MATHEMATICS

1. Which of the following is correct ?
   (A) A L.P.P always has unique solution
   (B) Every L.P.P has an optimal solution
   (C) A L.P.P admits two optimal solutions
   (D) If a L.P.P admits two optimal solutions then it has infinitely many optimal solutions

2. Mean marks scored by the students of a class is 53. The mean marks of the girls is 55 and the mean marks of the boys is 50. What is the percentage of girls in the school ?

   (A) 60 (B) 50
   (C) 45 (D) 40

3. Let Q be the set of all rational numbers. Define an operation X on $Q-\{-1\}$ by $a * b = a + b + ab$. Then identity element of $*$ on X on $Q-\{-1\}$ is

   (A) – 1 (B) 1
   (C) 2 (D) 0

4. Let $f(x)=\begin{cases} x-[x], & x<2 \\ 2x-3, & x\geq 2 \end{cases}$, where $[x]$ denotes the greatest integer function.

   Then $\lim\limits_{x\to 2} f(x)$ is equal to

   (A) 2 (B) 1
   (C) 0 (D) none of these

5. If $I=\int \frac{\cos x-\sin x}{\sqrt{\cos x \sin x}}\,dx$, then I equals

   (A) $\sqrt{2}\log\left(\sqrt{\tan x}-\sqrt{\cot x}\right)+C$

   (B) $\sqrt{2}\log\left|\sin x+\cos x+\sqrt{\sin 2x}\right|+C$

   (C) $\sqrt{2}\log\left|\sin x-\cos x+\sqrt{2}\sin x\cos x\right|+C$

   (D) $\sqrt{2}\log\left|\sin\left(x+\pi/4\right)+\sqrt{2}\sin x\cos x\right|+C$

6. The solution set of the equation $\begin{vmatrix} 5 & 3 & -1 \\ -7 & x & 2 \\ 9 & 6 & -2 \end{vmatrix} = 0$ is

(A) $\{0\}$ (B) $\{6\}$

(C) $\{-6\}$ (D) $\{0, 9\}$

7. If $A = \begin{bmatrix} 3 & -4 \\ -1 & 2 \end{bmatrix}$ and B is a square matrix of order 2 such that AB=I, then B is equal to

(A) $\begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$ (B) $\begin{bmatrix} 1 & \frac{1}{2} \\ 2 & \frac{2}{3} \end{bmatrix}$

(C) $\begin{bmatrix} \frac{3}{2} & \frac{1}{2} \\ 1 & 2 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & 2 \\ \frac{1}{2} & \frac{3}{2} \end{bmatrix}$

8. **Satement 1:** If the perpendicular bisector of the line segment joining $P(1, 4)$ and Q (K, 4) has y-intercept -4, then $K^2 - 16 = 0$

Statement 2: Locus of a point equidistant from two given points is the perpendicular bisector of the line joining the given points

(A) Statement 1 is true, Statement 2 is true; Statement 2 is a correct explanation for Statement 1

(B) Statement 1 is true, Statement 2 is true; Statement 2 is not a correct explanation for Statement 1

(C) Statement 1 is true, Statement 2 is false

(D) Statement 1 is false, Statement 2 is true

9. $\cot^{-1}(9) + \operatorname{cosec}^{-1}\left(\frac{\sqrt{41}}{4}\right)$ is equal to

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$

(C) $\frac{\pi}{3}$ (D) $\frac{3\pi}{4}$

10. First term of a G.P of n terms is 'a' and the last term is 'l'. Then the product of all terms is

(A) $\frac{n}{2}(a+l)$ (B) $(a+l)^{\frac{n}{2}}$

(C) $(al)^{\frac{n}{2}}$ (D) $(al)^{n}$

11. $\lim_{x \to 0} \frac{8^x - 2^x}{x}$ is equal to

(A) log 2 (B) 2^{3x}

(C) log 4 (D) log 8

12. If $\vec{a}$ and $\vec{b}$ are two unit vectors, then the value of $(\vec{a}+\vec{b}).(\vec{a}-\vec{b})$ is equal to

(A) 0 (B) 1

(C) 2 (D) none of these

13. If A and B are two independent events, then P $(\overline{A}/\overline{B})$ is equal to

(A) 1 – P(A) (B) 1 – P (B)

