JEE Main 2025 April 2 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 the image of the point $P(1,0,3)$ in the line joining the points $A(4,7,1)$ and $B(3,5,3)$ is $Q(\alpha,\beta,\gamma)$, then $\alpha+\beta+\gamma$ is equal to:

(1) 47/3 (2) 46/3 (3) 18 (4) 13

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2. Let $f:[1,\infty)\to[2,\infty)$ be a differentiable function, If $\int_1^x f(t)\,dt = 5xf(x) - x^5 - 9$ for all $x \geq 1$, then the value of $f(3)$ is :

(1) 18 (2) 32 (3) 22 (4) 26

3. The number of terms of an A.P. is even; the sum of all the odd terms is 24, the sum of all the even terms is 30 and the last term exceeds the first by $\frac{21}{2}$. Then the number of terms which are integers in the A.P. is:

(1) 4 (2) 10 (3) 6 (4) 8

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4. Let $A = \{1, 2, 3, \ldots, 10\}$ and R be a relation on A such that $R = \{(a, b) : a = 2b + 1\}$. Let $(a_1, a_2), (a_3, a_4), (a_5, a_6), \ldots, (a_k, a_{k+1})$ be a sequence of k elements of R such that the second entry of an ordered pair is equal to the first entry of the next ordered pair. Then the largest integer k, for which such a sequence exists, is equal to:

(1) 6 (2) 7 (3) 5 (4) 8

4. Continued. For maximum number of ordered pairs in the sequence, the second element of each ordered pair is given by:

$$\lambda - \frac{2r - 2}{2^{r-2}}$$

For maximum number of ordered pairs in such sequence:

$$\lambda - \frac{2r - 2}{2^{r-2}} = 1 \quad \text{or} \quad 2; \quad 1 \leq \lambda \leq 25$$

$$\lambda = 2^{r-1} \quad \text{or} \quad \lambda = 3 \times 2^{r-2}$$

Case 1: $\lambda = 2r - 1$

$$\lambda = 2, 2^2, 2^3, 2^4$$

$$r = 2, 3, 4, 5$$

Hence, the maximum value of r is 5 when $\lambda = 16$.
Case 2: $\lambda = 3 \times 2^{r-2}$

$$\lambda = 3, 6, 12, 24$$

$$r = 2, 3, 4, 5$$

The final maximum value of r is also 5 when $\lambda = 24$.

Quick Tip

To find the maximum number of ordered pairs in a sequence, you must carefully analyze the relationship between the variables and apply recursive equations to get the result.

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5. If the length of the minor axis of an ellipse is equal to one fourth of the distance between the foci, then the eccentricity of the ellipse is:

(1) $\frac{4}{\sqrt{17}}$ (2) $\frac{\sqrt{5}}{16}$ (3) $\frac{3}{\sqrt{19}}$ (4) $\frac{\sqrt{5}}{7}$

6. The line L_1 is parallel to the vector $\mathbf{a} = -3\hat{i} + 2\hat{j} + 4\hat{k}$ and passes through the point $(7, 6, 2)$, and the line L_2 is parallel to the vector $\mathbf{b} = 2\hat{i} + \hat{j} + 3\hat{k}$ and passes through the point $(5, 3, 4)$. The shortest distance between the lines L_1 and L_2 is:

(1) $\frac{23}{\sqrt{38}}$ (2) $\frac{21}{\sqrt{57}}$ (3) $\frac{23}{\sqrt{57}}$ (4) $\frac{21}{\sqrt{38}}$

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7. Let (a, b) be the point of intersection of the curve $x^2 = 2y$ and the straight line $y = 2x - 6$ in the second quadrant. Then the integral

$$I = \int_a^b \frac{9x^2}{1 + 5x^3}\, dx$$

is equal to:

(1) 24 (2) 27 (3) 18 (4) 21

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8. If the system of equation

$$2x + \lambda y + 3z = 53x + 2y - z = 74x + 5y + \mu z = 9$$

has infinitely many solutions, then $\lambda^2 + \mu^2$ is equal to:

(1) 22 (2) 18 (3) 26 (4) 30

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9. If $\theta \in \left[\frac{7\pi}{6}, \frac{4\pi}{3}\right]$, then the number of solutions of

$$\sqrt{3}\csc^2\theta - 2(\sqrt{3} - 1)\csc\theta - 4 = 0,$$

is equal to:

(1) 6 (2) 8 (3) 10 (4) 7

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10. Given three identical bags each containing 10 balls, whose colours are as follows:

Bag I	3 Red	2 Blue	5 Green
Bag II	4 Red	3 Blue	3 Green
Bag III	5 Red	1 Blue	4 Green

A person chooses a bag at random and takes out a ball. If the ball is Red, the probability that it is from Bag I is p and if the ball is Green, the probability that it is from Bag III is q, then the value of $\frac{1}{p} + \frac{1}{q}$ is:

