XII- PUBLIC CENTUM MODEL QUESTION PAPER - 2025

SIR. CV .RAMAN COACHING CENTRE – IDAPPADI,SALEM – 637101

XII- MATHEMATICS CENTUM QUESTION PAPER -2025

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TOTAL MARK : 90 M „ TIME : 3 HRS

SECTION _ A (20 X 1 = 20 M)

I.CHOOSE THE CORRECT BEST ANSWER :

1. If $A\begin{bmatrix}1 & -2\\ 1 & 4\end{bmatrix}=\begin{bmatrix}6 & 0\\ 0 & 6\end{bmatrix}$ then A=

(1) $\begin{bmatrix}1 & -2\\ 1 & 4\end{bmatrix}$ (2) $\begin{bmatrix}1 & 2\\ -1 & 4\end{bmatrix}$ (3) $\begin{bmatrix}4 & 2\\ -1 & 1\end{bmatrix}$ (4) $\begin{bmatrix}4 & -1\\ 2 & 1\end{bmatrix}$

2. If $A=\begin{bmatrix}3 & 1 & -1\\ 2 & -2 & 0\\ 1 & 2 & -1\end{bmatrix}$ and $A^{-1}=\begin{bmatrix}a_{11} & a_{12} & a_{13}\\ a_{21} & a_{22} & a_{23}\\ a_{31} & a_{32} & a_{33}\end{bmatrix}$ then the value of a_{23} is

(1) 0 (2) –2 (3) –3 (4) –1

3. z_1, z_3, and z_3 are complex numbers such that $z_1+z_2+z_3=0$ and $|z_1|=|z_2|=|z_3|=1$ then $z_1^{\,2}+z_2^{\,2}+z_3^{\,2}$ is

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

4. The value of $\left(\frac{1+\sqrt{3}i}{1-\sqrt{3}i}\right)^{10}$ is

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

5. $\sin^{-1}\frac{3}{5}-\cos^{-1}\frac{12}{13}+\sec^{-1}\frac{5}{3}-\operatorname{cosec}^{-1}\frac{13}{12}$ is equal to

(1) 2π (2) π (3) 0 (4) $\tan^{-1}\frac{12}{65}$

6.

$\sin^{-1}\left(\tan\frac{\pi}{4}\right)-\sin^{-1}\left(\sqrt{\frac{3}{x}}\right)=\frac{\pi}{6}$. Then x is a root of the equation

(1) $x^2-x-6=0$ (2) $x^2-x-12=0$ (3) $x^2+x-12=0$ (4) $x^2+x-6=0$

7.

$\sin(\tan^{-1}x), |x|<1$ is equal to

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

8.

If the coordinates at one end of a diameter of the circle $x^2+y^2-8x-4y+c=0$ are $(11,2)$, the coordinates of the other end are

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

9.

If $\vec{a}=2\hat{i}+3\hat{j}-\hat{k}$, $\vec{b}=\hat{i}+2\hat{j}-5\hat{k}$, $\vec{c}=3\hat{i}+5\hat{j}-\hat{k}$, then a vector perpendicular to $\vec{a}$ and lies in the plane containing $\vec{b}$ and $\vec{c}$ is

(1) $-17\hat{i}+21\hat{j}-97\hat{k}$ (2) $17\hat{i}+21\hat{j}-123\hat{k}$

(3) $-17\hat{i}-21\hat{j}+97\hat{k}$ (4) $-17\hat{i}-21\hat{j}-97\hat{k}$

10.

The value of the limit $\lim_{x\to 0}\left(\cot x-\frac{1}{x}\right)$ is

(1) 0 (2) 1 (3) 2 (4) ∞

11.

The function $\sin^4 x+\cos^4 x$ is increasing in the interval

(1) $\left[\frac{5\pi}{8},\frac{3\pi}{4}\right]$ (2) $\left[\frac{\pi}{2},\frac{5\pi}{8}\right]$ (3) $\left[\frac{\pi}{4},\frac{\pi}{2}\right]$ (4) $\left[0,\frac{\pi}{4}\right]$

12.

The value of $\int_{-4}^{4}\left[\tan^{-1}\left(\frac{x^2}{x^4+1}\right)+\tan^{-1}\left(\frac{x^4+1}{x^2}\right)\right]dx$ is

(1) π (2) 2π (3) 3π (4) 4π

13.

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

14.