(C) 1 – P $(\overline{A}/B)$ (D) 1 – P $(A/\overline{B})$

14. x-axis is the intersection of the two planes

(A) xy and yz (B) yz and zx

(C) xy and zx (D) none of these

15. $\begin{vmatrix} \frac{1}{a} & a^2 & bc \\ \frac{1}{b} & b^2 & ac \\ \frac{1}{c} & c^2 & ab \end{vmatrix}$ is equal to

(A) 1 (B) 0

(C) –1 (D) abc

16. $\int \sqrt{a^2 - x^2}\,dx$ is equal to

(A) $\dfrac{x\sqrt{a^2+x^2}}{2}+\dfrac{a^2}{2}\sin^{-1}\left(\dfrac{x}{a}\right)+C$

(B) $\dfrac{x\sqrt{a^2-x^2}}{2}-\dfrac{a^2}{2}\sin^{-1}\left(\dfrac{x}{a}\right)+C$

(C) $\dfrac{x\sqrt{a^2-x^2}}{2}+\dfrac{a^2}{2}\log\left(x+\sqrt{a^2-x^2}\right)+C$

(D) $\dfrac{x\sqrt{a^2-x^2}}{2}+\dfrac{a^2}{2}\sin^{-1}\left(\dfrac{x}{a}\right)+C$

17. The minimum value of P = $6x + 16y$ subject to the constraints $x \leq 40$, $y \geq 20$, $x, y \geq 0$ is

(A) 240 (B) 320
(C) 0 (D) 560

18. If the variance of α, β, γ is 9, then the variance of 5α, 5β and 5γ is

(A) $\dfrac{5}{4}$ (B) $\dfrac{9}{5}$
(C) 225 (D) 45

19. $\sin\left[\dfrac{1}{2}\sin^{-1}\left(\dfrac{4}{5}\right)\right]$ is equal to

(A) $\dfrac{1}{\sqrt{5}}$ (B) $\dfrac{2}{\sqrt{5}}$
(C) $\dfrac{1}{\sqrt{10}}$ (D) $\dfrac{2}{\sqrt{10}}$

20. The point of discontinuity of the function f defined by

$$f(x) = \begin{cases} x+2, & \text{if } x<1 \\ 0, & \text{if } x=1 \\ x-2, & \text{if } x>1 \end{cases}$$ is

(A) 0 (B) 1
(C) -1 (D) $\mathrm{R}-\{1\}$

21. The equation of a circle which touches the x-axis and whose centre is (3,4) is

(A) $x^2 + y^2 + 3x + 4y = 16$ (B) $x^2 + y^2 - 6x - 8y + 9 = 0$
(C) $x^2 + y^2 + 8x + 10y + 25 = 0$ (D) $x^2 + y^2 - 9x - 16y + 25 = 0$

22. If A = {1, 2, 3, 4, 5} and B = {2, 3, 6, 7}, then number of elements of $(A \times B) \cap (B \times A)$ is equal to

(A) 5 (B) 4

(C) 10 (D) 20

23. $A = \begin{bmatrix} 2x & 0 \\ x & x \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1 & 0 \\ -1 & 2 \end{bmatrix}$, then x is equal to

(A) 1 (B) 2

(C) $\frac{1}{2}$ (D) -2

24. The anti derivative F of f defined by $f(x) = 4x^3 - 6$, where $F(0) = 3$ is

(A) $x^4 - 6x + 3$ (B) $12x^2$

(C) $x^4 - 6x$ (D) $x^4 - 6x - 3$

25. The line through the points $(-2, 6)$ and $(4, 8)$ is perpendicular to the line through the points $(8, 12)$ and $(x, 24)$, then the value of x is

