2 u}{\partial x^2} = m\,[\,r^{m-2} + x^2(m-2)\,r^{m-4}]$ .....(iii)

Similarly

$\frac{\partial^2 u}{\partial y^2} = m\,[\,r^{m-2} + y^2(m-2)\,r^{m-4}]$ .....(iv)

and $\frac{\partial^2 u}{\partial z^2} = m\,[r^{m-2} + z^2(m-2)\,r^{m-4}]$ ..... (v)

Adding (iii), (iv) and (v), we get $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}$

$\frac{\partial^2 u}{\partial y^2} = m\,[\,r^{m-2} + y^2(m-2)\,r^{m-4}]$ .....(iv)

and $\frac{\partial^2 u}{\partial z^2} = m\,[r^{m-2} + z^2(m-2)\,r^{m-4}]$ ..... (v)

Adding (iii), (iv) and (v), we get $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}+\frac{\partial^2 u}{\partial z^2}$

$= m\,[3r^{m-2} + (x^2 + y^2 + z^2)(m-2)\,r^{m-4}] \quad = m\,[3r^{m-2} + (m-2)\,r^{m-2}]$

$= m(m+1)r^{m-2}$

21.(D) The given function is a straight line. So there is no maxima or minima.

22.(B) Required area $= \int_0^1 \tan^{-1} x \; dx$

Put $x = \tan\theta$

$\Rightarrow dx = \sec^2\theta \, d\theta$

$= \int_0^{\pi/4} \theta \sec^2\theta \; d\theta \quad = (\theta.\tan\theta)_0^{\pi/4} - \int_0^{\pi/4} 1.\tan\theta \; d\theta \quad = \frac{\pi}{4}\tan\frac{\pi}{4} - \left[\log(\sec\theta)\right]_0^{\pi/4}$

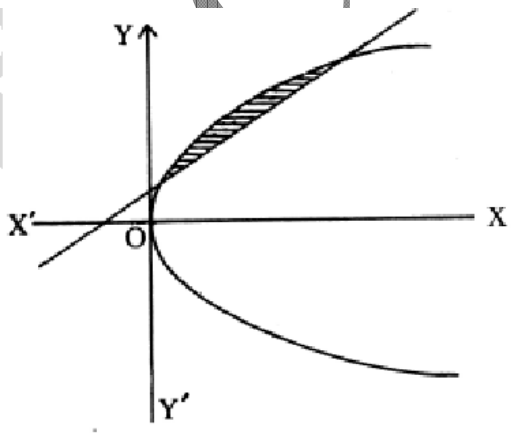
$= \frac{\pi}{4} - \left(\log\sqrt{2} - \log 1\right) \quad = \frac{\pi}{4} - \log\sqrt{2}$

23.(B) The equation of the given curves are

$y^2 = 9x$ ...(i)

$x - y + 2 = 0$ ...(ii)

The curves (i) and (ii) intersect at A (1, 3) and B(4, 6)



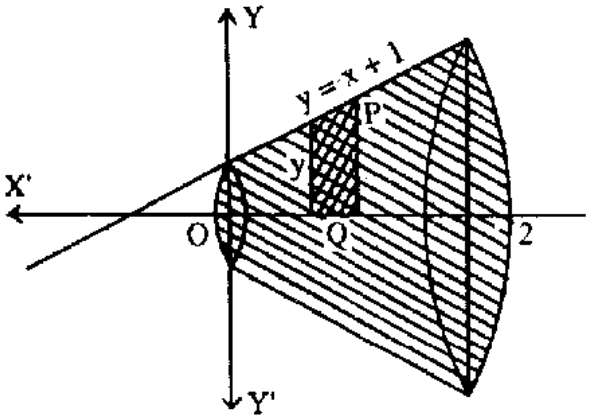
$\therefore$ The required area

$$A = \int_1^4 \int_{x+2}^{3\sqrt{x}} dy\, dx = \int_1^4 [y]_{x+2}^{3\sqrt{x}} dx = \int_1^4 \left[3\sqrt{x} - (x+2)\right] dx$$

$$=\left[2x^{3/2}-\frac{1}{2}x^2-2x\right]_1^4=(16-8-8)-\left(2-\frac{1}{2}-2\right)=\frac{1}{2}$$

24.(D) The given curve is y = x + 1

This represents a straight line.



∴ The required volume

$$V=\pi\int_0^2 y^2\,dx=\pi\int_0^2(x+1)^2\,dx=\pi\int_0^2\left(x^2+2x+1\right)\,dx=\pi\left[\frac{x^3}{3}+x^2+x\right]_0^2=\frac{26\pi}{3}$$

25.(D) The given equation can be written as

$$\frac{dy}{dx}=\frac{y\left(y\sin\frac{y}{x}+x\cos\frac{y}{x}\right)}{x\left(y\sin\frac{y}{x}-x\cos\frac{y}{x}\right)} \qquad ...(1)$$

This is a homogeneous equation. Thus putting

y = vx.

$$\Rightarrow \quad \frac{dy}{dx}=v+x\frac{dv}{dx}$$

From(1)

$$\therefore \quad v+x\frac{dv}{dx}=\frac{vx(vx\sin v+x\cos v)}{x(vx\sin v-x\cos v)}$$

$\therefore \quad x\frac{dv}{dx} = \frac{2v\cos v}{v\sin v - \cos v}$

or, $\left(\tan v - \frac{1}{v}\right)dv = 2\frac{dx}{x}$

on integrating, the required solution is

log sec v - log v = 2 log x + log k

or, log sec v = log (v x^2k)

or, sec v = vx^2k

or, $\sec\frac{y}{x} = kxy$

or, xy cosy/x = 1/k = C (say)

26.(D) cot y cosec y $\frac{dy}{dx} + \frac{1}{x}$ cosec y = $\frac{1}{x^2}$

Put cosec y = v

$\Rightarrow$ cosec y cot y $\frac{dy}{dx} = \frac{-dv}{dx}$

$\therefore \quad \frac{-dv}{dx} + \frac{1}{x}y = \frac{1}{x^2}$

$\frac{dv}{dx} - \frac{1}{x}y = -\frac{1}{x^2}$

I.F. = $e^{\int -\frac{1}{x}dx}$

$= e^{-\log x. = \frac{1}{x}}$

$\therefore \quad v\cdot\frac{1}{x} = \int -\frac{1}{x^2}\cdot\frac{1}{x}dx = \frac{1}{2x^2} + C$

2x = 1 + 2Cx^2

2x cosec y = 2 Cx^2 + 1

27.(A) The A.E. of the given d.e. is - m^2 - m - 2 = 0

$\Rightarrow$ m = 1, m = -2

$\therefore$ C.F. is $y = C_1e^x + C_2e^{-2x}$

and P.I. $= \frac{1}{D^2+D-2}e^x = x.\frac{1}{2D+1}e^x$

$= x\frac{1}{2+1}e^x = \frac{1}{3}xe^x$

$\therefore$ Required solution is

$y = C_1e^x + C_2e^{-2x} + \frac{1}{3}xe^x$

28.(A) $\frac{1}{D^2+D+1}\sin x$

$= \frac{1}{-1^2+D+1}\sin x$

$= \frac{1}{D}\sin x = -\cos x.$

29.(C) Rationalizing the degree 0 differential equation (d.e.) we see that

$$y + x\left(\frac{d^2y}{dx^2}\right)^2 = \left(\frac{d^3y}{dx^3}\right)^4$$

Hence the degree of given d.e. is 4.

30.(C) Let

$$\alpha = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}, \beta = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$$

$$\gamma = \begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix}, \delta = \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$$

be four elements of V, if a, b, c, d are scalars such that

$$a\alpha + b\beta + c\gamma + d\delta = \vec{0}$$

$$\Rightarrow a\begin{bmatrix}1 & 0\\ 0 & 0\end{bmatrix}+b\begin{bmatrix}0 & 1\\ 0 & 0\end{bmatrix}+c\begin{bmatrix}0 & 0\\ 1 & 0\end{bmatrix}+d\begin{bmatrix}0 & 0\\ 0 & 1\end{bmatrix}$$

$$=\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$$

$$\Rightarrow\begin{bmatrix}a & b\\ c & d\end{bmatrix}=\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}.$$

$\Rightarrow a=0, b=0, c=0, d=0$

Hence, $\alpha, \beta, \gamma, \text{and } \delta$ are linearly independent

Let $\begin{bmatrix}a & b\\ c & d\end{bmatrix}$ be any vector in V, then we can write $\begin{bmatrix}a & b\\ c & d\end{bmatrix}=a\alpha+b\beta+c\gamma+d\delta$

$\therefore$ S = $\{\alpha, \beta, \gamma, \delta\}$ is linearly independent and L(S) = V

$\therefore$ S is a basis of V.S.containing 4 elements.