The solution of the differential equation $\frac{dy}{dx} = \frac{y}{x} + \frac{\phi\left(\frac{y}{x}\right)}{\phi'\left(\frac{y}{x}\right)}$ is

(1) $x\phi\left(\frac{y}{x}\right) = k$ (2) $\phi\left(\frac{y}{x}\right) = kx$ (3) $y\phi\left(\frac{y}{x}\right) = k$ (4) $\phi\left(\frac{y}{x}\right) = ky$

15.

If the solution of the differential equation $\frac{dy}{dx} = \frac{ax + 3}{2y + f}$ represents a circle, then the value of a is

(1) 2 (2) −2 (3) 1 (4) −1

16.

The slope at any point of a curve $y = f(x)$ is given by $\frac{dy}{dx} = 3x^2$ and it passes through (-1,1). Then the equation of the curve is

(1) $y = x^3 + 2$ (2) $y = 3x^2 + 4$ (3) $y = 3x^3 + 4$ (4) $y = x^3 + 5$

17.

A rod of length $2l$ is broken into two pieces at random. The probability density function of the shorter of the two pieces is

$$f(x) = \begin{cases} \frac{1}{l} & 0 < x < l \\ 0 & l \le x < 2l \end{cases}$$

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) $\frac{l}{2}, \frac{l^2}{12}$

18.

A pair of dice numbered 1, 2, 3, 4, 5, 6 of a six-sided die and 1, 2, 3, 4 of a four-sided die is rolled and the sum is determined. Let the random variable X denote this sum. Then the number of elements in the inverse image of 7 is

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

19.

Four buses carrying 160 students from the same school arrive at a football stadium. The buses carry, respectively, 42, 36, 34, and 48 students. One of the students is randomly selected. Let X denote the number of students that were on the bus carrying the randomly selected student. One of the 4 bus drivers is also randomly selected. Let Y denote the number of students on that bus.
Then $E(X)$ and $E(Y)$ respectively are

(1) $50, 40$ (2) $40, 50$ (3) $40.75, 40$ (4) $41, 41$

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

SECTION – B (7 X 2 = 14 M)

ANSWER ANY SEVEN QUESTIONS COMPULSORY Q NO .30.

21. Determine the order and degree (if exists) of the following differential equations

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

22. Find the values of the following

(i) $\int_0^{\frac{\pi}{2}} \sin^4 x \cos^6 x \, dx$

23.

Let $g(x,y)=2y+x^2, x=2r-s, y=r^2+2s, r,s\in\mathbb{R}$. Find $\frac{\partial g}{\partial r}, \frac{\partial g}{\partial s}$.

24. Find two positive numbers whose sum is 12 and their product is maximum.

25.

If the vectors $\vec{a},\vec{b},\vec{c}$ are coplanar, then prove that the vectors $\vec{a}+\vec{b},\vec{b}+\vec{c},\vec{c}+\vec{a}$ are also coplanar.

26.

If $y=2\sqrt{2}x+c$ is a tangent to the circle $x^2+y^2=16$, find the value of c.

27. Find the principal value of $\sin^{-1}(2)$, if it exists.

28. Solve the equation $7x^3-43x^2=43x-7$.

29. Simplify $(1+i)^{18}$

30. Find the rank of the following matrices which are in row-echelon form

$$\begin{bmatrix} 6 & 0 & -9 \\ 0 & 2 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

SECTION – C (7 X 3 = 21 M)

II.ANSWER ANY SEVEN QUESTIONS COMPULSORY Q NO .40.

31. If $A=\begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$, show that $A^{-1}=\frac{1}{2}\left(A^2-3I\right)$.

32. If $|z|=2$ show that $3\le|z+3+4i|\le 7$

33. Solve the equation : $x^4-14x^2+45=0$.

34. Find $\cos^{-1}\left(-\frac{1}{\sqrt{2}}\right)$

35. Find the equation of the parabola whose vertex is $(5,-2)$ and focus $(2,-2)$.

36. Show that the lines $\frac{x-1}{4}=\frac{2-y}{6}=\frac{z-4}{12}$ and $\frac{x-3}{-2}=\frac{y-3}{3}=\frac{5-z}{6}$ are parallel.

37. Prove, using mean value theorem, that

$$|\sin\alpha-\sin\beta|\le|\alpha-\beta|,\ \alpha,\ \beta\in\mathbb{R}.$$

38. Assuming $\log_{10}e=0.4343$, find an approximate value of $\log_{10}1003$.

39. Evaluate $\int_0^{\infty}\frac{x^n}{n^x}dx$, where n is a positive integer ≥ 2.

40.

