JEE Main 2025 April 3 Shift 2 Mathematics Question Paper

Time Allowed :3 Hours	**Maximum Marks :**300	**Total Questions :**75

General Instructions

Read the following instructions very carefully and strictly follow them:

1. Multiple choice questions (MCQs)
2. Questions with numerical values as answers.
3. There are three sections: **Mathematics, Physics, Chemistry**.
4. **Mathematics:** 25 (20+5) 10 Questions with answers as a numerical value. Out of 10 questions, 5 questions are compulsory.
5. **Physics:** 25 (20+5) 10 Questions with answers as a numerical value. Out of 10 questions, 5 questions are compulsory..
6. **Chemistry:** 25 (20+5) 10 Questions with answers as a numerical value. Out of 10 questions, 5 questions are compulsory.
7. Total: 75 Questions (25 questions each).
8. 300 Marks (100 marks for each section).
9. **MCQs:** Four marks will be awarded for each correct answer and there will be a negative marking of one mark on each wrong answer.
10. **Questions with numerical value answers:** Candidates will be given four marks for each correct answer and there will be a negative marking of 1 mark for each wrong answer.

Mathematics

Section - A

1. Let $f : R \to R$ be a function defined by $f(x) = ||x + 2| - 2|x||$. If m is the number of points of local maxima of f and n is the number of points of local minima of f, then m + n is

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

2. Each of the angles β and γ that a given line makes with the positive y- and z-axes, respectively, is half the angle that this line makes with the positive x-axis. Then the sum of all possible values of the angle β is

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

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3. If the four distinct points $(4,6)$, $(-1,5)$, $(0,0)$ and $(k,3k)$ lie on a circle of radius r, then $10k + r^2$ is equal to

(1) 32
(2) 33
(3) 34
(4) 35

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4. Let the Mean and Variance of five observations x_i, $i = 1,2,3,4,5$ be 5 and 10 respectively. If three observations are $x_1 = 1, x_2 = 3, x_3 = a$ and $x_4 = 7, x_5 = b$ with $a > b$, then the Variance of the observations $n + x_n$ for $n = 1,2,3,4,5$ is

(1) 17
(2) 16.4
(3) 17.4
(4) 16

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5. Consider the lines $x(3\lambda+1) + y(7\lambda+2) = 17\lambda+5$. If P is the point through which all these lines pass and the distance of L from the point $Q(3,6)$ is d, then the distance of L from the point $(3,6)$ is d, then the value of d^2 is

(1) 20
(2) 30
(3) 10
(4) 15

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6. Let $A = \{-2,-1,0,1,2,3\}$. Let R be a relation on A defined by $(x,y) \in R$ if and only if $|x| \leq |y|$. Let m be the number of reflexive elements in R and n be the minimum number of elements required to be added in R to make it reflexive and symmetric relations, respectively. Then $l + m + n$ is equal to

(1) 13
(2) 12
(3) 11
(4) 14

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7. Let the equation $x(x+2) * (12-k) = 2$ have equal roots. The distance of the point $\left(k, \frac{k}{2}\right)$ from the line $3x + 4y + 5 = 0$ is

(1) 15
(2) $5\sqrt{5}$
(3) $15\sqrt{5}$
(4) 12

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8. Line L1 of slope 2 and line L2 of slope $\frac{1}{2}$ intersect at the origin O. In the first quadrant, $P_1, P_2, \ldots, P_{12}$ are 12 points on line L1 and $Q_1, Q_2, \ldots, Q_9$ are 9 points on line L2. Then the total number of triangles that can be formed having vertices at three of the 22 points O, $P_1, P_2, \ldots, P_{12}$, $Q_1, Q_2, \ldots, Q_9$, is:

(A) 1080
(B) 1134
(C) 1026
(D) 1188

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9. The integral $\int_0^{\pi} \frac{8x dx}{4\cos^2 x + \sin^2 x}$ is equal to

(A) $2\pi^2$
(B) $4\pi^2$
(C) π^2
(D) $\frac{3\pi^2}{2}$

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10. Let f be a function such that $f(x) + 3f\left(\frac{24}{x}\right) = 4x$, $x \neq 0$. Then $f(3) + f(8)$ is equal to

(A) 11
(B) 10
(C) 12
(D) 13

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11. The area of the region $\{(x, y) : |x - y| \leq y \leq 4\sqrt{x}\}$ is