$\therefore$ dim of S = 4

31.(C) Let $\vec{a}+\vec{b}+\vec{c}=0$

Now take cross product of both side by $\vec{b}$, we get

$\vec{a}\times\vec{b}+\vec{b}\times\vec{b}+\vec{c}\times\vec{b}=0$

or, $\vec{a}\times\vec{b}=-\vec{c}\times\vec{b}$

or, $\vec{a}\times\vec{b}=\vec{b}\times\vec{c}$

Similarly $\vec{b}\times\vec{c}=\vec{c}\times\vec{a}$

hence $\vec{a}\times\vec{b}=\vec{b}\times\vec{c}=\vec{c}\times\vec{a}$

Let us consider $[\vec{a}\ \vec{b}\ \vec{c}]=\vec{a}\cdot\vec{b}\times\vec{c}$

$=\vec{a}\cdot\vec{a}\times\vec{b}$

= 0

$\therefore$ $\vec{a}, \vec{b}, \vec{c}$ are coplanar

32.(A) Given np = 6 npq = 4

$\therefore \ \frac{npq}{np} = \frac{4}{6} \Rightarrow q = \frac{2}{3} \text{ and } p = \frac{1}{3}$

$\because \ np = 6 \Rightarrow n \times \frac{1}{3} = 6 \Rightarrow n = 18.$

33.(A) f(x) = 3x – 4 = y(let)

Now f(x) = y $\Rightarrow \ x = \frac{y+4}{3} \Rightarrow f^{-1}(x) = \frac{4+x}{3}$

34.(A) Let $x + y = v$

$\Rightarrow \ 1 + \frac{dy}{dx} = \frac{dv}{dx}$

$\Rightarrow \ 1 + \frac{a^2}{v^2} = \frac{dv}{dx}$

$\therefore \quad \int \frac{v^2}{a^2+v^2} dv = x + c$

or, $\quad \int \left(1 - \frac{a^2}{a^2+v^2}\right) dv = x + c$

or, $\quad v - \frac{a^2}{a} \tan^{-1} \frac{v}{a} = x + c$

or, $\quad x + y - a \tan^{-1} \frac{x+y}{a} = x + c$

or, $\quad y - a \tan^{-1} \frac{x+y}{a} = c$

or, $\quad y + x = a \tan\left(\frac{y-c}{a}\right)$

35.(B) Divide the d.e. by z $(\log z)^3$ we get

$$\frac{1}{z(\log z)^3} \frac{dz}{dx} + \frac{2x}{x^2+1} \cdot \frac{1}{(\log z)^2} = \frac{x}{x^2+1}$$

Put $\quad y = \frac{1}{(\log z)^2}$

$$\frac{dy}{dx} = -\frac{2}{(\log z)^3} \cdot \frac{1}{z} \cdot \frac{dz}{dx}$$

$$\therefore \qquad = -\frac{1}{z(\log z)^3}\frac{dz}{dx} = \frac{1}{2} \cdot \frac{dy}{dx}$$

$\therefore$ Differential equation becomes

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

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

Which is a linear equation

$\therefore$ Transform required is

$$y = \frac{1}{(\log z)^2}$$

36.(B) A^{-1} exist $\Leftrightarrow$ A is non-singular $\Leftrightarrow |A| \neq 0$.

37.(B) For positive integer, square matrix A is nilpotent $\Rightarrow A^m = 0$.

38.(D) The region of integration is OAB. On solving the equations of two curves, we have

$$y = x = y^2$$

$$y = 0; \quad y = 1$$

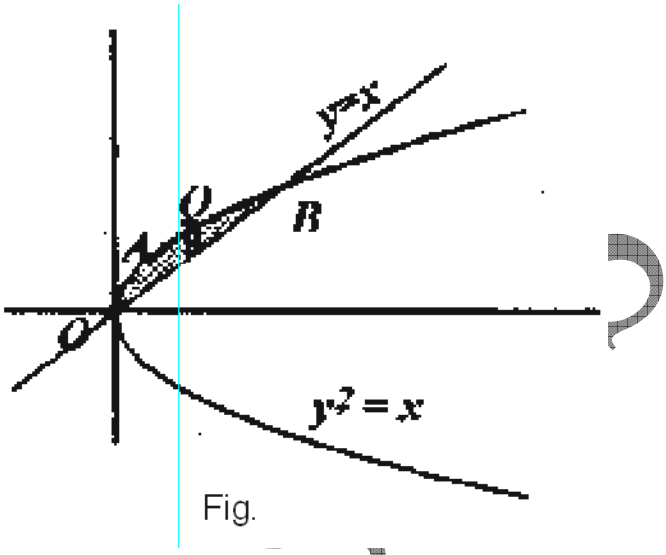


Fig.

∴ The two points of intersection are O (0, 0) and B (1, 1)

Limit of integrations are, on the strips PQ parallel to y axis y varies from line y = x to parabola $y^2 = x$.

limits of y are from y = x to $y = \sqrt{x}$

and then the minimum value of x is 0 and maximum value of x is 1 for the given region.

So the integral reduces to

$$= \int_0^1 \int_{y=x}^{\sqrt{x}} xy(x+y)\, dx\, dy = \int_0^1 \left(\frac{x^2y^2}{2} + \frac{xy^3}{3} \right)_x^{\sqrt{x}} dx,$$

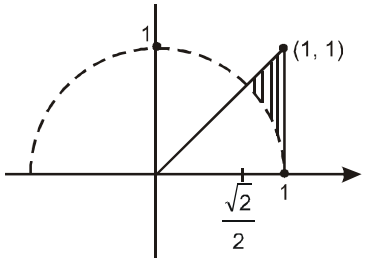
$$= \int_0^1 \left(\frac{x^2 x}{2} + \frac{x x^{3/2}}{3} - \frac{x^4}{2} - \frac{x^4}{3} \right) dx, = \left(\frac{x^4}{8} + \frac{2}{7}.\frac{x^{7/2}}{3} - \frac{x^5}{10} - \frac{x^5}{15} \right)_0^1,$$

$$= \frac{1}{8} + \frac{2}{21} - \frac{1}{10} - \frac{1}{15}, = \frac{1}{8} - \frac{3}{30} - \frac{2}{30} + \frac{2}{21}, = \frac{1}{8} - \frac{1}{6} + \frac{2}{21},$$

$$= \frac{6-8}{48} + \frac{2}{21} = \frac{2}{21} - \frac{1}{24} = \frac{48-21}{21 \times 24} = \frac{3}{7 \times 8}. = \frac{3}{56}$$

39.(A) The region of integration consists of all points in the first quadrant above the circle $x^2 + y^2 = 1$ and under the line y =x. Transform to polar coordinates, nothing that x = 1 is equivalent to r = sec θ.

$$I = \int_0^{\pi/4}\int_1^{\sec\theta} \frac{1}{r}\cdot r\, dr\, d\theta = \int_0^{\pi/4}\int_1^{\sec\theta} dr\, d\theta = \int_0^{\pi/4}(\sec\theta - 1)d\theta = \left(\ln\left|\sec\theta + \tan\theta\right| - \theta\right)\Big]_0^{\pi/4} = \ln\left(\sqrt{2}+1\right) - \pi/4.$$



40.(A) We know that the Green's theorem in Cartesian form is .

$$\int_C (F_1\, dx + F_2\, dy) = \iint_S \left(\frac{\partial F_2}{\partial x} - \frac{\partial F_1}{\partial y}\right) dx\, dy \quad \text{..(i)}$$

Hence F_1 = cos x sin y - x y and F_2 = sin x cos y

$\therefore \frac{\partial F_1}{\partial y}$ = cos x cos y - x and $\frac{\partial F_2}{\partial x}$ = cos x cos y

Hence by (i) the given line integral.