(A) 28 (B) 6

(C) 4 (D) 3

26. If A is a singular matrix, then A.(adjA) is equal to

(A) a null matrix (B) a unit matrix

(C) a scalar matrix (D) none of these

27. Two cards are drawn from a pack of 52 cards. The probability of being queens is

(A) $\frac{1}{26}$ (B) $\frac{1}{2}$

(C) $\frac{1}{221}$ (D) none of these

28. $\frac{d}{dx} \log \tan \left(\frac{\pi}{4} + \frac{x}{2} \right)$ is equal to

(A) $\sec x$ (B) $\operatorname{cosec} x$

(C) $\tan x$ (D) $\cot x$

29. The general solution of the differential equation $\frac{dy}{dx} = e^{x-y}$ is

(A) $y = xC$ (B) $e^y = e^x + C$

(C) $e^{x-y} = C$ (D) none of these

30. The arithmetic mean of values 0, 2, 4 ....2n is

(A) n (B) n + 1

(C) 2n (D) 2 (n +1)

31. If A and B are square matrices of order 4 such that $|A| = -1$ and $|B| = 3$, then $|3AB|$ is equal to

(A) – 243 (B) – 81

(C) 243 (D) 81

32. Let $f(x) = \begin{cases} x+2, & -1 \le x < 0 \\ 1, & x = 0 \\ \frac{x}{2}, & 0 < x \le 1 \end{cases}$. Then on $[-1,1]$ this function has

(A) a minimum (B) a maximum

(C) a maximum and a minimum (D) neither maximum nor minimum

33. The value of x for which the angle between the vectors $\vec{a} = x\hat{i} - 3\hat{j} - \hat{k}$ and $\vec{b} = 2x\hat{i} + x\hat{j} - \hat{k}$ is acute, and the angle between the vector $\vec{b}$ and the axis of ordinate is obtuse, are

(A) for all $x > 0$ (B) for all $x < 0$

(C) 1, – 1 (D) 2, – 2

34. The value of the expression $1 - \frac{\sin^2 y}{1+\cos y} + \frac{1+\cos y}{\sin y} - \frac{\sin y}{1-\cos y}$ is

(A) 0 (B) 1

(C) $\sin y$ (D) $\cos y$

35. If $f(x) = x^2$, $g(x) = \tan x$ and $h(x) = \log x$, then $ho\,(gof)\left(\sqrt{\frac{\pi}{4}}\right)$ is equal to

(A) 0 (B) 1

(C) $\frac{1}{2}$ (D) $\frac{1}{2}\log\frac{\pi}{4}$

36. The value of θ and p, if the equation $x\cos\theta + y\sin\theta = p$ is the normal form of the line $\sqrt{3}\,x + y + 2 = 0$ are

(A) $\theta = \frac{\pi}{6}, p = -1$ (B) $\theta = \frac{\pi}{6}, p = 1$

(C) $\theta = \frac{7\pi}{6}, p = 2$ (D) $\theta = \frac{7\pi}{6}, p = 1$

37. **Statement 1**: $f(x) = e^{-|x|}$ is differentiable for all x

Statement 2: $f(x) = e^{-|x|}$ is continuous for all x

(A) Statement 1 is true, Statement 2 is true; Statement 2 is a correct explanation for Statement 1

(B) Statement 1 is true, Statement 2 is true; Statement 2 is not a correct explanation for Statement 1

(C) Statement 1 is true, Statement 2 is false

(D) Statement 1 is false, Statement 2 is true

38. If $n \in \mathrm{N}$ then $3.5^{2n+1} + 2^{3n+1}$ is divisible by

(A) 24 (B) 19

(C) 17 (D) 13

39. If A and B are two square matrices such that AB=A and BA=B, then A^2 is equal to

(A) B (B) A

(C) I (D) 0

40. $\lim_{x \to 0} f(x)$, where $f(x) = \begin{cases} \dfrac{x}{|x|}, & x \neq 0 \\ 0, & x = 0 \end{cases}$