(1) 6 (2) 9 (3) 7 (4) 8

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11. If the mean and the variance of 6, 4, 8, 8, b, 12, 10, 13 are 9 and 9.25 respectively, then $a + b + ab$ is equal to:

(1) 105 (2) 103 (3) 100 (4) 106

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12. If the domain of the function $f(x) = \frac{1}{\sqrt{10+3x-x^2}}$ is (a, b), then $(1 + a)^2 + b$ is equal to:

(1) 26 (2) 29 (3) 25 (4) 30

13.

$$\int \frac{1}{\sqrt{3+x^2}+\sqrt{1+x^2}}\,dx - 3\log\left(\sqrt{3}\right)$$

is equal to:

(1) $2+\sqrt{2}+\log\left(1+\sqrt{2}\right)$ (2) $2-\sqrt{2}-\log\left(1+\sqrt{2}\right)$
(3) $2+\sqrt{2}-\log\left(1+\sqrt{2}\right)$ (4) $2-\sqrt{2}+\log\left(1+\sqrt{2}\right)$

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14. If $\lim_{x\to 0} \frac{\cos(2x)+a\cos(4x)-b}{x^4}$ is finite, then $(a + b)$ is equal to:

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

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15. If $\sum_{r=0}^{10} \left(10^{r+1} - 1\right) \binom{10}{r} = \alpha^{11} - 1$, then α is equal to :

(1) 15 (2) 11 (3) 24 (4) 20

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16. The number of ways, in which the letters A, B, C, D, E can be placed in the 8 boxes of the figure below so that no row remains empty and at most one letter can be placed in a box, is:

(1) 5880 (2) 960 (3) 840 (4) 5760

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17. Let the point P of the focal chord PQ of the parabola $y^2 = 16x$ be $(1, -4)$. If the focus of the parabola divides the chord PQ in the ratio $m : n$, $\gcd(m, n) = 1$, then m^2+n^2 is equal to:

(1) 17 (2) 10 (3) 37 (4) 26

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18. Let $\mathbf{a} = 2\hat{i} - 3\hat{j} + \hat{k}$, $\mathbf{b} = 3\hat{i} + 2\hat{j} + 5\hat{k}$ and a vector $\mathbf{c}$ be such that $(\mathbf{a} - \mathbf{c}) \times \mathbf{b} = -18\hat{i} - 3\hat{j} + 12\hat{k}$ and $\mathbf{a} \cdot \mathbf{c} = 3$. If $\mathbf{b} \times \mathbf{c} = \mathbf{a}$, then $|\mathbf{a} \cdot \mathbf{c}|$ is equal to:

(1) 18 (2) 12 (3) 9 (4) 15

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19. Let the area of the triangle formed by a straight line $L : x + by + c = 0$ with co-ordinate axes be 48 square units. If the perpendicular drawn from the origin to the line L makes an angle of $45°$ with the positive x-axis, then the value of $b^2 + c^2$ is:

(1) 90 (2) 93 (3) 97 (4) 83

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20. Let A be a 3×3 real matrix such that $A^2(A - 2I) - 4(A - I) = O$, where I and O are the identity and null matrices, respectively. If $A^3 = \alpha A^2 + \beta A + \gamma I$, where α, β, and γ are real constants, then $\alpha + \beta + \gamma$ is equal to:

(1) 12 (2) 20 (3) 76 (4) 4

SECTION-B

21. Let $y = y(x)$ be the solution of the differential equation

$$\frac{dy}{dx} + 2y \sec^2 x = 2 \sec^2 x + 3 \tan x \sec^2 x$$

such that $y(0) = \frac{5}{4}$. Then $12 \left(y \left(\frac{\pi}{4} \right) - e^2 \right)$ is equal to:

(1) 21 (2) 22 (3) 20 (4) 25

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22. If the sum of the first 10 terms of the series

$$\frac{4.1}{1 + 4.1^4} + \frac{4.2}{1 + 4.2^4} + \frac{4.3}{1 + 4.3^4} + \cdots$$

is $\frac{m}{n}$, where $\gcd(m, n) = 1$, then $m + n$ is equal to ....

(1) 15 (2) 24 (3) 41 (4) 76

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23. If $y = \cos\left(\frac{\pi}{3} + \cos^{-1}\frac{x}{2}\right)$, then $(x-y)^2 + 3y^2$ is equal to ______.

(1) 6 (2) 8 (3) 3 (4) 7

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24. Let $A(4,-2), B(1,1)$ and $C(9,-3)$ be the vertices of a triangle ABC. Then the maximum area of the parallelogram AFDE, formed with vertices D, E and F on the sides BC, CA and AB of the triangle ABC respectively, is ______.

(1) 4 (2) 6 (3) 3 (4) 9

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25. If the set of all $a \in R \setminus \{1\}$, for which the roots of the equation $(1-a)x^2 + 2(a-3)x + 9 = 0$ are positive is $(-\infty, -\alpha] \cup [\beta, \gamma]$, then $2\alpha + \beta + \gamma$ is equal to ....

(1) 7 (2) 10 (3) 3 (4) 9