$= \iint_s$ [cos x cos y - (cos x cos y - x)] dx dy,

where S is the area of the circle bounded by C i.e. the circle $x^2 + y^2 = 1$.

$$= \iint_s x\, dx\, dy = \int_{x=-1}^{1}\int_{y=-\sqrt{(1-x^2)}}^{\sqrt{(1-x^2)}} x\, dx\, dy. \quad = \int_{-1}^{1} x\,[y]_{-\sqrt{(1-x^2)}}^{\sqrt{(1-x^2)}}\, dx$$

$$= 2\int_{-1}^{1} x\sqrt{(1-x^2)}\, dx = 2\left[-\frac{2}{3}\left(1-x^2\right)^{3/2}\right]_{-1}^{1} = 0.$$

41.(B) If we take U be an arbitrary non–empty set, S denote the set of all subsets of U, for X, Y∈S, if we define X + Y = {x : x ∈ X or x ∈ Y but x ∉ X ∩ Y}, then (S, +, 0) will be commutative ring with unity and X_0X = X for all X∈S.

42.(B) First rewrite the differential equation in the proper form

$$\frac{dy}{dx}=\frac{1}{3}\left(e^{0.1x}-\sqrt{y}\right)$$

$$f(x,y) = \frac{1}{3}\left(e^{0.1x}-\sqrt{y}\right)$$

Euler's method is given by

$$y_{1+1} = y_i + f(x_i, y_i)h$$

where

$$h = 0.3$$

For i = 0 , $x_0 = 0.3$, $y_0 = 5$

$$y_1 = y_0 + f(x_0,y_0)h$$

$$= 5 + f(0.3,5) \times 0.3$$

$$= 5 + \frac{1}{3}\left(e^{0.1\times 03}-\sqrt{5}\right) \times 0.3$$

$$= 5 + (-0.12056)$$

$$= 4.8794$$

y_1 is the approximate value of *y* at

$$x = x_1 = x_0 + h = 0.3 + 0.3 = 0.6$$

For i = 1, $x_1 = 0.6$, $y_1 = 4.8794$

$$y_2 = y_1 + f(x_1, y_1)\, h$$

$$= 4.8794 + f(0.6,4.8794) \times 0.3$$

$$= 4.8794 + \frac{1}{3}\left(e^{0.1\times 0.6}-\sqrt{4.8794}\right) \times 0.3$$

$$= 4.8794 + (-0.11471)$$

y_2 is the approximate value of y at

$$x = x_2 = x_1 + h = 0.6 + 0.3 = 0.9$$

$$y(0.9) \approx 4.7647$$

Thus $\frac{dx}{dt} = \frac{1}{3}\left(e^{0.1x} - \sqrt{y}\right)$

$\frac{dy}{dx}(0.9) \approx \frac{1}{3}\left(e^{0.1\times 0.9} - \sqrt{4.7647}\right)$

$= -0.36288$

43.(D) A vector is perpendicular to a plane if and only if it is parallel to a normal vector for the plane.

To find a vector $\vec{n}$ which is normal to the plane containing P(2, 1, 5), Q(–1, 3, 4), and R(3, 0, 6) we need to find two non-parallel vectors in the plane and compute their cross products. The vectors

$$\overrightarrow{PQ} = \langle -2-2, 3-1, 4-5\rangle = \langle -3, 2, -1\rangle$$

$$\overrightarrow{PR} = \langle 3-2, 0-1, 6-5\rangle = \langle 1, -1, 1\rangle$$

are not parallel and belong to the plane, so we have

$$\vec{n} = \overrightarrow{PQ} \times \overrightarrow{PR} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -3 & 2 & -1 \\ 1 & -1 & 1 \end{vmatrix} = (2-1)\hat{i} + (3-1)\hat{j} + (3-2)\hat{k} = \boxed{\hat{i} + 2\hat{j} + \hat{k}}$$

44.(A) The correct choice is (A) and the correct answer is **7!**.

There are seven positions to be filled. The first position can be filled using any of the 7 letters contained in PROBLEM. The second position can be filled by the remaining 6 letters as the letters should not repeat. The third position can be filled by the remaining 5 letters only and so on. Therefore, the total number of ways of rearranging the 7 letter word

= 7*6*5*4*3*2*1 = 7! Ways.

45.(D) Here $\ell_1 R\, \ell_2$, ℓ_1 is parallel to ℓ_2 and also ℓ_2 is parallel to ℓ_1, so it is symmetric.

Clearly, it is also reflexive and transitive. Hence it is an equivalence relation.

46.(D) For 0 < x < 1, we have $\frac{1}{2}x^2 < x^2 < x$

$\Rightarrow -x^2 > -x$, so that $e^{-x^2} < e^{-x}$.

Hence $\int_0^1 e^{-x^2}\cos^2 x\,dx > \int_0^1 e^{-x}\cos^2 x\,dx$.

Also $\cos^2 x \le 1$

Therefore $\int_0^1 e^{-x^2}\cos^2 x dx \le \int_0^1 e^{-x^2}dx < \int_0^1 e^{-x^2/2}dx = I_4$

Hence I_4 is the greatest integral.

47.(D) We have $f'(x) = f(x) \Rightarrow \frac{f'(x)}{f(x)} = 1$

$\Rightarrow \log f(x) = x + \log c \Rightarrow f(x) = ce^x$

Since f(0) = 1, therefore 1 = ce° $\Rightarrow$ c = 1

Thus f(x) = e^x.

Hence g(x) = $x^2 - e^x$

$\therefore \int_0^1 f(x)g(x)dx = \int_0^1 e^x(x^2 - e^x)dx$

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

48.(B) This statement is always true that if an l.p.p has unbounded solution, then it's dual is infeasible.

But, if an LPP is infeasible then it's dual always has unbounded solution is not necessarily true.

49.(A) Let q = 1 – p. Since head appears first time in an even throw i.e., 2 or 4 or 6 etc.

$\therefore \frac{2}{5} = qp + q^3p + q^5p + ...$

$\Rightarrow \frac{2}{5} = \frac{qp}{1-q^2}$ $\Rightarrow \frac{2}{5} = \frac{(1-p)p}{1-(1-p)^2} = \frac{1-p}{2-p}$

$\Rightarrow 2(2 - p) = 5(1 - p) \Rightarrow p = \frac{1}{3}$.

Hence (a) is correct answer.

50.(D) The number of ways of arranging n numbers in a row is n!.

Considering digits 1, 2, 3, 4, ..., k as one digit, we have (n – k + 1) digits which can be arranged in (n – k + 1)! ways.

So, the total number of ways in the digits 1, 2, 3, ..., k appear as neighbours in the same order is (n – k + 1)!.

Hence, required probability = $\frac{(n-k+1)!}{n!}$.

Hence (d) is correct answer.

51.(D) Out of 5 horses only one is the winning horse. The probability that Mr. A selected the losing horse = $\frac{4}{5}\times\frac{3}{4}$

∴ The probability that Mr. A selected the winning horse

$$. = 1-\frac{4}{5}\times\frac{3}{4}=\frac{2}{5}$$

52.(A) The total number of cases are 2^{100}

The number of favourable ways

$$^{100}C_1 + {}^{100}C_3 + \ldots\ldots + {}^{100}C_{99} = 2^{100-1} = 2^{99}$$

Hence required probability = $\frac{2^{99}}{2^{100}}=\frac{1}{2}$.

53.(B)

$$L_0(x)=\frac{(x-2.5)(x-3.0)}{(-0.5)(-1.0)}=2x^2-11x+15$$

Similarly, $L_1(x) = -(4x^2 - 20x + 24)$

and $L_2(x) = 2x^2 - 9x + 10$

∴ $L_2(x) = (2x^2 - 11x + 15)(0.69315) - (4x - 20x + 24)(0.091629) + (2x^2 - 9x + 10)(1.09861)$

$$= -0.08164x^2 + 0.81366x - 0.60761$$

which is the required quadratic polynomial.