(A) is 0 (B) is 1

(C) is –1 (D) does not exist

41. If $k = e^{2007}$, then value of $I = \int_1^k \frac{\pi \cos(\pi \log x)}{x} dx$ is

(A) 0 (B) $-\pi$

(C) $\frac{\pi}{e}$ (D) 2007π

42. If one of the roots of the equation $x^2 = px + q$ is the reciprocal of the other, then the correct relationship is

(A) $pq = -1$ (B) $q = -1$

(C) $q = 1$ (D) $pq = 1$

43. Q^+ is set of all positive rational numbers and '$\sqcup$' is a binary operation on Q^+ defined by $a \sqcup b = \dfrac{ab}{2}\ \forall\ a, b \in Q^+$. Then the inverse of $a \in Q^+$ is equal to

(A) $\dfrac{2}{a}$ (B) $\dfrac{4}{a}$

(C) 2 (D) $\dfrac{1}{a}$

44. If $A = \begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$, then $(A - 2I)(A - 3I)$ is equal to

(A) A (B) I

(C) O (D) 5I

Paragraph for question numbers 45, 46, 47, 48, 49 and 50

Consider the point P(2, 3, – 4) and the vector $\vec{b} = 2\hat{i} - \hat{j} + 2\hat{k}$

45. Vector equation of a line L passing through the point P and parallel to $\vec{b}$ is

(A) $\vec{r} = \left(2\hat{i} + 3\hat{j} - 4\hat{k}\right) + \lambda\left(2\hat{i} - \hat{j} + 2\hat{k}\right)$

(B) $\vec{r} = \left(2\hat{i} - \hat{j} + 2\hat{k}\right) + \lambda\left(2\hat{i} + 3\hat{j} - 4\hat{k}\right)$

(C) $\vec{r} = \left(4\hat{i} + 2\hat{j} - 2\hat{k}\right) + \lambda\left(2\hat{i} - \hat{j} + 2\hat{k}\right)$

(D) none of these

46. Cartesian equation of the plane passing through the point P and perpendicular to the vector $\vec{b}$ is

(A) $2x - y + 2z = 7$ (B) $2x + 3y - 4z = -7$

(C) $2x - y + 2z = -7$ (D) $2x + 3y - 4z = 7$

47. Cartesian equation of a plane π passing through the point with position vector $\vec{b}$ and perpendicular to the vector $\overline{OP}$, O being origin is

(A) $2x - y + 2z + 7 = 0$ (B) $2x - y + 2z - 7 = 0$

(C) $2x + 3y - 4z + 7 = 0$ (D) $2x + 3y - 4z - 7 = 0$

48. Sum of the lengths of the intercepts made by the plane π on the coordinate axes is

(A) 14 (B) 91/12

(C) 9/7 (D) 5/7

49. The equation of a plane passing through point P, perpendicular to the plane π and parallel to the line L is

(A) $x - 4y + 6z = 0$ (B) $x - 6y - 4z = 0$

(C) $2x - 3y + z = 3$ (D) $3x - 2y + 5z = 6$

50. The angle between the plane π and the line L is

(A) $\sin^{-1}\left(\frac{-7}{3\sqrt{29}}\right)$ (B) $\sin^{-1}\left(\frac{7}{\sqrt{29}}\right)$

(C) $\cos^{-1}\left(\frac{-3}{\sqrt{29}}\right)$ (D) $\cos^{-1}\left(\frac{3}{\sqrt{29}}\right)$

51. Let 'S' be the set of real numbers and R be a relation on S defined by $aRb \Leftrightarrow a^2 + b^2 = 1$. Then R is

(A) equivalence relation

(B) reflexive but neither symmetric nor transitive

(C) transitive but neither reflexive nor symmetric

(D) symmetric but neither reflexive nor transitive

52. If A is a 3-rowed square matrix and $|A| = 4$, then adj (adj A) is equal to

(A) 4 A (B) 16 A

(C) 64 A (D) -4 A

53. If a line makes angle $90°$, $60°$ and $30°$ with the positive X,Y and Z-axes respectively, its direction cosines are

