JEE Main 2025 April 8th 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. If $\frac{1}{1^4}+\frac{1}{2^4}+\frac{1}{3^4}+\ldots\infty=\frac{\pi^4}{90}$, $\frac{1}{1^4}+\frac{1}{3^4}+\frac{1}{5^4}+\ldots\infty=\alpha$, $\frac{1}{2^4}+\frac{1}{4^4}+\frac{1}{6^4}+\ldots\infty=\beta$, then $\frac{\alpha}{\beta}$ is equal to:
(A) 23
(B) 15
(C) 14
(D) 18

2. Let the ellipse $3x^2 + py^2 = 4$ pass through the centre C of the circle $x^2 + y^2 - 2x - 4y - 11 = 0$ of radius r. Let f_1, f_2 be the focal distances of the point C on the ellipse. Then $6f_1f_2 - r$ is equal to
(1) 70
(2) 68
(3) 78
(4) 74

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3. Let $f(x)$ be a positive function and

$$I_1 = \int_{-\frac{1}{2}}^{1} 2x\, f\left(2x(1-2x)\right) dx$$

and

$$I_2 = \int_{-1}^{2} f\left(x(1-x)\right) dx.$$

Then the value of $\frac{I_2}{I_1}$ is equal to ____
(1) 4
(2) 6
(3) 12
(4) 9

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4. Let α be a solution of $x^2 + x + 1 = 0$, and for some a and b in R,

$$\begin{bmatrix} 1 & 16 & 13 \\ -1 & -1 & 2 \\ -2 & -14 & -8 \end{bmatrix} \begin{bmatrix} 4 \\ a \\ b \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}.$$

If $\frac{4}{\alpha^4} + \frac{m}{\alpha^a} + \frac{n}{\alpha^b} = 3$, then $m + n$ is equal to ______.
(1) 11
(2) 7
(3) 8
(4) 3

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5. Let $A = \begin{bmatrix} 2 & 2+p & 2+p+q \\ 4 & 6+2p & 8+3p+2q \\ 6 & 12+3p & 20+6p+3q \end{bmatrix}$ If $\det(\text{adj}(\text{adj}(3A))) = 2^m \cdot 3^n$, $m, n \in N$, then $m + n$ is equal to:
(A) 22
(B) 26
(C) 20
(D) 24

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6. The number of integral terms in the expansion of

$$\left(5^{\frac{1}{2}} + 7^{\frac{1}{8}}\right)^{1016}$$

is:
(1) 130
(2) 128
(3) 127
(4) 129

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7. The value of

$$\cot^{-1}\left(\frac{\sqrt{1+\tan^2(2)}-1}{\tan(2)}\right) - \cot^{-1}\left(\frac{\sqrt{1+\tan^2\left(\frac{1}{2}\right)}+1}{\tan\left(\frac{1}{2}\right)}\right)$$

is equal to:
(1) $\pi - \frac{5}{4}$
(2) $\pi - \frac{3}{2}$
(3) $\pi + \frac{3}{2}$
(4) $\pi + \frac{5}{2}$

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8. Given below are two statements:
Statement I:

$$\lim_{x\to 0}\left(\frac{\tan^{-1}x + \log_e\sqrt{\frac{1+x}{1-x}} - 2x}{x^5}\right) = \frac{2}{5}$$

Statement II:

$$\lim_{x\to 1}\left(\frac{2}{x^{1-x}}\right) = \frac{1}{e^2}$$

In the light of the above statements, choose the correct answer from the options given below
(1)Both Statement I and Statement II are false
(2)Statement I is false but Statement II is true
(3)Both Statement I and Statement II are true
(4)Statement I is true but Statement II is false

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9. Let a be the length of a side of a square OABC with O being the origin. Its side OA makes an acute angle α with the positive x-axis and the equations of its diagonals are

$$\left(\sqrt{3}+1\right)x + \left(\sqrt{3}-1\right)y = 0$$

and

$$\left(\sqrt{3}-1\right)x-\left(\sqrt{3}+1\right)y+8\sqrt{3}=0.$$

Then a^2 is equal to
(1) 24
(2) 32
(3) 48
(4) 16

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10. Let the values of λ for which the shortest distance between the lines

$$\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$$

and

$$\frac{x-\lambda}{3}=\frac{y-4}{4}=\frac{z-5}{5}$$

is $\frac{1}{\sqrt{6}}$ be λ_1 and λ_2. Then the radius of the circle passing through the points $(0,0),(\lambda_1,\lambda_2)$ and (λ_2,λ_1) is
(1)4
(2)3
(3)$\frac{\sqrt{2}}{3}$
(4)$\frac{5\sqrt{2}}{2}$

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11. Let $A=\{0,1,2,3,4,5\}$. Let R be a relation on A defined by $(x,y)\in R$ if and only if $\max\{x,y\}\in\{3,4\}$. Then among the statements (S_1) : The number of elements in R is 18, and (S_2) : The relation R is symmetric but neither reflexive nor transitive
(1)only (S_1) is true
(2)both are true
(3)only (S_2) is true
(4)both are false