Putting x = 2.7 in the above polynomial, we get

$$\ln 2.7 \approx L_2(2.7) = -0.08164(2.7)^3 + 0.81366(2.7) - 0.60761$$

$$= 0.9941164$$

Actual value of ln 2.7 = 0.9932518, therefore

$$|\text{Error}| = \mathbf{0.0008646.}$$

54.(A) $P'(x) = 5x^4 + 20x^3 - 80x - 80$, so $P'(-2) = 80 - 160 + 160 - 80 = 0$.

Thus, the zero at p = –2 has multiplicity $m \geq 2$, which implies that Newton's method has linear convergence (that is, the order of convergence is 1).

55.(B) Formula for (n + 1)the approximated value of x by False position method is

$$x_{n+1} = x_{n-1} - \frac{[x_n - x_{n-1}]f(x_{n-1})}{f(x_n) - f(x_{n-1})}$$

For end approximation put n = 1

$$x_2 = x_0 - \frac{(x_1 - x_0)f(x_0)}{f(x_1)f(x_0)}$$

$$x_2 = \frac{x_0 f(x_1) - x_1 f(x_0)}{f(x_1) - f(x_0)}$$

Hence (B) is correct answer.

56.(D) The error in Simpson's rule for the integral $\int_a^b f(x)dx$ is given by $\left|\frac{(b-a)^5 f^{iv}(c)}{180n^4}\right|$, where a < c < b

Here we have a = 1, b = 3 and $f(x) = \frac{1}{x}$, so that

$f^{iv}(x) = 24x^5$.

Thus the required error is

$$\left|\frac{(2)^5(24)}{(180)(4^4)(c^5)}\right| < \frac{(2)^4(24)}{(180)(4^4)} = \frac{1}{60}[\because c > 1].$$

Hence (d) is correct answer.

57.(C) $f(x) = x^2$, a = 1, b = 9, n = 4

$$h = \frac{b-a}{n} = \frac{9-1}{4} = 2.$$

x	1	3	5	9
y	1	9	25	81

By trapezoidal method

$$\int_a^b f(x)dx = \frac{h}{2}\left[(y_0 + y_4) + 2(y_1 + y_2 + y_3)\right]$$

$$\int_1^9 x^2\,dx = \frac{2}{2}\left[\left(1+9^2\right) + 2\left(3^2 + 5^2 + 7^2\right)\right]$$

Therefore, $\alpha = 3$, $\beta = 5$

58.(C) By Newton-method

$$x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} \text{ or } x_n = x - \frac{f(x)}{f'(x)}$$

$f(x) = x^2 - x - 2$, $f'(x) = 2x - 1$

In general, $x_n = x - \frac{x^2 - x - 2}{2x-1} = \frac{x^2+2}{2x-1}$

$$\therefore\ x_1 = \frac{x_0^2+2}{2x_0-1}, x_2 = \frac{x_1^2+2}{2x_1-1}$$

$\because\ x_0 = 1$

$$\therefore x_1 = \frac{1+2}{2-1} = 3 \text{ and } x_2 = \frac{3^2+2}{6-1} = \frac{11}{5}.$$

59.(B) $\frac{\partial u}{\partial x} = \frac{3}{2}\left(x^2+y^2+z^2\right)^{1/2}.2x$

$$\therefore \left(\frac{\partial u}{\partial x}\right)^2 = \frac{9}{4}\left(x^2+y^2+z^2\right)4x^2 = 9x^2\left(x^2+y^2+z^2\right)$$

$$\therefore \left(\frac{\partial u}{\partial x}\right)^2 + \left(\frac{\partial u}{\partial y}\right)^2 + \left(\frac{\partial u}{\partial z}\right)^2$$

$= 9(x^2 + y^2 + z^2)\,(x^2 + y^2 + z^2)$

$= 9(x^2 + y^2 + z^2)^2 = 9.u^{4/3}.$

60.(D) $f(x)=\int_0^x te^{-t^2}dt \Rightarrow f'(x)=xe^{-x^2}=0 \Rightarrow x=0$

$f''(x)=e^{-x^2}(1-2x^2); f''(0)=1>0$

$\therefore$ Minimum value f(0) = 0.

61.(C) Let x = 5, y = 0 $\Rightarrow$ f(5 + 0) = f(5) . f(0)

$\Rightarrow$ f(5) = f(5) f(0) $\Rightarrow$ f(0) = 1

Therefore, $f'(5)=\lim_{h\to 0}\frac{f(5+h)-f(5)}{h}$

$=\lim_{x\to 0}\frac{f(5)f(h)-f(5)}{h}=\lim_{h\to 0}2\left[\frac{f(h)-1}{h}\right],\{\because f(5)=2\}$

$=2\lim_{h\to 0}.\left[\frac{f(h)-f(0)}{h}\right]=2\times f'(0)=2\times 3=6.$

62.(C) $e^{x-[x]}$ is a periodic function with period 1.

$\therefore$, $\int_0^{1000}e^{x-[x]}dx=1000\int_0^1 e^{x-[x]}dx$

[$\because$ [x] = 0, if 0 < x < 1]

$=1000\left[e^x\right]_0^1=1000(e-1)$.

63.(C) Let $I=\int_0^{\pi/2}\frac{dx}{\sqrt{\tan x}-\sqrt{\cot x}}$

$=\int_0^{\pi/2}\frac{dx}{\sqrt{\tan\left(\frac{\pi}{2}-x\right)}-\sqrt{\cot\left(\frac{\pi}{2}-x\right)}}$

$=\int_0^{\pi/2}\frac{dx}{\sqrt{\cot x}-\sqrt{\tan x}}=-1$

$\Rightarrow$ 2I = 0. $\therefore$ I = 0.

64.(A) $\int_0^{2[x]}(x-[x])dx=\int_0^{2[x].1}(x-[x])dx$

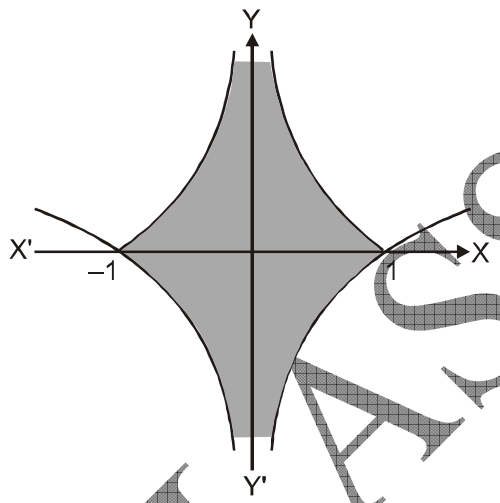
$=2[x]\int_0^1(x-[x])dx$

[$\because$ x – [x] is a periodic function of period 1]

$$= 2[x]\left(\frac{x^2}{2}\Big| - \int_0^1 [x]dx\right) = 2[x]\left(\frac{1}{2} - 0\right) = [x] \quad .$$

65.(A) We know that log x is defined for x > 0 and log |x| is defined for all $x \in R - \{0\}$

Also $|\log x| \geq 0$ and $|\log|x|| \geq 0$



$\therefore$ Required area is symmmetrical in all the four quadrants and is equal to

$$4\int_0^1 |\log x|\, dx = -4\int_0^1 \log x\, dx, \qquad (\because \text{In } (0,1), \log x < 0)$$

$$= 4\left[x\log x - x\right]_0^1 = -4(-1) = 4 \text{ sq.unit}, \left(\because \lim_{x\to 0} x\log x = 0\right).$$

66.(C) Given equations of curves y = cos x and y = sin x and ordinates x = 0 to $x = \frac{\pi}{4}$. We know that area bounded by the curves

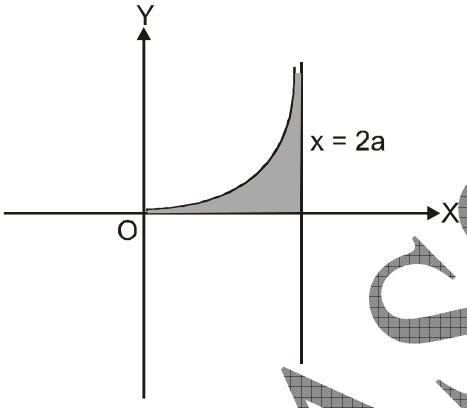
$$= \int_{x_1}^{x_2} y\, dx = \int_0^{\pi/4} \cos x dx - \int_0^{\pi/4} \sin x\, dx$$

$$= [\sin x]_0^{\pi/4} - [-\cos x]_0^{\pi/4}$$

$$= \left(\sin\frac{\pi}{4} - \sin 0\right) + \left(\cos\frac{\pi}{4} - \cos 0\right) = \left(\frac{1}{\sqrt{2}} - 0\right) + \left(\frac{1}{\sqrt{2}} - 1\right)$$

$$= \sqrt{2} - 1.$$

67.(B) Curve y^2 (2a – x) = x^3 is symmetrical about x-axis and passes through origin. Also $\frac{x^3}{2a-x} < 0$ for x > 2a or x < 0. So curve does not lie in x > 2a and x < 0, curve lies wholly on $0 \le x \le 2a$.