(A) $1, \frac{\sqrt{3}}{2}, \frac{1}{2}$ (B) $0, \frac{1}{2}, \frac{\sqrt{3}}{2}$

(C) undefined, $\sqrt{3}, \frac{1}{\sqrt{3}}$ (D) none of these

54. Three dice are thrown together. The probability of getting a total of atleast 6 is

(A) $\frac{103}{108}$ (B) $\frac{10}{216}$

(C) $\frac{93}{108}$ (D) $\frac{91}{108}$

55. The locus of the points which are equidistant from $(-a, 0)$ and the line $x = a$ is

(A) $y^2 = 4ax$

(B) $y^2 = -4ax$

(C) $x^2 + y^2 = a^2$

(D) $(x-a)^2 + (y+a)^2 = 0$

56. $\int \sin^3 x \cos^2 x \, dx$ is equal to

(A) $\frac{\sin^5 x}{5} - \frac{\sin^3 x}{3} + C$

(B) $\frac{\cos^4 x}{4} - \frac{\sin^4 x}{4} + C$

(C) $\frac{\cos^5 x}{5} - \frac{\cos^3 x}{3} + C$

(D) none of these

57. If the mean and variance of a binomial distribution are 2 and $\frac{4}{3}$, then the value of P(X=0) is

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

(B) $\frac{1}{729}$

(C) $\frac{8}{2728}$

(D) $\frac{64}{729}$

58. The number of proper subsets of the set $\{1, 2, 3\}$ is

(A) 8

(B) 6

(C) 7

(D) 5

59. The line $\frac{x-2}{3} = \frac{y-2}{4} = \frac{z-4}{5}$ is parallel to the plane

(A) $2x + y - 2z = 0$

(B) $3x + 4y + 5z = 7$

(C) $x + y + z = 2$

(D) $2x + 3y + 4z = 0$

60. If $f(2) = 4$ and $f'(2) = 1$, then $\lim_{x \to 2} \frac{xf(2) - 2f(x)}{x-2}$ is equal to

(A) 2

(B) -2

(C) 1

(D) 3

61. The value of sin 20° sin 40° sin 60° sin 80° is equal to

(A) $\frac{5}{16}$ (B) $\frac{-5}{16}$

(C) $\frac{3}{16}$ (D) $\frac{3}{8}$

62. $\sin^{-1}\left[\cos\left(\sin^{-1}x\right)\right] + \cos^{-1}\left[\sin\left(\cos^{-1}x\right)\right]$ is equal to

(A) 0 (B) $\pi/4$

(C) $\pi/2$ (D) $3\pi/4$

63. The real value of α for which the expression $\frac{1-i\sin\alpha}{1+2i\sin\alpha}$ is purely real is

(A) $(n+1)\frac{\pi}{2}, n \in Z$ (B) $(2n+1)\frac{\pi}{2}, n \in Z$

(C) $n\pi, n \in Z$ (D) none of these

64. If $y = \cos^{-1} x$, then $\frac{d^2y}{dx^2}$ is equal to

(A) $\cos y \sin y$ (B) $-\operatorname{cosec} y \cot y$

(C) $-\operatorname{cosec}^2 y \cot y$ (D) none of these

65. The value of $\left[\vec{a}-\vec{b}\ \ \vec{b}-\vec{c}\ \ \vec{c}-\vec{a}\right]$ is

(A) 3 (B) 2

(C) 1 (D) 0

66. If the points (3, – 2) , B(k, 2) and C(8, 8) are collinear, then k is equal to

(A) 2 (B) – 3

(C) 5 (D) – 4

67. The value of $\tan 15° + \cot 15°$ is

(A) $\sqrt{3}$ (B) $2\sqrt{3}$

(C) 4 (D) not defined

68. A die is rolled twice and the sum of the numbers appearing is observed to be 7. The conditional probability that the number 2 has appeared atleast once is

