Choose the correct or the most suitable answer from the given four alternatives:

1. If A = $\begin{bmatrix} \frac{3}{5} & \frac{4}{5} \\ x & \frac{3}{5} \end{bmatrix}$ and $A^T = A^{-1}$, then the value of x is

(1) $\frac{-4}{5}$ (2) $\frac{-3}{5}$ (3) $\frac{3}{5}$ (4) $\frac{4}{5}$

2. If $x^a y^b = e^m$, $x^c y^d = e^n$,$\Delta_1 = \begin{vmatrix} m & b \\ n & d \end{vmatrix}$, $\Delta_2 = \begin{vmatrix} a & m \\ c & n \end{vmatrix}$, $\Delta_3 = \begin{vmatrix} a & b \\ c & d \end{vmatrix}$ then the values of x and y are respectively,

(1) $e^{(\Delta_2/\Delta_1}, e^{(\Delta_3/\Delta_1)}$ (2) $\log(\Delta_1/\Delta_3), \log(\Delta_2/\Delta_3)$

(3) $\log(\Delta_2/\Delta_1), \log(\Delta_3/\Delta_1)$ (4) $e^{(\Delta_1/\Delta_3}, e^{(\Delta_2/\Delta_3)}$

3. The augmented matrix of a system of linear equations is $\begin{bmatrix} 1 & 2 & 7 & 3 \\ 0 & 1 & 4 & 6 \\ 0 & 0 & \lambda-7 & \mu+5 \end{bmatrix}$. The system has infinitely many solutions if

(1) $\lambda = 7, \mu \neq -5$ (2) $\lambda = -7, \mu = 5$ (3) $\lambda \neq 7, \mu \neq -5$ (4) $\lambda = 7, \mu = -5$

4. If A = $\begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$ be such that $\lambda A^{-1} = A$, then λ is

(1)17 (2) 14 (3) 19 (4) 21

5. If A = $\begin{bmatrix} 3 & 5 \\ 1 & 2 \end{bmatrix}$, B = adjA and C = 3A, then $\frac{|adjB|}{|C|}$ =

(1)$\frac{1}{3}$ (2) $\frac{1}{9}$ (3)$\frac{1}{4}$ (4)1

6. If $z = \frac{(\sqrt{3}+i)^2(3i+4)^2}{(8+6i)^2}$ then | z | is equal to

(1) 0 (2) 1 (3) 2 (4) 3

7. If $\frac{z-1}{z+1}$ is purely imaginary, then $|z|$ is

(1) $\frac{1}{2}$ (2) 1 (3) 2 (4) 3

8. If $(1+i)(1+2i)(1+3i)\cdots(1+ni) = (x+iy)$, then $2\cdot 5\cdot 20\cdots(1+n^2)$

(1) 1 (2) i (3) x^2+y^2 (4) $1+n^2$

9. The product of all four values of $\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)^{\frac{3}{4}}$ is

(1)−2 (2)−1 (3)1 (4)2

10. The principal argument of $(\sin 40^\circ + i\cos 40^\circ)^5$ is

(1) -110° (2) -70° (3) 70° (4) 110°

11. According to the rational root theorem, which number is not possible rational zero of $4x^7 + 2x^4 - 10x^3 - 5$?

(1) −1 (2) $\frac{5}{4}$ (3) $\frac{4}{5}$ (4) 5

12. The polynomial $x^3 + 2x + 3$ has

(1) one negative and two imaginary zeros (2) one positive and two imaginary zeros

(3) three real zeros (4) no zeros

13. If $sin^{-1}x = 2sin^{-1}\alpha$ has a solution, then

(1) $|\alpha| \leq \frac{1}{\sqrt{2}}$ (2) $|\alpha| \geq \frac{1}{\sqrt{2}}\pi$ (3) $|\alpha| < \frac{1}{\sqrt{2}}$ (4) $|\alpha| > \frac{1}{\sqrt{2}}$

14. If $cot^{-1}x = \frac{2\pi}{5}$ for some $x \in R$, the value of $tan^{-1}x$ is

(1) $-\frac{\pi}{10}$ (2) $\frac{\pi}{5}$ (3) $\frac{\pi}{10}$ (4) $-\frac{\pi}{5}$

15. If $|x| \le 1$, then $2tan^{-1}x - sin^{-1}\left(\frac{2x}{1+x^2}\right)$ is equal to

(1) $tan^{-1}x$ (2) $sin^{-1}x$ (3) 0 (4) π

16. If $sin^{-1}x + cot^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{2}$, then x is equal to

(1) $\frac{1}{2}$ (2) $\frac{1}{\sqrt{5}}$ (3) $\frac{2}{\sqrt{5}}$ (4) $\frac{\sqrt{3}}{2}$