$\therefore$ Area $= \int_0^{2a} \frac{x^{3/2}}{\sqrt{2a-x}} dx = \int_0^{\pi/2} 8a^2 \sin^4\theta d\theta$, (Put x = 2a sin2 θ)

$= 8a^2\left[\frac{3}{4}\cdot\frac{1}{2}\cdot\frac{\pi}{2}\right] = \frac{3\pi a^2}{2}$, (Applying Gamma function).

68.(C) Given $x^2 + y^2 = 1$ ...(1)

$x + y + z = 3$ ...(2)

$z = 0$ ...(3)

Here,

(i) z varies from 0 to 3 – x – y.

(ii) y varies from $-\sqrt{1-x^2}$ to $\sqrt{1-x^2}$.

(iii) x varies from – 1 to 1.,

$$V = \int_{-1}^{+1} dx \int_{-\sqrt{1-x^2}}^{\sqrt{1-x^2}} dy \int_0^{3-x-y} dz$$

$$= \int_{-1}^{+1} dx \int_{-\sqrt{1-x^2}}^{\sqrt{1-x^2}} dy \left[z\right]_0^{3-x-y}$$

$$= \int_{-1}^{+1} dx \int_{-\sqrt{1-x^2}}^{\sqrt{1-x^2}} dy (3-x-y)$$

$$= \int_{-1}^{+1} dx \left[\frac{(3-x-y)^2}{-2} \right]_{-\sqrt{1-x^2}}^{\sqrt{1-x^2}}$$

$$= -\frac{1}{2}\int_{-1}^{+1} dx \left[\left[3-x-\sqrt{1-x^2}\right]^2 - \left[2-x+\sqrt{1-x^2}\right]^2 \right]$$

$$= -\frac{1}{2}\int_{-1}^{+1} (6-2x)\left[-2\sqrt{1-x^2}\right] dx$$

$$= \int_{-1}^{+1} (6-2x)\sqrt{1-x^2}\, dx$$

$$= \int_{-1}^{+1} \left[6\sqrt{1-x^2} - 2x\sqrt{1-x^2}\right] dx$$

$$= 6\left[\frac{x}{2}\sqrt{1-x^2} + \frac{1}{2}\sin^{-1}x\right]_{-1}^{+1} + \left[\frac{2}{3}\left(1-x^2\right)^{3/2}\right]_{-1}^{+1}$$

$$= 3\left[\frac{\pi}{2} - \left(-\frac{\pi}{2}\right)\right]$$

$$= 3\pi$$

69.(B) Given $x^2 + y^2 = 4$ ...(1)

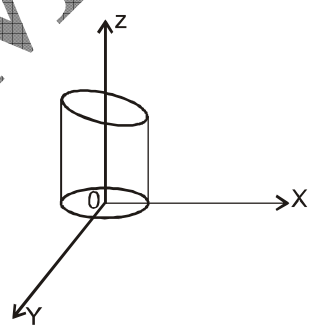
$y + z = 3$ ...(2)

$z = 0$ ...(3)

(i) z varies from 0 to 3 – y.

(ii) y varies from $-\sqrt{4-x^2}$ to $\sqrt{4-x^2}$.

(iii) x varies from – 2 to +2.



∴ Required volume

$$V = \int_{-2}^{+2} dx \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} dy \int_0^{3-y} dz$$

$$= \int_{-2}^{+2} dx \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} dy\,[x]_0^{3-y}$$

$$= \int_{-2}^{+2} dx \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} dy\,[3-y]$$

$$= \int_{-2}^{+2} dx \left[3y - \frac{y^2}{2}\right]_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}}$$

$$= \int_{-2}^{+2} \left[3\sqrt{4-x^2} - \frac{4-x^2}{2} + 3\sqrt{4-x^2} + \frac{4-x^2}{2}\right] dx$$

$$= 6\int_{-2}^{+2} \sqrt{4-x^2}\,dx$$

$$= 6\left[\frac{x}{2}\sqrt{4-x^2} + \frac{4}{2}\sin^{-1}\frac{x}{2}\right]_{-2}^{+2}$$

$$= 6\left[2\sin^{-1}\frac{2}{2} - 2\sin^{-1}\frac{-2}{2}\right]$$

$$= 12\left[\frac{\pi}{2} + \frac{\pi}{2}\right]$$

$$= 12\pi$$

70.(A) Putting y = vx and therefore $\frac{dy}{dx} = v + x\frac{dv}{dx}$ in the given equation,

we have $x \sin v \left(v + x\frac{dv}{dx}\right) = v\,x \sin v - x$

or v + x (dv/dx) = v – cosec v, dividing each term by x sin v

or $x\frac{dv}{dx} == -\text{cosec } v$ or $\sin v\, dv + \frac{dx}{x} = 0$

or –cos v + log x = log C , where C is an arbitrary constant.

or log(x/C) = cos v or x/C = $e^{\cos V}$ or $x = C e^{\cos(y/x)}$

71.(C) $P(x) = \frac{2x+1}{x}$

and hence an integrating factor is

$$\exp\left[\int P(x)\,dx\right] = \exp\left[\int\left(\frac{2x+1}{x}\right)dx\right] = \exp\left(2x + \ell n\,|x|\right)$$

$$= \exp(2x)\exp\left(\ell n\,|x|\right) = x\exp(2x).*$$

Multiplying Equation through by this integrating factor, we obtain

$$xe^{2x}\frac{dy}{dx} + e^{2x}(2x+1)y = x$$

or

$$xe^{2x}\frac{dy}{dx} + e^{2x}(2x+1)y = x$$

Integrating, we obtain the solutions

$$xe^{2x}y = \frac{x^2}{2} + c$$

or

$$y = \frac{1}{2}xe^{-2x} + \frac{c}{x}e^{-2x},$$

where c is an arbitrary constant.

72.(C) Here, given differential equation is

$$x\left\{y\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2\right\} = y\frac{dy}{dx} \qquad \text{.... (i)}$$

Let $ax^2 + by^2 = 1$ be the solution of Eq. (i)

Now, differentiating it w.r.t. x

$$2ax + 2by\frac{dy}{dx} = 0$$

$$\Rightarrow \quad \frac{dy}{dx} = -\frac{ax}{b} \qquad \text{.... (ii)}$$

Again differentiating

$$2a + 2by\frac{d^2y}{dx^2} + 2b\left(\frac{dy}{dx}\right)^2 = 0$$

or $$a + b\left\{y\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2\right\} = 0$$

or $$\left\{y\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^2\right\}=-\frac{ax}{b}$$

∴ By Eqs. (ii) and (iii), we can see that both satisfy Eq. (i)

∴ Required solution is

$$ax^2 + by^2 = 1$$

2nd Method : Let $p\frac{dy}{dx}$ in given equation

∴ $$x\left\{y\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^2\right\}=y\frac{dy}{dx}$$

then, we get

$$x\left\{y\frac{dp}{dx}+p^2\right\}=yp$$

or $$x\frac{d}{dx}(yp)=yp$$

or $$\frac{d(yp)}{yp}=\frac{dx}{x}$$

Now integrating it, we get

$$\log yp = \log x + \log c$$

or $$yp = xc$$

or $$y\frac{dy}{dx}=xc \quad \left[\because p=\frac{dy}{dx}\right]$$

or $$cx\,dx - y\,dy = 0$$

On integration, we get

$$\frac{cx^2}{2}-\frac{y^2}{2}=k \qquad \text{(say)}$$

or $$\left(\frac{c}{2k}\right)x^2\left(-\frac{1}{2k}\right)y^2=1$$

or $$ax^2+by^2=1\left[\text{Here } a=\frac{c}{2k} \text{ and } b=-\frac{1}{2k}\right]$$

