JEE Main January 2026

Question Paper With Text Solution

21 January | Shift-2

MATHEMATICS

MATRIX

JEE Main & Advanced | XI-XII Foundation| VI-X Pre-Foundation

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JEE MAIN JANUARY 2026 | 21TH JANUARY SHIFT-2

SECTION – A

Question ID : 860654843

1. Let $f : R \to R$ be a twice differentiable function such that $f''(x) > 0$ for all $x \in R$ and $f'(a-1) = 0$, where a is a real number, Let $g(x) = f(\tan^2 x - 2\tan x + a)$, $0 < x < \frac{\pi}{2}$.

Consider the following two statements :

(I) g is increasing in $\left(0, \frac{\pi}{4}\right)$

(II) g is decreasing in $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$

Then,

(1) Only (I) is True

(2) Both (I) and (II) are True

(3) Neither (I) nor (II) is True

(4) Only (II) is True

Ans. Official answer NTA (3)

Sol.

Question ID : 860654832

2. Let a, $\frac{a_2}{2}, \frac{a_3}{2^2}, \ldots, \frac{a_{10}}{2^9}$ be a G.P. of common ratio $\frac{1}{\sqrt{2}}$. If $a_1 + a_2 + \ldots\ldots + a_{10} = 62$, then a_1 is equal to :

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

Ans. Official answer NTA (3)

Sol.

Question ID : 860654833

3. Let $A = \{x : |x^2 - 10| \le 6\}$ and $B = \{x : |x-2| > 1\}$. Then :

(1) $A \cap B = [-4,-2] \cup [3,4]$ (2) $A \cup B = (-\infty, 1] \cup (2, \infty)$

(3) $A - B = [2,3)$ (4) $B - A = (-\infty,-4) \cup (-2,1) \cup (4,\infty)$

Ans. Official answer NTA (4)

Sol.

Question ID : 860654831

4. If the system of equations

$3x + y + 4z = 3$

$2x + \alpha y - z = -3$

$x + 2y + z = 4$

has no solution, then the value of α is equal to : :

(1) 4 (2) 19 (3) 23 (4) 13

Ans. Official answer NTA (2)

Sol.

Question ID : 860654827

5. Let z be the complex number satisfying $|z-5| \le 3$ and having maximum positive principal argument. Then

$34\left|\frac{5z-12}{5iz+16}\right|^2$ is equal to :

(1) 16 (2) 20 (3) 12 (4) 26

Ans. Official answer NTA (2)

Sol.

Question ID : 860654844

6. Let $y = y(x)$ be the solution of the differential equation $\sec x \frac{dy}{dx} - 2y = 2 + 3\sin x$, $x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$, $y(0) = -\frac{7}{4}$.

Then $y\left(\frac{\pi}{6}\right)$ is equal to :

(1) $-3\sqrt{3} - 7$ (2) $-\frac{5}{4}$ (3) $-\frac{5}{2}$ (4) $-3\sqrt{2} - 7$

Ans. Official answer NTA (3)

Sol.

Question ID : 860654826

7. Let A = {2, 3, 5, 7, 9}. Let R be the relation on A defined by xRy if and only if $2x \le 3y$. 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 symmetric relation. Then $l + m$ is equal to :

(1) 23 (2) 21 (3) 27 (4) 25

Ans. Official answer NTA (4)

Sol.

Question ID : 860654838

8. If the line $\alpha x + 4y = \sqrt{7}$, where $\alpha \in R$, touches the ellipse $3x^2 + 4y^2 = 1$ at the point P in the first quadrant, then one of the focal distances of P is :

(1) $\frac{1}{\sqrt{3}} - \frac{1}{2\sqrt{5}}$ (2) $\frac{1}{\sqrt{3}} + \frac{1}{2\sqrt{7}}$ (3) $\frac{1}{\sqrt{3}} - \frac{1}{2\sqrt{11}}$ (4) $\frac{1}{\sqrt{3}} + \frac{1}{2\sqrt{5}}$

Ans. Official answer NTA (2)

Sol.

Question ID : 860654839

9. Let the line L pass through the point (–3, 5, 2) and make equal angles with the positive coordinate axes. If the distance of L from the point (–2, r, 1) is $\sqrt{\frac{14}{3}}$, then the sum of all possible values of r is :

(1) 12 (2) 6 (3) 10 (4) 16

Ans. Official answer NTA (3)

Sol.

Question ID : 860654840

10. Let the line L_1 be parallel to the vector $-3\hat{i} + 2\hat{j} + 4\hat{k}$ and pass through the point (2, 6, 7), and the line L_2 be parallel to the vector $2\hat{i} + \hat{j} + 3\hat{k}$ and pass through the point (4, 3, 5). If the line L_3 is parallel to the vector $-3\hat{i} + 5\hat{j} + 16\hat{k}$ and intersects the lines L_1 and L_2 at the points C and D, respectively, then $\left|\overrightarrow{CD}\right|^2$ is equal to :

(1) 171 (2) 312 (3) 89 (4) 290

Ans. Official answer NTA (4)

Sol.

Question ID : 860654842

11. Let $f(x) = x^3 + x^2 f'(1) + 2x f''(2) + f'''(3)$, $x \in R$. Then the value of $f'(5)$:

(1) $\frac{117}{5}$ (2) $\frac{62}{5}$ (3) $\frac{657}{5}$ (4) $\frac{2}{5}$

Ans. Official answer NTA (1)

Sol.

Question ID : 860654834

12. The largest $n \in N$, for which 7^n divides 101!, is :

(1) 16 (2) 18 (3) 15 (4) 19

Ans. Official answer NTA (1)

Sol.