17. The circle passing through $(1,-2)$ and touching the axis of x at $(3,0)$ passing through the point

(1) $(-5,2)$ (2) $(2,-5)$ (3) $(5,2)$ (4) $(-2,5)$

18. The eccentricity of the ellipse $(x-3)^2 + (y-4)^2 = \frac{y^2}{9}$ is

(1) $\frac{\sqrt{3}}{2}$ (2) $\frac{1}{3}$ (3) $\frac{1}{3\sqrt{2}}$ (4) $\frac{1}{\sqrt{3}}$

19. If $x + y = k$ is a normal to the parabola $y^2 = 12x$, then the value of k is

(1) 3 (2) -1 (3) 1 (4) 9

20. The area of quadrilateral formed with foci of the hyperbolas $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $\frac{x^2}{a^2} - \frac{y^2}{b^2} = -1$ is

(1) $4(a^2+b^2)$ (2) $2(a^2+b^2)$ (3) (a^2+b^2) (4) $\frac{1}{2}(a^2+b^2)$

21. The circle $x^2 + y^2 = 4x + 8y + 5$ intersects the line $3x - 4y = m$ at two distinct points if

(1) $15 < m < 65$ (2) $35 < m < 85$

(3) $-85 < m < -35$ (4) $-35 < m < 15$

22. Area of the greatest rectangle inscribed in the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is

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

23. If $\vec{a}$ and $\vec{b}$ are parallel vectors, then $[\vec{a}, \vec{c}, \vec{b}]$ is equal to

(1) 2 (2) -1 (3) 1 (4) $\vec{0}$

24. The volume of the parallelepiped with its edges represented by the vectors $\hat{\imath} + \hat{\jmath}, \hat{\imath} + 2\hat{\jmath}, \hat{\imath} + \hat{\jmath} + \pi\hat{k}$ is

(1) $\frac{\pi}{2}$ (2) $\frac{\pi}{3}$ (3) π (4) $\frac{\pi}{4}$

25. If the volume of the parallelepiped with $\vec{a} \times \vec{b}, \vec{b} \times \vec{c}, \vec{c} \times \vec{a}$ as coterminous edges is 8 cubic units, then the volume of the parallelepiped with $(\vec{a} \times \vec{b}) \times (\vec{b} \times \vec{c}), (\vec{b} \times \vec{c}) \times (\vec{c} \times \vec{a})$ and $(\vec{c} \times \vec{a}) \times (\vec{a} \times \vec{b})$ as coterminous edges is,

(1) 8 cubic units (2) 512 cubic units (3) 64 cubic units (4) 24 cubic units

26. If the line $\frac{x-2}{3} = \frac{y-1}{-5} = \frac{z+2}{2}$ lies in the plane $x + 3y - \alpha z + \beta = 0$, then (α, β) is

(1) $(-5,5)$ (2) $(-6,7)$ (3) $(5,-5)$ (4) $(6,-7)$

27. If the direction cosines of a line are $\frac{1}{c}, \frac{1}{c}, \frac{1}{c}$ then

(1) $c = \pm 3$ (2) $c = \pm\sqrt{3}$ (3) $c > 0$ (4) $0 < c < 1$

28. The volume of a sphere is increasing in volume at the rate of 3π cm³/sec. The rate of change of its radius when radius is $\frac{1}{2}$ cm

(1) 3 cm/s (2) 2 cm/s (3) 1 cm/s (4) $\frac{1}{2}$ cm/s

29. The abscissa of the point on the curve f(x) = $\sqrt{8-2x}$ at which the slope of the tangent is -0.25?

(1) -8 (2) -4 (3) -2 (4) 0

30. Angle between $y^2 = x$ and $x^2 = y$ at the origin is

(1) $tan^{-1}\frac{3}{4}$ (2) $tan^{-1}\frac{4}{3}$ (3) $\frac{\pi}{2}$ (4) $\frac{\pi}{4}$

31. 4. If $V(x,y) = \log(e^x + e^y)$, then $\frac{\partial v}{\partial x} + \frac{\partial v}{\partial y}$ is equal to

(1) $e^x + e^y$ (2) $\frac{1}{e^x+e^y}$ (3) 2 (4) 1

32. If $(x,y) = x^2$, then $\frac{\partial u}{\partial x}$ is equal to

(1) $x^y \log x$ (2) $y \log x$ (3) yx^{y-1} (4) $x \log y$

33. If $f(x,y) = e^{xy}$, then $\frac{\partial^2 f}{\partial x \partial y}$ is equal to

(1) xye^{xy} (2) $(1+xy)\,e^{xy}$ (3) $(1+y)\,e^{xy}$ (4) $(1+x)\,e^{xy}$

34. The value of $\int_{-1}^{2} |x|\, dx$ is

(1) $\frac{1}{2}$ (2) $\frac{3}{2}$ (3) $\frac{5}{2}$ (4) $\frac{7}{2}$

35. The value of $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \left(\frac{2x^7-3x^5+7x^3-x+1}{\cos^2 x}\right) dx$ is