73.(B) Here, it is given that

$$\frac{d^2y}{dx^2}-(a+b)\frac{dy}{dx}+aby=Q(x)$$

$\therefore$ Its auxiliary equation will be

$$D^2-(a+b)D+ab=0$$

or $\quad D^2-aD-bD+ab=0$

or $\quad D(D-a)-b(D-a)=0$

or $\quad (D-a)(D-b)=0$

$$\therefore \quad PI=\frac{1}{(D-a)(D-b)}Q(x)$$

$$=\frac{1}{(D-a)}\left[\frac{1}{(D-b)}Q(x)\right]$$

$$=\frac{1}{D-a}\left[e^{bx}\int Q(x)e^{-bx}dx\right]$$

$$=e^{ax}\int[e^{bx}\int Q(x)e^{-bx}\,dx]\,e^{-ax}\,dx$$

$$=e^{ax}\int[e^{(b-a)x}\int Q(x)e^{-bx}dx]dx$$

74.(C) **Here, Assertion (A) :** differential equation $\frac{d^2y}{dx^2}+x\frac{dy}{dx}+(x^2+5)y=e^x$ is linear equation of degree 2 is a true statement. But every first degree equation can not be a linear equation. So, Reason (R) is a false statement.

75.(D)

$$P.I.=\frac{1}{D^3+3D^2+2D}x^2$$

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

$$=\frac{1}{2D}\left(1-\frac{3}{2}D+\frac{7}{4}D^2+\ldots\right)x^2$$

$$=\frac{1}{2D}\left(x^2-\frac{3}{2}\cdot 2x+\frac{7}{4}\cdot 2\right)$$

$$=\frac{1}{2D}\left(x^2-3x+\frac{7}{2}\right)$$

$$= \frac{1}{2}\left(\frac{x^3}{3} - 3\cdot\frac{x^2}{2} + \frac{7}{2}x\right)$$

76.(D) The given equation can be written as

$$(D^2 + 2D + 10)\, y = -37 \sin 3x.$$

Its auxiliary equation is $m^2 + 2m + 10 = 0$, which gives

$$m = -1 \pm 3i.$$

$\therefore$ C.F. = $e^{-x}[C_1 \cos 3x + C_2 \sin 3x]$, where C_1 and C_2 are arbitrary constants , and

$$\text{P.I.} = \frac{1}{D^2 + 2D + 10}(-37 \sin 3x)$$

$$= -37.\frac{1}{-9 + 2D + 10}\sin 3x = -37\cdot\frac{1}{2D+1}\sin 3x$$

$$= -37.\frac{1}{(4D^2 - 1)}(2D - 1)\sin 3x$$

$$= -37\cdot\frac{1}{(-36 - 1)}(2D - 1)\sin 3x$$

$$= (2D - 1)\sin 3x = 6\cos 3x - \sin 3x.$$

Hence the required solution of the given differential equation is $y = e^{-x}(C_1 \cos 3x + C_2 \sin 3x) + 6 \cos 3x - \sin 3x$.

Differentiating both sides of (i) with respect to x, we get

$dy/dx = e^{-x}(-3C_1 \sin 3x + 3C_2 \cos 3x) - e^{-x}(C_1 \cos 3x + C_2 \sin 3x) - 18 \sin 3x - 3 \cos 3x.$ .... (i)

It is given that when x = 0, y = 3 and dy/dx = 0.

$\therefore$ From (i) and (ii) we have

$3 = C_1 + 6$ .... (iii)

and $0 = 3C_2 - C_1 - 3$ .... (iv)

$\therefore$ From (i), we have

$y = -3e^{-x} \cos 3x + 6 \cos 3x - \sin 3x$ .... (v)

$\therefore$ When $x = \pi/2$ we have from (v)

$$y = -3e^{-\pi/2}\cos\frac{3}{2}\pi + 6\cos\frac{3}{2}\pi - \sin\frac{3}{2}\pi = -3^{-\pi/2}.0 + 6.0 + 1$$

or $y = 1$.

77.(A) The surface in this example is a level surface for the function u = xyz. Since the gradient of u is normal to the level surface u = constant, therefore, at (1, –1, –2) we have

$$\text{grad } u = \mathbf{i}\frac{\partial u}{\partial x} + \mathbf{j}\frac{\partial u}{\partial y} + \mathbf{k}\frac{\partial u}{\partial z} = +\mathbf{i}yz + \mathbf{k}xz + \mathbf{k}xy = 2\mathbf{i} - 2\mathbf{j} - \mathbf{k}.$$

But this vector is directed along the unit normal n to u = xyz in the direction of increasing u.

$$\text{Hence } n = \frac{\text{grad}u}{|\text{grad}u|} = \frac{2\mathbf{i} - 2\mathbf{j} - \mathbf{k}}{|2\mathbf{i} - 2\mathbf{j} - \mathbf{k}|} = \pm\frac{1}{3}(2\mathbf{i} - 2\mathbf{j} - \mathbf{k}).$$

$\therefore$ the required unit normals are $\frac{1}{3}(2\mathbf{i} - 2\mathbf{j} - \mathbf{k})$ and $\frac{1}{3}(-2\mathbf{i} + 2\mathbf{j} + \mathbf{k})$.

78.(C) $\phi = xz$

$$\text{grad } \phi = \hat{i}\frac{\partial}{\partial x}(xz) + \hat{j}\frac{\partial}{\partial y}(xz) + \hat{k}\frac{\partial}{\partial x}(xz)$$

$$= \hat{i}z + x\hat{k}$$

79.(A) Let $\vec{u}$ is a unit vector along $\vec{A}$, given by

$$\vec{u} = \frac{\vec{A}}{|\vec{A}|} = \frac{1}{3}(2\hat{i} - 2\hat{j} + \hat{k}).$$

We know that

$$\vec{\nabla}\phi = \hat{i}\frac{\partial\phi}{\partial x} + \hat{j}\frac{\partial\phi}{\partial y} + \hat{k}\frac{\partial\phi}{\partial z}$$

$$= (2xy + z)\hat{i} + x^2\hat{j} + x\hat{k}$$

$\vec{\nabla}\phi$ at the point (1, 2, –1) $= 3\hat{i} + \hat{j} + \hat{k}$

directional derivative $\frac{d\phi}{ds}$, given by,

$$\frac{d\phi}{ds}\vec{\nabla}\phi\cdot\vec{u}=\left(3\hat{i}+\hat{j}+\hat{k}\right)\cdot\frac{1}{3}\left(2\hat{i}-2\hat{j}+\hat{k}\right) \qquad \text{at } (1, 2, -1)$$

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

80.(B) $3f(x)+2f\left(\frac{x+59}{x-1}\right)=10x+30$

For x = 7, 3f(7) + 2f(11) = 70 + 30 = 100

For x = 11, 3f(11) + 2f(7) = 140

$\therefore \frac{f(7)}{-20}=\frac{f(11)}{-220}=\frac{-1}{9-4}\Rightarrow f(7)=4$

81.(D) In all other groups,

Number at the end $=\frac{1}{2}\times$ (Sum of positions of first and last letters).

i.e. $\frac{1}{2}(D+H)\Rightarrow\frac{1}{2}(4+8)=6$

$\frac{1}{2}(U+O)\Rightarrow\frac{1}{2}(21+15)=18$

$\frac{1}{2}(X+P)\Rightarrow\frac{1}{2}(24+16)=20$

$\frac{1}{2}(Z+D)\Rightarrow\frac{1}{2}(26+4)=15$

But, $\frac{1}{2}(N+B)\Rightarrow\frac{1}{2}(14+2)=8\neq10$

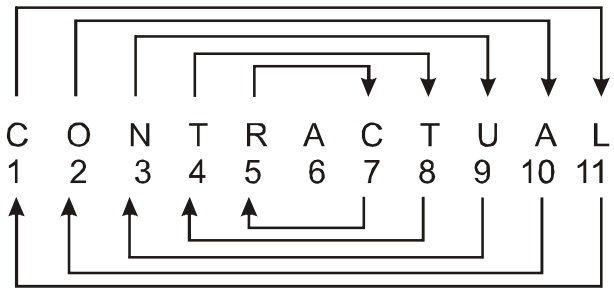
Therefore, NB10 is the odd one.