(A) $\frac{2}{3}$ (B) $\frac{1}{6}$

(C) $\frac{1}{8}$ (D) $\frac{1}{3}$

69. The statement "if x is divisible by 8, then it is divisible by 6" is false if x equals

(A) 6 (B) 14

(C) 32 (D) 48

70. A vector $\vec{a}$ can be written as

(A) $(\vec{a}.\hat{i})\hat{i}+(\vec{a}.\hat{j})\hat{j}+(\vec{a}.\hat{k})\hat{k}$ (B) $(\vec{a}.\hat{j})\hat{i}+(\vec{a}.\hat{k})\hat{j}+(\vec{a}.\hat{i})\hat{k}$

(C) $(\vec{a}.\hat{k})\hat{i}+(\vec{a}.\hat{i})\hat{j}+(\vec{a}.\hat{j})\hat{k}$ (D) $(\vec{a}.\vec{a})(\hat{i}+\hat{j}+\hat{k})$

71. If A and B are two sets of the universal set 'U', then (A – B) equals

(A) $A \cap B^C$ (B) $A^C \cap B$

(C) $A \cap B$ (D) U – A

72. The probability of the safe arrival of one ship out of 5 is $\frac{1}{5}$. What is the probability of the safe arrival of atleast 3 ships out of 5 ?

(A) $\frac{181}{3125}$ (B) $\frac{183}{3125}$

(C) $\frac{185}{3125}$ (D) $\frac{184}{3125}$

73. The foci of the ellipse $9x^2 + 4y^2 = 36$ are

(A) (–5, 0) (B) $(\pm\sqrt{5},0)$

(C) $(0,\pm\sqrt{5})$ (D) (0, –5)

74. Area between the curve $y = x(x-4)$ and the x-axis from $x = 0$ to $x = 5$ is

(A) $\frac{25}{3}$ sq units (B) 13 sq units

(C) $\frac{20}{3}$ sq units (D) none of these

75. Range of the function $f(x) = \begin{cases} \frac{|x|}{x}, & \text{when } x \neq 0 \\ 0, & \text{when } x = 0 \end{cases}$ is

(A) R (B) $\{-1, 0, 1\}$

(C) $[-1, 1]$ (D) $R - \{0\}$

76. The number of integral solutions of $\frac{x+2}{x^2+1} > \frac{1}{2}$ is

(A) 0 (B) 1

(C) 5 (D) 3

77. If $(3!)! = k(n!)$ then $(n + k)$ equals

(A) 123 (B) 120

(C) 6 (D) 9

78. Order of the differential equation whose solution $y = ae^x + be^{2x} + ce^{-x}$ (where a, b, c are arbitrary constants) is

(A) 1 (B) 2

(C) 3 (D) 4

79. If $3 \sin \alpha = 5 \sin \beta$, then $\dfrac{\tan\left(\frac{\alpha+\beta}{2}\right)}{\tan\left(\frac{\alpha-\beta}{2}\right)}$ is equal to

(A) 14 (B) 2

(C) 4 (D) 1

80. If $f(x) = e^{\sqrt{x^2-1}} \log_e(x-1)$, then dom f is equal to

(A) $(-\infty, 1]$ (B) $[-1, \infty)$

(C) $(1, \infty)$ (D) $(-\infty, -1] \cup (1, \infty)$

81. The slope of normal to the curve $y = 2x^2 + 3\sin x$ at $x = 0$ is

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

(C) -3 (D) $-\frac{1}{3}$

82. The locus of a point such that the difference of its distances from (4, 0) and (−4, 0) is always equal to 2 is the curve

(A) $15x^2 - y^2 = 15$ (B) $y^2 - 15x^2 = 15$

(C) $15x^2 + y^2 = 15$ (D) $16y^2 = -4x + 2$

83. If $\omega = \frac{-1+\sqrt{3}i}{2}$, then $(3+\omega+\omega^2)^4$ is equal to

(A) 16 (B) -16

(C) $16\,\omega$ (D) $16\,\omega^2$

84. Two cards are drawn from a well shuffled deck of 52 cards one after the other without replacement. The probability of first card being a spade and the second a black king is