The mean and variance of a binomial variate X are respectively 2 and 1.5. Find

(i) $P(X=0)$ (ii) $P(X=1)$ (iii) $P(X \geq 1)$

SECTION – D (7 X 5 = 35 M)

ANSWER ALL QUESTIONS:

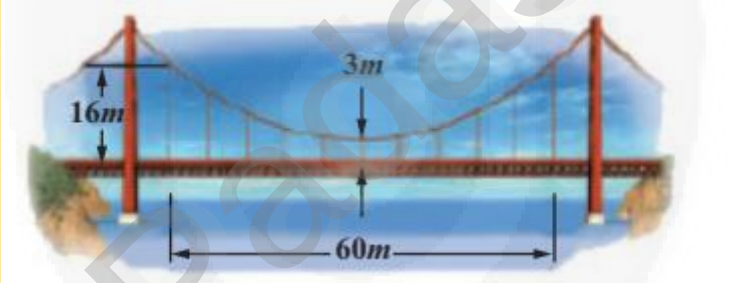
41 .a) Suppose a pair of unbiased dice is rolled once. If X denotes the total score of two dice, write down (i) the sample space (ii) the values taken by the random variable X, (iii) the inverse image of 10, and (iv) the number of elements in inverse image of X.

(or)

b)

Find the non-parametric form of vector equation, and Cartesian equation of the plane passing through the point $(2,3,6)$ and parallel to the straight lines $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z-3}{1}$ and $\frac{x+3}{2}=\frac{y-3}{-5}=\frac{z+1}{-3}$

42.a) Parabolic cable of a 60m portion of the roadbed of a suspension bridge are positioned as shown below. Vertical Cables are to be spaced every 6m along this portion of the roadbed. Calculate the lengths of first two of these vertical cables from the vertex.



(or)

b) Assume that the rate at which radioactive nuclei decay is proportional to the number of such nuclei that are present in a given sample. In a certain sample 10% of the original number of radioactive nuclei have undergone disintegration in a period of 100 years. What percentage of the original radioactive nuclei will remain after 1000 years?

43.a) Find the volume of a sphere of radius a.

(or)

b) .

Prove that $\tan\left(\sin^{-1}x\right)=\frac{x}{\sqrt{1-x^2}}, \ -1<x<1.$

44.a)

A firm produces two types of calculators each week, x number of type A and y number of type B. The weekly revenue and cost functions (in rupees) are $R(x,y)=80x+90y+0.04xy-0.05x^2-0.05y^2$ and $C(x,y)=8x+6y+2000$ respectively.

(i) Find the profit function $P(x,y)$,

(ii) Find $\frac{\partial P}{\partial x}(1200,1800)$ and $\frac{\partial p}{\partial y}(1200,1800)$ and interpret these results.

(or)

b) .

Find the sum of the squares of the roots of $ax^4+bx^3+cx^2+dx+e=0,\ a\neq 0$

45 a) If we blow air into a balloon of spherical shape at a rate of 1000 cm^3 per second, at what rate the radius of the baloon changes when the radius is 7cm? Also compute the rate at which the surface area changes.

(or)

b) Find the cube roots of unity.

46.a)

Determine the values of λ for which the following system of equations $(3\lambda-8)x+3y+3z=0,\ 3x+(3\lambda-8)y+3z=0,\ 3x+3y+(3\lambda-8)z=0$ has a non-trivial solution.

(or)

b) Prove by vector method that the perpendiculars (attitudes) from the vertices to the opposite sides triangle are the concurrent .

47.a)

Let $A=\begin{pmatrix}1&0&1&0\\0&1&0&1\\1&0&0&1\end{pmatrix}$, $B=\begin{pmatrix}0&1&0&1\\1&0&1&0\\1&0&0&1\end{pmatrix}$, $C=\begin{pmatrix}1&1&0&1\\0&1&1&0\\1&1&1&1\end{pmatrix}$ be any three boolean matrices of the same type. Find (i) $A\vee B$ (ii) $A\wedge B$ (iii) $(A\vee B)\wedge C$ (iv) $(A\wedge B)\vee C$.

(or)

b).

Find the value of

(i) $\tan^{-1}\left(\sqrt{3}\right)-\sec^{-1}(-2)$ (ii) $\sin^{-1}(-1)+\cos^{-1}\left(\frac{1}{2}\right)+\cot^{-1}(2)$

ALL THE BEST

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