82.(B) The given sequence of number follows the pattern :

1	1	1	1	1	1	1	1	1
2	6	12	20	30	42	56	72	90
2×3	3×4	4×5	5×6	6×7	7×8	8×9	9×10	

Therefore, Missing fractions $= \frac{1}{42}, \frac{1}{56}, \frac{1}{72}$ and $\frac{1}{90}$

83.(B) The new arrangement of letters is as given below :

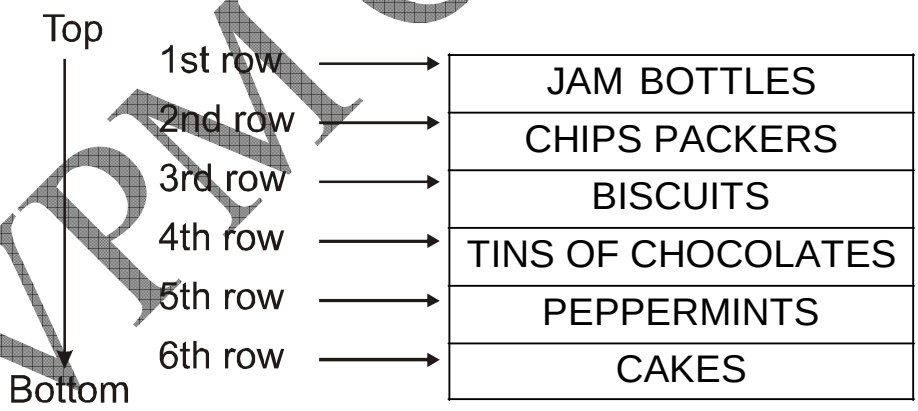


C O N T R A C T U A L On
1 2 3 4 5 6 7 8 9 10 11 Interchanging

L A U T C A R T N O C
11 10 9 8 7 6 5 4 3 2 1

So, new arrangement : LAUTCARTNOC.

Therefore, the third letter to the right of the sixth letter from the left end = (6 + 3) = 9th letter from the left end = 'N'.



84.(D)

Therefore, 'Peppermints' from the top = 5th

85.(D) The pattern is as follows :

1 2 3 4 5 6
B R E A K T H R O U G H $\xrightarrow{\text{coded}}$ E A O U H R B R G H K T 2 5 4 1 6 3

Similarly,

1 2 3 4 5 6
D I S T R I B U T I O N $\xrightarrow{\text{coded}}$ S T T I B U D I O N R I 2 5 4 1 6 3

86.(D) The colour of clear sky ⇒ 'Blue'.

But according to the question

'Pink' ⇒ 'Blue'.

Therefore, the colour of clear sky ⇒ 'Pink'.

[Note : Do not opt for 'White' because 'Blue' means 'White' implies that 'White' is called 'Blue'.]

87.(D) Using the mathematical signs given in (d), we get the given equation as

$45 \div 5 + 9 \div 3 - 2 \times 6 = 0$

Using BODMAS RULE, we get

$9 + 3 - 2 \times 6 = 0$

or, $9 + 3 - 12 = 0$

or, $12 - 12 = 0$

or, $0 = 0$, which is true

Therefore, the correct answer is (D)

88.(D) Let the weight of free luggage = y kg.

Then Digvijay has x kg and Sankalp's has 2x kg extra luggage.

Then, the weight of Digvijay's luggage = (y + x) kg

The weight of Sankalp's luggage = (y + 2x)kg

Now, according to the question,

$(y + x) + (y + 2x) = 60$ ... (i)

If 3x extra luggage cost Rs. 3600 then Rs. 5400 will be cost of

$$\left(\frac{5400}{3600} \times 3x\right) = \frac{9}{2}x$$

Free luggage + Total extra luggage $= \frac{9}{2}x$

$$y + (2x + x) = \frac{9}{2}x$$

or $$y + 3x + \frac{9}{2}x$$

or, $$y = \frac{3}{2}x \quad \text{... (ii)}$$

Put the value of y from (ii) in (i), we get

$$2 \times \frac{3}{2} + 3x = 60$$

or, x = 10 kg

So, $y = \frac{3}{2}x = \frac{3}{2} \times 10 = 15\,\text{kg}$

Therefore, the weight of Sankalp's luggage

= (y + 2x)kg = (15 + 2 × 10) kg = 35 kg.

89.(D) If the size of the bacteria doubles each day, then the dish must be half full one day before it is full i.e.

(50 days– 1 day) = 49 days.

Therefore, the dish will be half full in 49 days.

Important Note : Don't choose the option (c) blindly i.e. 25 days, as it gives half the time it takes to fill the dish, not the time when the dish is half full.

In case, when the dish was one-quarter full, then our answer would have been 48 days i.e (50 days–2 days).

[48 days : One-quarter full i.e. $\frac{1}{4}$ the full; 49 days : $\left(\frac{1}{4}\times 2\right)$ full i.e. $\frac{1}{2}$th full (hallfull; 50 days : $\left(\frac{1}{2}\times 2\right)$ full i.e. completely full].

90.(D) The pressure of a given mass of a gas is directly proportional to its absolute temperature. Therefore in summers the atmospheric temperature is much higher as compared to winter. Consequently, the same volume of air will exert greater pressure in summer than in winter.Therefore, it is advisable in order to avoid burst.

91.(C) According to the question, initially he is at the centre O. His Journey is as shown in Fig

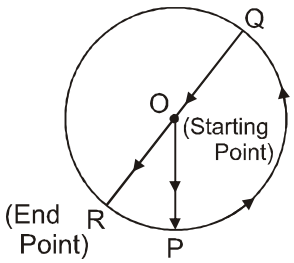
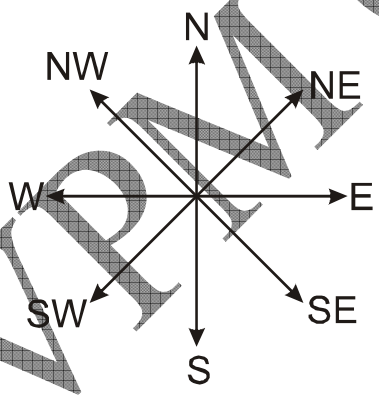


Fig:

The movements are from O to P, P to q and Q t R.

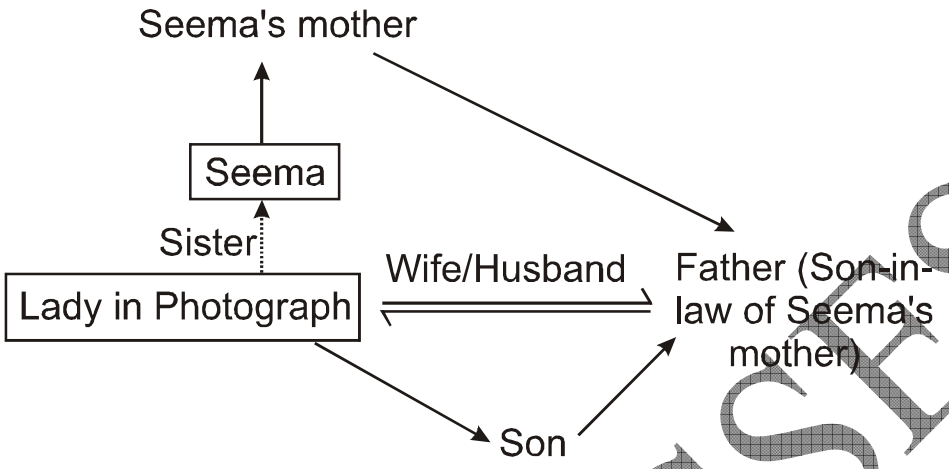
Starting Point = O End Point = R



Basic direction diagram

Therefore, R clearly lies to the South-west of O.