(A) $\frac{1}{104}$ (B) $\frac{25}{2652}$

(C) $\frac{3}{104}$ (D) $\frac{26}{2652}$

85. The total number of terms in the expansion of $(x+y)^{100}+(x-y)^{100}$ after simplification is

(A) 50 (B) 101

(C) 202 (D) 51

86. Let $f(x) = \sin x$, $g(x) = x^2$ and $h(x) = \log x$. If $u(x) = h(f(g(x)))$ then $\frac{d^2u}{dx^2}$ is

(A) $2\cos^3 x$ (B) $2\cot x^2 - 4x^2 \operatorname{cosec}^2 x^2$

(C) $2x\cot x^2$ (D) $-2\operatorname{cosec}^2 x$

87. If $\int_0^{x^2(1+x)} f(t)\,dt = x$, then $f(2)$ is equal to

(A) 1/3 (B) 1/4

(C) 1 (D) 1/5

88. The number of ways in which a student can choose 5 courses out of 9 courses in which 2 courses are compulsory is

(A) 35 (B) 25

(C) 45 (D) 95

89. The maximum number of points of intersection of 8 straight lines is

(A) 8 (B) 16

(C) 28 (D) 56

90. There are two boxes. One box contains 3 white and 2 black balls. The other box contains 7 yellow balls and 3 black balls. If a box is selected at random and from it a ball is drawn, the probability that the ball drawn is black is

(A) $\frac{1}{3}$ (B) $\frac{1}{5}$

(C) $\frac{3}{20}$ (D) $\frac{7}{20}$

91. The function $f(x) = a^x$ is increasing on R if

(A) $0 < a < 1$ (B) $a > 1$

(C) $a < 1$ (D) $a > 0$

92. The integrating factor of $\frac{dy}{dx} + y \cot x = \cos x$ is

(A) $\cos x$ (B) $\tan x$

(C) $\cot x$ (D) $\sin x$

93. The greatest coefficient in the expansion of $(1 + x)^{2n+2}$, $n \in$ N is

(A) $\frac{(2n)!}{n!}$ (B) $\frac{(2n+2)!}{n!(n+1)!}$

(C) $\frac{(2n+2)!}{[(n+1)!]^2}$ (D) $\frac{(2n+2)!}{n(n+1)!}$

94. If for the matrix $A^3 = I$, then A^{-1} is equal to

(A) A^2 (B) A^3

(C) A (D) none of these

95. The differential equation of all non-horizontal lines in a plane is

(A) $\frac{dy}{dx}=0$ (B) $\frac{d^2y}{dx^2}=0$

(C) $\frac{d^3y}{dx^3}=0$ (D) $\frac{dy}{dx}=5$

96. An unbiased die is tossed twice. The probability of getting a 4, 5 or 6 on the first toss and a 1, 2, 3 or 4 on the second toss is

(A) $\frac{1}{3}$ (B) $\frac{2}{3}$

(C) $\frac{4}{3}$ (D) $\frac{5}{6}$

97. The equation $e^{x-1}+x-2=0$ has

(A) one real root (B) two real roots

(C) three real roots (D) four real roots

98. One of the two events must occur. If the chance of one is $\frac{2}{3}$ of the other, then the odds in favour of the other is

(A) 1 : 3 (B) 1 : 2

(C) 3 : 1 (D) 3 : 2

99. The area in the first quadrant and bounded by the curve $x^2+y^2=4$ and the lines $x=0$ and $x=2$ is

(A) π (B) $\frac{\pi}{2}$

(C) $\frac{\pi}{3}$ (D) $\frac{\pi}{4}$

100. There are four letter boxes in a post office. The number of ways in which a man can post 8 distinct letters is

(A) 8^2 (B) 8^4

(C) 4^8 (D) ${}^8P_4$

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