(1) 4 (2) 3 (3) 2 (4) 0

36. The value of $\int_0^{\pi} \frac{dx}{1+5^{\cos x}}$ is

(1) $\frac{\pi}{2}$ (2) π (3) $\frac{3\pi}{2}$ (4) 2π

37. The value of $\int_0^1 (\sin^{-1} x)^2\, dx$ is

(1) $\frac{\pi^2}{4} - 1$ (2) $\frac{\pi^2}{4} + 2$ (3) $\frac{\pi^2}{4} + 1$ (4) $\frac{\pi^2}{4} - 2$

38. A rod of length $2l$ is broken into two pieces at random. The probability density function of the shorter of the two pieces is $f(x) = \begin{cases} \frac{1}{l} & 0 < x < l \\ 0 & l \le x \le 2l \end{cases}$ The mean and variance of the shorter of the two pieces are respectively

(1) $\frac{l}{2}, \frac{l^2}{3}$ (2) $\frac{l}{2}, \frac{l^2}{6}$ (3) $l, \frac{l^2}{12}$ (4) $\frac{l}{2}, \frac{l^2}{12}$

39. Let X represent the difference between the number of heads and the number of tails obtained when a coin is tossed n times. Then the possible values of X are

(1) $i + 2n, i = 0,1,2\ldots n$ (2) $2i - n, i = 0,1,2\ldots n$

(3) $n - i, i = 0,1,2\ldots n$ (4) $2i + 2n, i = 0,1,2\ldots n$

40. The random variable X has the probability density function $f(x) = \begin{cases} ax + b, & 0 < x < 1 \\ 0, & otherwise \end{cases}$ and $E(X) = \frac{7}{12}$, then a and b are respectively

(1) 1 *and* $\frac{1}{2}$ (2) $\frac{1}{2}$ *and* 1 (3) 2 *and* 1 (4) 1 *and* 2

41. Which of the following is a discrete random variable?

I. The number of cars crossing a particular signal in a day.

II. The number of customers in a queue to buy train tickets at a moment.

III. The time taken to complete a telephone call.

(1) *I and II* (2) *II only* (3) *III only* (4) *II and III*

42. In the set ℝ of real numbers '*' is defined as follows. Which one of the following is not a binary operation on ℝ ? (1) $a * b = \min(a . b)$ (2) $a * b = \max(a, b)$

(3) $a * b = a$ (4) $a * b = a^b$

43. Which one of the following statements has truth value F ?

(1) Chennai is in India or $\sqrt{2}$ is an integer

(2) Chennai is in India or $\sqrt{2}$ is an irrational number

(3) Chennai is in China or $\sqrt{2}$ is an integer

(4) Chennai is in China or $\sqrt{2}$ is an irrational number

44. In the last column of the truth table for $\neg (p \vee \neg q)$ the number of final outcomes of the truth value $'F'$ are

(1) 1 (2) 2 (3) 3 (4) 4

45. The dual of $\neg (p \vee q) \vee [(p \vee (p \wedge \neg r)]$ is

(1) $\neg (p \wedge q) \vee [(p \vee (p \wedge \neg r)]$ (2) $(p \wedge q) \wedge [(p \wedge (p \vee \neg r)]$

(3) $\neg (p \wedge q) \wedge [(p \wedge (p \wedge \neg r)]$ (4) $\neg (p \wedge q) \wedge [(p \wedge (p \vee \neg r)]$

46. If f(x) = $x^2 - 3x$, then the points at which f(x) = f ‘ (x) are

(1) both positive integers (2)both negative integers

(3)both irrational (4)one rational and another irrational

47. $\frac{d}{dx}(e^{x+5logx})$ is

(1) $e^x . x^4(x+5)$ (2) $e^x . x(x+5)$ (3)$e^x + \frac{5}{x}$ (4) $e^x - \frac{5}{x}$

48. If f(x) = x+2 , then f’(f(x)) at x = 4 is

(1)8 (2)1 (3)4 (4)5

49. It is given that f’(a) exists , then $\lim_{x \to a} \frac{xf(a)-af(x)}{x-a}$ is

(1)f(a)-af’(a) (2)f’(a) (3)-f’(a) (4)f(a)+af’(a)

50. The derivative of f(x) = x $|x|$ at x = -3 is

(1)6 (2)-6 (3)does not exist (4)0

MURALIRAJA.M.Sc.,B.Ed., CELL NO: 9786760672