Question ID : 860654841

13. For a triangle ABC, let $\vec{p} = \overrightarrow{BC}, \vec{q} = \overrightarrow{CA}$ and $\vec{r} = \overrightarrow{BA}$. If $|\vec{p}| = 2\sqrt{3}, |\vec{q}| = 2$ and $\cos\theta = \frac{1}{\sqrt{3}}$, where θ, is the angle between $\vec{p}$ and $\vec{q}$, then $|\vec{p} \times (\vec{q} - 3\vec{r})|^2 + 3|\vec{r}|^2$ is equal to :

(1) 340 (2) 410 (3) 200 (4) 220

Ans. Official answer NTA (3)

Sol.

Question ID : 860654829

14. Let α and β be the roots of the equation $x^2 + 2ax + (3a + 10) = 0$ such that $\alpha < 1 < \beta$. Then the set of all possible values of α is :

(1) $(-\infty, -3)$ (2) $(-\infty, -2) \cup (5, \infty)$

(3) $\left(-\infty, -\frac{11}{5}\right) \cup (5, \infty)$ (4) $\left(-\infty, -\frac{11}{5}\right)$

Ans. Official answer NTA (4)

Sol.

Question ID : 860654836

15. Let one end of a focal chord of the parabola $y^2 = 16x$ be (16, 16). If $P(\alpha, \beta)$ divides this focal chord internally in the ratio 5 : 2, then the minimum value of $\alpha + \beta$ is equal to :

(1) 22 (2) 7 (3) 5 (4) 16

Ans. Official answer NTA (2)

Sol.

Question ID : 860654828

16. The positive integer n, for which the solutions of the equation $x(x+2) + (x+2)(x+4) + ... + (x+2n-2)(x+2n) = = \frac{8n}{3}$ are two consecutive even integers, is :

(1) 6 (2) 9 (3) 12 (4) 3

Ans. Official answer NTA (4)

Sol.

Question ID : 860654835

17. A random variable X takes values 0, 1, 2, 3 with probabilities $\frac{2a+1}{30}, \frac{8a-1}{30}, \frac{4a+1}{30}$, b respectively, where a, b $\in$ R. Let μ and σ respectively be the mean and standard deviation of X such that $\sigma^2 + \mu^2 = 2$. Then $\frac{a}{b}$ is equal to :

(1) 60 (2) 3 (3) 12 (4) 30

Ans. Official answer NTA (1)

Sol.

Question ID : 860654837

18. Let $y^2 = 12x$ be the parabola with its vertex at O . Let P be a point on the parabola and A be a point on the x-axis such that $\angle OPA = 90°$. Then the locus of the centroid of such triangles OPA is :

(1) $y^2 - 6x + 4 = 0$ (2) $y^2 - 4x + 8 = 0$ (3) $y^2 - 2x + 8 = 0$ (4) $y^2 - 9x + 6 = 0$

Ans. Official answer NTA (3)

Sol.

Question ID : 860654830

19. For the matrices $A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} -29 & 49 \\ -13 & 18 \end{bmatrix}$, if $(A^{15} + B)\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$, then among the following which one is true :

(1) x = 11, y = 2 (2) x = 18, y = 11 (3) x = 5, y = 7 (4) x = 16, y = 3

Ans. Official answer NTA (1)

Sol.

Question ID : 860654845

20. If the area of the region $\{(x, y) : 1 - 2x \le y \le 4 - x^2, x \ge 0, y \ge 0\}$ is $\frac{\alpha}{\beta}, \alpha, \beta \in N$, gcd $(\alpha, \beta) = 1$, then the value of $(\alpha + \beta)$ is :

(1) 67 (2) 91 (3) 85 (4) 73

Ans. Official answer NTA (4)

Sol.

SECTION – B

Question ID : 860654849

21. Let [•] denote the greatest integer function and $f(x) = \lim_{n\to\infty} \frac{1}{n^3} \sum_{k=1}^{n} \left[\frac{k^2}{3^x}\right]$. Then $12\sum_{j=1}^{\infty} f(j)$ is equal to _____.

Ans. Official answer NTA (2)

Sol.

Question ID : 860654846

22. If $\left(\frac{1}{{}^{15}C_0}+\frac{1}{{}^{15}C_1}\right)\left(\frac{1}{{}^{15}C_1}+\frac{1}{{}^{15}C_2}\right)\cdots\left(\frac{1}{{}^{15}C_{12}}+\frac{1}{{}^{15}C_{13}}\right)=\frac{\alpha^{13}}{{}^{14}C_0\,{}^{14}C_1\cdots{}^{14}C_{12}}$, then 30α is equal to _____.

Ans. Official answer NTA (32)

Sol.

Question ID : 860654848

23. Let the maximum value of $\left(\sin^{-1}x\right)^2+\left(\cos^{-1}x\right)^2$ for $x\in\left[-\frac{\sqrt{3}}{2},\frac{1}{\sqrt{2}}\right]$ be $\frac{m}{n}\pi^2$, where gcd (m, n) = 1.

There m + n is equal to _____.

Ans. Official answer NTA (65)

Sol.

Question ID : 860654850

24. If $\int_0^1 4\cot^{-1}\left(1-2x+4x^2\right)dx=a\tan^{-1}(2)-b\log_e(5)$, where a, b ∈ N, then (2a + b) is equal to _____.

Ans. Official answer NTA (9)

Sol.

Question ID : 860654847

25. If P is a point on the circle $x^2+y^2=4$, Q is a point on the straight line $5x+y+2=0$ and $x-y+1=0$ is the perpendicular bisector of PQ, then 13 times the sum of abscissas of all such points P is _____.

Ans. Official answer NTA (2)

Sol.