92.(A) The Blood relationship tree/chart can be constructed as given below :



Therefore, 'Seema' is the sister of the 'lady in photograph'.

93.(C) By analysing the given information, we get

[redacted]

By analysing the above table, it is clear that statement in option (C) is true.

94.(C) $\frac{30}{S_B - S_S} + \frac{44}{S_B + S_S} = 10$ also

$$\frac{40}{S_B - S_S} + \frac{55}{S_B + S_S} = 13$$

let $\frac{1}{S_B - S_T} = x$ and $\frac{1}{S_B + S_S} = y$,

then

$30x + 44y = 10$ ...(i)

$40x + 55y = 13$ ...(ii)

By solving we get

$S_B = 8$ km/hr.

95.(A) Rs. 600 for 2 years = Rs. 1200 for 1 year

and Rs. 150 for 4 years = Rs. 600 for 1 year

∴ Total principal = Rs. 1800 for 1 year

Interest = Rs. 90

∴ Rate of interest $= \frac{90 \times 100}{1800 \times 1} = 5\%$

96.(A) A and B did the work for 35 days to complete it. A can complete the work in 60 days.

So, $\frac{\text{A did}}{\text{A can}} + \frac{\text{B did}}{\text{B can}} = 1$

∴ $\frac{35}{60} + \frac{35}{x} = 1$

or $x = 84$ days.

97.(D) The given series decrements by 15,20,25,30,35 and so on. Therefore the next number will be 85.

98.(D) $(2)^2 + 1 = 5$

$(5)^2 + 1 = 26$

$(26)^2 + 1 = 677$

$(677)^2 + 1 = 458330$

99.(D) Series starting from

$2^8, 2^9, 2^{10}, \ldots\ldots 2^{13}$

100.(B) Most of the students say the answer to be 10% as 200 or we can say students find the P% on the selling price but

$$P\% = \frac{\text{Profit}}{\text{CP}} \times 100$$

So, Cost price = SP – Profit

= 200 – 20 = 180

$\therefore$ P% $= \frac{20}{180} \times 100$ i.e. $11\frac{1}{9}\%$

101.(D) c = a % b ;

c = 5 % 2 = 2.5

Mismatching of " 2.5 " float value & format specifier for 'c' variable i. e. '% f'.

102.(C) 32 = 2^5 ; 1 kbyte = 2^{10} ; So 10 + 5 = 15 bits are needed.

103.(C) Hence the BCD Coding for the word DIGIT in octal notation will be

D I G I T

64 71 67 71 23

So the value of G in reference of word Digit is 67.

104.(B) Character constants are stored in memory as their ASCII values respectively. Therefore, ch = 'z' will store the ASCII value of z.

105.(D) $(73)_{10} = (?)_2$

2	73	
2	36	1
2	18	0
2	9	0
2	4	1
2	2	0
	1	0
		1

Thus $(73)_{10} = (1001001)_2$

106.(D) It is easy to prove AND and OR are both commutative and associative.

Also

$$x \oplus y = y \oplus x \text{ and } x \oplus (y \oplus z) = (x \oplus y) \oplus z$$
$$= xyz + x\overline{yz} + \overline{x}y\overline{z} + \overline{x}\,\overline{y}z$$

But NAND ($\uparrow$) is commutative but not associative.

clearly $x \uparrow y = y \uparrow x$ and

$x \uparrow (y \uparrow z) = \overline{x} + yz$

$(x \uparrow y) \uparrow z = xy + \overline{z}$

107.(A)

$$y = \overline{A}.\overline{B}.\overline{C}.(\overline{D} + D) + A.\overline{B}.\overline{C}.(\overline{D} + D)$$
$$= \overline{A}.\overline{B}.\overline{C}.(1) + \overline{A}.\overline{B}.\overline{C}.(1)$$
$$= \overline{A}.\overline{B}.\overline{C}. + A.\overline{B}.\overline{C}.$$
$$= (\overline{A} + A).\overline{B}.\overline{C}$$
$$= \overline{B}.\overline{C}$$

108.(A) $42_{(10)} = \frac{0100}{4}\frac{0010}{2}$

or 01000010 in BCD

109.(D) ∴ Data dictionary contains details of data structures, data & data stores

∴ actigram represents processor activities, methods & procedures in DFD.

∴ Primary tool used in structured design is structure chart.

∴ Data flow diagram is the graphical representation of information system

110.(D)

```
   9999.99
 – 2059.84
 ---------
   7940.15
```

111.(B) p = 51 (00110011)

00110011

p<<2 110011 $\boxed{00}$ = (204)

↑ filled state

112.(C) No output will be printed as else part is missing so, nothing will be printed as the condition goes wrong.

113.(B) $AB + \overline{AC} + A\bar{B}C(AB + C)$

$= AB + \overline{AC} + A\bar{B}C\,AB + A\bar{B}C\,C$

$= AB + \overline{AC} + AA\,B\bar{B}\,C + A\,\bar{B}\,C\,C$ $\quad (B\bar{B} = 0)$

$= AB + \overline{AC} + A\bar{B}C$ $\quad$ (CC = C)

$= AB + \bar{A} + \bar{C} + A\bar{B}C$ $\quad (\overline{AC} = \bar{A} + \bar{C})$

$= \bar{A} + AB + \bar{C} + A\bar{B}C$

$= \bar{A} + B + \bar{C} + A\bar{B}C$ $\quad$ (rearranging the terms)

$= \bar{A} + \bar{C} + B + A\bar{B}C$

$= \bar{A} + \bar{C} + B + \bar{B}AC$

$= \bar{A} + \bar{C} + B + AC$ $\quad B + \bar{B}AC = B + AC$ $\quad$ (because $X + \bar{X}Y = X + Y$)

$= \bar{A} + B + \bar{C} + A$ $\quad (\bar{C} + CA = \bar{C}A)$

$= \bar{A} + B + \bar{C} + A$

$= A + \bar{A} + B + \bar{C}$

$= 1 + B + \bar{C}$

$= 1$

114.(C) $7 = 111_2$

```
   111
 × 111
 -----
   111
  111
 111
 ------
 110001
```

115.(A) 9 is the 1st digit from the right; its weight is 9×16^0

A is the 2nd digit from the right; its weight is $A \times 16^1$

5 is the 3rd digit from right, its weight is 5×16^2

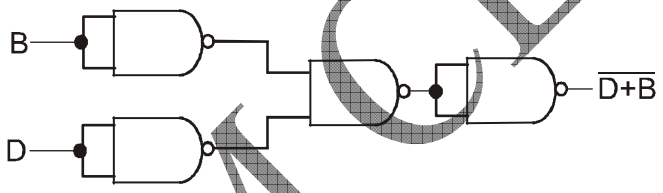
$$5A9 \text{ (hex)} = 5 \times 16^2 + A \times 16^1 + 9 \times 16^0$$
$$= 5 \times 256 + 10 \times 16 + 9$$
$$= 1280 + 160 + 9 = \mathbf{1449 \text{ (decimal)}}.$$

116.(C)

DE \ ABC	000	001	011	010	110	111	101	100
00								
01			1	1	1	X		
11			1	1	X	1		
10	1	1					X	1

The terms A'BE corresponds to A' – 0; B – 1; E – 1; C – 0 or 1; D – 0 or 1. Similarly marks all 1's and get the Karnaugh map as above. The 1's can be covered in the optimal way, if the slots marked X are set to 1's. So the three X's in the position ABCD'E, ABC'DE, AB'CDE' are then don't care conditions to be set to 1 and used. Hence the answer is (c).

117.(C) 4 NAND is required to made a NOR



118.(B) $Z = \overline{(\overline{AB})(\overline{CD})(\overline{EF})} = AB + CD + EF$

119.(D) The given 'c' fragment outputs the value of variable 'a' .

As in printf ( ) , value of 'b' variable get assigned to 'a' variable i.e. 'a' becomes '20' then it will be pointed on the screen i.e. 20.

120.(C) y = 3 * (x + +)

y = 3 * (10 + +) = 3 * 10

y = 30

then x = 11

z = 3 * (+ + x)

z = 3 * (+ + 11)

z = 3 * 12

z = 36

so, x = 12 , y = 30 , z = 36.