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12. If A and B are two events such that $P(A)=0.7$, $P(B)=0.4$ and $P\left(A\cap\overline{B}\right)=0.5$, where $\overline{B}$ denotes the complement of B, then $P\left(B|\left(A\cup\overline{B}\right)\right)$ is equal to
(1)$\frac{1}{2}$
(2)$\frac{1}{4}$
(3)$\frac{1}{3}$
(4)$\frac{1}{6}$

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13. A line passing through the point $P(a,0)$ makes an acute angle α with the positive x-axis. Let this line be rotated about the point P through an angle $\frac{\alpha}{2}$ in

the clock-wise direction. If in the new position, the slope of the line is $2-\sqrt{3}$ and its distance from the origin is $\frac{1}{\sqrt{2}}$, then the value of $3a^2\tan^2\alpha - 2\sqrt{3}$ is
(1)4
(2)5
(3)8
(4)6

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14. Let $f(x) = x-1$ and $g(x) = e^x$ for $x \in R$. If

$$\frac{dy}{dx} = \left(e^{-2\sqrt{x}} g\left(f\left(f(x)\right)\right) - \frac{y}{\sqrt{x}}\right),\ y(0) = 0,$$

then $y(1)$ is
(1) $\frac{2e-1}{e^3}$
(2) $\frac{1-e^2}{e^4}$
(3) $\frac{e-1}{e^4}$
(4) $\frac{1-e^3}{e^4}$

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15. The sum of the squares of the roots of $|x-2|^2 + |x-2| - 2 = 0$ and the squares of the roots of $x^2|x-3| - 5 = 0$, is:
(1) 24
(2) 26
(3) 36
(4) 30

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16. There are 12 points in a plane, no three of which are in the same straight line, except 5 points which are collinear. Then the total number of triangles that can be formed with the vertices at any three of these 12 points is:
(1) 210
(2) 200
(3) 230
(4) 220

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17. The integral $\int_{-1}^{\frac{3}{2}} \left(\pi^2 x \sin(\pi x)\right) dx$ is equal to:
(1) $2+3\pi$
(2) $3+2\pi$
(3) $1+3\pi$
(4) $4+\pi$

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18. Let the function $f(x) = \frac{x}{3} + \frac{3}{x} + 3$, $x \neq 0$, be strictly increasing in $(-\infty, \alpha_1) \cup (\alpha_2, \infty)$ and strictly decreasing in $(\alpha_3, \alpha_4) \cup (\alpha_5, \alpha_s)$. Then $\sum_{i=1}^{5} \alpha_i^2$ is equal to:

(1) 36
(2) 28
(3) 48
(4) 40

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19. Let $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} - \hat{k}$. Let $\hat{c}$ be a unit vector in the plane of the vectors $\vec{a}$ and $\vec{b}$ and perpendicular to $\vec{a}$. Then such a vector $\hat{c}$ is:

(1) $\frac{1}{\sqrt{3}}(\hat{i} - \hat{j} + \hat{k})$
(2) $\frac{1}{\sqrt{2}}(-\hat{i} + \hat{k})$
(3) $\frac{1}{\sqrt{5}}(\hat{j} - 2\hat{k})$
(4) $\frac{1}{\sqrt{3}}(-\hat{i} + \hat{j} - \hat{k})$

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20. Let $A = \left\{\theta \in [0, 2\pi] : \Re\left(\frac{2\cos\theta + i\sin\theta}{\cos\theta - 3i\sin\theta}\right) = 0\right\}$. Then $\sum_{\theta \in A} \theta^2$ is equal to:

(1) $\frac{27}{4}\pi^2$
(2) $\frac{21}{4}\pi^2$
(3) $6\pi^2$
(4) $8\pi^2$

Section - B

21. Let the area of the bounded region $\{(x, y) : 0 \leq 9x \leq y^2, y \geq 3x - 6\}$ be A. Then $6A$ is equal to:

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22. Let r be the radius of the circle, which touches the x-axis at point $(a, 0)$, $a < 0$ and the parabola $y^2 = 9x$ at the point $(4, 6)$. Then r is equal to:

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23. Let the domain of the function $f(x) = \cos^{-1}\left(\frac{4x+5}{3x-7}\right)$ be $[\alpha, \beta]$ and the domain of $g(x) = \log_2(2 - 6\log_2(2x + 5))$ be (γ, δ). Then $|7(\alpha + \beta) + 4(\gamma + \delta)|$ is equal to:

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24. Let the area of the triangle formed by the lines $\frac{x+2}{-3} = \frac{y-3}{3} = \frac{z-2}{1}$, $\frac{x-3}{5} = \frac{y}{-1} = \frac{z-1}{1}$ be A. Then A^2 is equal to:

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25. The product of the last two digits of $(1919)^{1919}$ is:
