JEE Main 2025 April 3 Shift 1 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 A be a matrix of order 3×3 and $|A| = 5$. If

$$|2\,\mathrm{adj}(3A\,\mathrm{adj}(2A))| = 2^{\alpha} \cdot 3^{\beta} \cdot 5^{\gamma}, \quad \alpha, \beta, \gamma \in N$$

then $\alpha + \beta + \gamma$ is equal to

(1) 25
(2) 26
(3) 27
(4) 28

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2. Let a line passing through the point $(4,1,0)$ intersect the line $L_1 : \frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ at the point $A(\alpha,\beta,\gamma)$ and the line $L_2 : x-6 = y = -z+4$ at the point $B(a,b,c)$. Then

$$\begin{vmatrix} 1 & 0 & 1 \\ \alpha & \beta & \gamma \\ a & b & c \end{vmatrix} \textbf{ is equal to}$$

(1) 8
(2) 16
(3) 12
(4) 6

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3. Let α and β be the roots of $x^2 + \sqrt{3}x - 16 = 0$, and γ and δ be the roots of $x^2 + 3x - 1 = 0$. If $P_n = \alpha^n + \beta^n$ and $Q_n = \gamma^n + \delta^n$, then

$$\frac{P_{25} + \sqrt{3}P_{24}}{2P_{23}} + \frac{Q_{25} - Q_{23}}{Q_{24}} \textbf{ is equal to}$$

(1) 3
(2) 4
(3) 5
(4) 7

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4. The sum of all rational terms in the expansion of $\left(2+\sqrt{3}\right)^8$ is

(1) 16923
(2) 3763
(3) 33845
(4) 18817

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5. Let A = {-3,-2,-1,0,1,2,3}. Let R be a relation on A defined by xRy if and only if $0 \leq x^2 + 2y \leq 4$. Let l be the number of elements in R and m be the minimum number of elements required to be added in R to make it a reflexive relation. then $l + m$ is equal to

(1) 19
(2) 20
(3) 17
(4) 18

6. A line passing through the point P$(\sqrt{5}, \sqrt{5})$ intersects the ellipse $\frac{x^2}{36} + \frac{y^2}{25} = 1$ at A and B such that (PA).(PB) is maximum. Then 5(PA^2 + PB^2) is equal to :

(1) 218
(2) 377
(3) 290
(4) 338

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7. The sum 1 + 3 + 11 + 25 + 45 + 71 + ... upto 20 terms, is equal to

(1) 7240
(2) 7130
(3) 6982
(4) 8124

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8. If the domain of the function $f(x) = \log_e\left(\frac{2x-3}{5+4x}\right) + \sin^{-1}\left(\frac{4+3x}{2-x}\right)$ is $[\alpha, \beta]$, then $\alpha^2 + 4\beta$ is equal to

(1) 5
(2) 4
(3) 3
(4) 7

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9. If $\sum_{r=1}^{9}\left(\frac{r+3}{2^r}\right) \cdot {}^9C_r = \alpha\left(\frac{3}{2}\right)^9 - \beta$, $\alpha, \beta \in N$, then $(\alpha+\beta)^2$ is equal to

(1) 27
(2) 9
(3) 81
(4) 18

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10. The number of solutions of the equation $2x + 3\tan x = \pi$, $x \in [-2\pi, 2\pi] - \left\{\pm\frac{\pi}{2}, \pm\frac{3\pi}{2}\right\}$ is

(1) 6
(2) 5
(3) 4
(4) 3

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11. If $y(x) = \begin{vmatrix} \sin x & \cos x & \sin x + \cos x + 1 \\ 27 & 28 & 27 \\ 1 & 1 & 1 \end{vmatrix}$**,** $x \in R$**, then** $\frac{d^2y}{dx^2} + y$ **is equal to**

(1) -1
(2) 28
(3) 27
(4) 1

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12. Let g be a differentiable function such that $\int_0^x g(t)dt = x - \int_0^x tg(t)dt$**,** $x \geq 0$ **and let** $y = y(x)$ **satisfy the differential equation** $\frac{dy}{dx} - y\tan x = 2(x+1)\sec x g(x)$**,** $x \in \left[0, \frac{\pi}{2}\right)$**. If** $y(0) = 0$**, then** $y\left(\frac{\pi}{3}\right)$ **is equal to**