(A) 512
(B) $\frac{1024}{3}$
(C) $\frac{512}{3}$
(D) $\frac{2048}{3}$

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12. If the domain of the function $f(x) = \log_7(1 - \log_4(x^2 - 9x + 18))$ is $(\alpha, \beta) \cup (\gamma, \delta)$, then $\alpha + \beta + \gamma + \delta$ is equal to

(A) 18
(B) 16
(C) 15
(D) 17

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13. If the probability that the random variable X takes the value x is given by $P(X = x) = k(x + 1)3^{-x}$, $x = 0, 1, 2, 3, \ldots$, where k is a constant, then $P(X \geq 3)$ is equal to

(A) $\frac{7}{27}$
(B) $\frac{4}{9}$
(C) $\frac{8}{27}$
(D) $\frac{1}{9}$

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14. Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} + 3(\tan^2 x)y + 3y = \sec^2 x$, with $y(0) = \frac{1}{3} + e^3$. Then $y\left(\frac{\pi}{4}\right)$ is equal to

(A) $\frac{2}{3}$
(B) $\frac{4}{3}$
(C) $\frac{4}{3} + e^3$
(D) $\frac{2}{3} + e^3$

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15. If $z_1, z_2, z_3 \in C$ are the vertices of an equilateral triangle, whose centroid is z_0, then $\sum_{k=1}^{3}(z_k - z_0)^2$ is equal to

(A) 0
(B) 2
(C) $3i$
(D) $-i$

16. The number of solutions of the equation $(4-\sqrt{3})\sin x - 2\sqrt{3}\cos^2 x = \frac{-4}{1+\sqrt{3}}$, $x \in \left[-2\pi, \frac{5\pi}{2}\right]$ is

(A) 4
(B) 3
(C) 6
(D) 5

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17. Let C be the circle of minimum area enclosing the ellipse E: $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ with eccentricity $\frac{1}{2}$ and foci $(\pm 2, 0)$. Let PQR be a variable triangle, whose vertex P is on the circle C and the side QR of length 29 is parallel to the major axis and contains the point of intersection of E with the negative y-axis. Then the maximum area of the triangle PQR is:

(A) $6(3+\sqrt{2})$
(B) $8(3+\sqrt{2})$
(C) $6(2+\sqrt{3})$
(D) $8(2+\sqrt{3})$

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18. The shortest distance between the curves $y^2 = 8x$ and $x^2 + y^2 + 12y + 35 = 0$ is:

(A) $2\sqrt{3} - 1$
(B) $\sqrt{2}$
(C) $3\sqrt{2} - 1$
(D) $2\sqrt{2} - 1$

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19. The distance of the point (7, 10, 11) from the line $\frac{x-4}{1} = \frac{y-4}{0} = \frac{z-2}{3}$ along the line $\frac{x-7}{2} = \frac{y-10}{3} = \frac{z-11}{6}$ is

(A) 18
(B) 14
(C) 12
(D) 16

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20. The sum $1 + \frac{1+3}{2!} + \frac{1+3+5}{3!} + \frac{1+3+5+7}{4!} + \ldots$ upto ∞ terms, is equal to

(A) $6e$

(B) $4e$
(C) $3e$
(D) $2e$

Section - B

21. Let I be the identity matrix of order 3×3 and for the matrix $A = \begin{pmatrix} \lambda & 2 & 3 \\ 4 & 5 & 6 \\ 7 & -1 & 2 \end{pmatrix}$, $|A| = -1$. Let B be the inverse of the matrix $\text{adj}(A \cdot \text{adj}(A^2))$. Then $|(\lambda B + I)|$ is equal to ______

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22. Let $(1 + x + x^2)^{10} = a_0 + a_1 x + a_2 x^2 + \cdots + a_{20} x^{20}$. If $(a_1 + a_3 + a_5 + \cdots + a_{19}) - 11a_2 = 121k$, then k is equal to ______

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23. If $\lim_{x \to 0} \left(\frac{\tan x}{x}\right)^{\frac{1}{x^2}} = p$, then $96 \log_e p$ is equal to ______

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24. Let $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$, $\vec{b} = 3\hat{i} - 3\hat{j} + 3\hat{k}$, $\vec{c} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{d}$ be a vector such that $\vec{b} \times \vec{d} = \vec{c} \times \vec{d}$ and $\vec{a} \cdot \vec{d} = 4$. Then $|\vec{a} \times \vec{d}|^2$ is equal to ______

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25. If the equation of the hyperbola with foci $(4, 2)$ and $(8, 2)$ is $3x^2 - y^2 - \alpha x + \beta y + \gamma = 0$, then $\alpha + \beta + \gamma$ is equal to ______