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

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13. A line passes through the origin and makes equal angles with the positive coordinate axes. It intersects the lines $L_1 : 2x + y + 6 = 0$ **and** $L_2 : 4x + 2y - p = 0$**,** $p > 0$**, at the points A and B, respectively. If** $AB = \frac{9}{\sqrt{2}}$ **and the foot of the perpendicular from the point A on the line** L_2 **is M, then** $\frac{AM}{BM}$ **is equal to**

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

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14. Let $z \in C$ **be such that** $\frac{z+3i}{z-2+i} = 2 + 3i$**. Then the sum of all possible values of** z **is**

(1) $19 - 2i$
(2) $-19 - 2i$
(3) $19 + 2i$
(4) $-19 + 2i$

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15. Let $f(x) = \int x^3\sqrt{3 - x^2}dx$**. If** $5f(\sqrt{2}) = -4$**, then** $f(1)$ **is equal to**

(1) $-\frac{2\sqrt{2}}{5}$
(2) $-\frac{8\sqrt{2}}{5}$
(3) $-\frac{4\sqrt{2}}{5}$
(4) $-\frac{6\sqrt{2}}{5}$

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16. Let $a_1, a_2, a_3, ...$ be a G.P. of increasing positive numbers. If $a_3a_5 = 729$ and $a_2 + a_4 = \frac{111}{4}$, then $24(a_1 + a_2 + a_3)$ is equal to

(1) 131
(2) 130
(3) 129
(4) 128

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17. Let the domain of the function $f(x) = \log_2 \log_4 \log_6(3 + 4x - x^2)$ be (a, b). If $\int_0^{a+b}[x^2]dx = p - q\sqrt{r}$, $p, q, r \in N$, gcd(p, q, r) = 1, where [.] is the greatest integer function, then p + q + r is equal to

(1) 10
(2) 8
(3) 11
(4) 9

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18. The radius of the smallest circle which touches the parabolas $y = x^2 + 2$ and $x = y^2 + 2$ is

(1) $\frac{7\sqrt{2}}{2}$
(2) $\frac{7\sqrt{2}}{16}$
(3) $\frac{7\sqrt{2}}{4}$
(4) $\frac{7\sqrt{2}}{8}$

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19. Let $f(x) = \begin{cases} (1 + ax)^{1/x} & , x < 0 \\ 1 + b & , x = 0 \\ \frac{(x+4)^{1/2} - 2}{(x+c)^{1/3} - 2} & , x > 0 \end{cases}$ be continuous at x = 0. Then $e^a bc$ is equal to

(1) 64
(2) 72

(3) 48
(4) 36

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20. Line L_1 passes through the point (1, 2, 3) and is parallel to z-axis. Line L_2 passes through the point $(\lambda, 5, 6)$ and is parallel to y-axis. Let for $\lambda = \lambda_1, \lambda_2, \lambda_2 < \lambda_1$, the shortest distance between the two lines be 3. Then the square of the distance of the point $(\lambda_1, \lambda_2, 7)$ from the line L_1 is

(1) 40
(2) 32
(3) 25
(4) 37

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21. All five letter words are made using all the letters A, B, C, D, E and arranged as in an English dictionary with serial numbers. Let the word at serial number n be denoted by W_n. Let the probability $P(W_n)$ of choosing the word W_n satisfy $P(W_n) = 2P(W_{n-1})$, $n > 1$. If $P(CDBEA) = \frac{2^\alpha}{2^\beta - 1}$, $\alpha, \beta \in N$, then $\alpha + \beta$ is equal to :

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22. Let the product of the focal distances of the point P(4, $2\sqrt{3}$) on the hyperbola H: $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ be 32. Let the length of the conjugate axis of H be p and the length of its latus rectum be q. Then $p^2 + q^2$ is equal to .....

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23. Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 3\hat{i} + 2\hat{j} - \hat{k}$, $\vec{c} = \lambda\hat{j} + \mu\hat{k}$ and $\hat{d}$ be a unit vector such that $\vec{a} \times \hat{d} = \vec{b} \times \hat{d}$ and $\vec{c} \cdot \hat{d} = 1$. If $\vec{c}$ is perpendicular to $\vec{a}$, then $|3\lambda\hat{d} + \mu\vec{c}|^2$ is equal to ____.

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24. If the number of seven-digit numbers, such that the sum of their digits is even, is $m \cdot n \cdot 10^a$; $m, n \in \{1, 2, 3, ..., 9\}$, then $m + n$ is equal to

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25. The area of the region bounded by the curve $y = \max\{|x|, |x - 2|\}$, then x-axis and the lines x = -2 and x = 4 is equal to ____.
