JEE Main January 2026

Question Paper With Text Solution

28 January | Shift-1

MATHEMATICS

JEE MAIN JANUARY 2026 | 28ᵀᴴ JANUARY SHIFT-1

SECTION – A

Question ID : 444792691

1. Let f be a polynomial function such that $f\left(x^2 + 1\right) = x^4 + 5x^2 + 2$, for all $x \in \mathbb{R}$.

   Then $\int_0^3 f(x)dx$ is equal to

   (1) $\dfrac{27}{2}$ (2) $\dfrac{33}{2}$ (3) $\dfrac{5}{3}$ (4) $\dfrac{41}{3}$

Ans. Official answer NTA (2)

Sol.

Question ID : 444792684

2. Let $S = \{1,2,3,4,5,6,7,8,9\}$. Let x be the number of 9-digit numbers formed using the digits of the set S such that only one digit is repeated and it is repeated exactly twice. Let y be the number of 9–digit numbers formed using the digits of the set S such that only two digits are repeated and each of these is repeated exactly twice. Then :

   (1) $56x = 9y$ (2) $29x = 5y$ (3) $21x = 4y$ (4) $45x = 7y$

Ans. Official answer NTA (3)

Sol.

Question ID : 444792694

3. Let $y = y(x)$ be the solution of the differential equation $x\dfrac{dy}{dx} - \sin 2y = x^3\left(2 - x^3\right)\cos^2 y, x \neq 0$. If $y(2)=0$, then $\tan(y(1))$ is equal to :

   (1) $-\dfrac{3}{4}$ (2) $\dfrac{7}{4}$ (3) $-\dfrac{7}{4}$ (4) $\dfrac{3}{4}$

Ans. Official answer NTA (2)

Sol.

Question ID : 444792680

4. Let A, B and C be three 2×2 matrices with real entries such that $B = (I + A)^{-1}$ and $A + C = I$. If

$BC = \begin{bmatrix} 1 & -5 \\ -1 & 2 \end{bmatrix}$ and $CB \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 12 \\ -6 \end{bmatrix}$, then $x_1 + x_2$ is :

(1) –2   (2) 2   (3) 4   (4) 0

Ans. Official answer NTA (4)

Sol.

Question ID : 444792690

5. The value of $\sum_{k=1}^{\infty} (-1)^{k+1} \left(\frac{k(k+1)}{k!} \right)$ is :

(1) 1/e   (2) 2/e   (3) $\sqrt{e}$ (4) e/2

Ans. Official answer NTA (1)

Sol.

Question ID : 444792682

6. A bag contains 10 balls out of which k are red and (10 –k) are black, where $0 \le k \le 10$. If three balls are drawn at random without replacement and all of them are found to be black, then the probability that the bag contains 1 red and 9 black balls is :

(1) $\frac{14}{55}$ (2) $\frac{7}{55}$ (3) $\frac{7}{110}$ (4) $\frac{7}{11}$

Ans. Official answer NTA (1)

Sol.

Question ID : 444792679

7. Let z be a complex number such that $|z - 6| = 5$ and $|z + 2 - 6i| = 5$. Then the value of $z^3 + 3z^2 - 15z + 141$ is equal to :

(1) 50   (2) 42   (3) 37   (4) 61

Ans. Official answer NTA (1)

Sol.

Question ID : 444792677

8. If $g(x) = 3x^2 + 2x - 3, f(0) = -3$ and $4g(f(x)) = 3x^2 - 32x + 72$, then $f(g(2))$ is equal to :

(1) $-\dfrac{7}{2}$ (2) $\dfrac{7}{2}$ (3) $-\dfrac{25}{6}$ (4) $\dfrac{25}{6}$

Ans. Official answer NTA (2)

Sol.

Question ID : 444792689

9. For three unit vectors $\vec{a}, \vec{b}, \vec{c}$ satisfying $|\vec{a} - \vec{b}|^2 + |\vec{b} - \vec{c}|^2 + |\vec{c} - \vec{a}|^2 = 9$ and $|2\vec{a} + k\vec{b} + k\vec{c}| = 3$, the positive value of k is :

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

Ans. Official answer NTA (3)

Sol.

Question ID : 444792687

10. If $\dfrac{\tan(A - B)}{\tan A} + \dfrac{\sin^2 C}{\sin^2 A} = 1, A, B, C \in \left(0, \dfrac{\pi}{2}\right)$, then :

(1) tanA, tanC, tanB, are in A.P.

(2) tanA, tanC, tanB, are in G.P.

(3) tanA, tanB, tanC, are in G.P.

(4) tanA, tanB, tanC, are in A.P.

Ans. Official answer NTA (2)

Sol.

Question ID : 444792681

11. The common difference of the A.P.: $a_1, a_2, \ldots, a_m$ is 13 more than the common difference of the A.P.: $b_1, b_2, \ldots, b_n$. If $b_{31} = -277, b_{43} = -385$ and $a_{78} = 327$, then a_1 is equal to :

(1) 24   (2) 21   (3) 16   (4) 19

Ans. Official answer NTA (4)

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Sol.

Question ID : 444792692

12. The area of the region $R = \left\{(x, y) : xy \le 8, 1 \le y \le x^2, x \ge 0\right\}$ is :

(1) $\frac{2}{3}\left(24\log_e(2) - 7\right)$

(2) $\frac{1}{3}\left(40\log_e(2) + 27\right)$

(3) $\frac{1}{3}\left(49\log_e(2) - 15\right)$

(4) $\frac{2}{3}\left(20\log_e(2) + 9\right)$

Ans. Official answer NTA (1)

Sol.

Question ID : 444792685

13. Let ABC be an equilateral triangle with orthocenter at the origin and the side BC on the line $x + 2\sqrt{2}y = 4$. If the co-ordinates of the vertex A are (α, β), then the greatest integer less than or equal to $\left|\alpha + \sqrt{2}\beta\right|$ is :

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

Ans. Official answer NTA (4)

Sol.

Question ID : 444792695

14. If $\int\left(\frac{1 - 5\cos^2 x}{\sin^5 x\cos^2 x}\right)dx = f(x) + C$, where C is the constant of integration, then $f\left(\frac{\pi}{6}\right) - f\left(\frac{\pi}{4}\right)$ is equal to :

(1) $\frac{4}{\sqrt{3}}(8 - \sqrt{6})$ (2) $\frac{1}{\sqrt{3}}(26 - \sqrt{3})$ (3) $\frac{1}{\sqrt{3}}(26 + \sqrt{3})$ (4) $\frac{2}{\sqrt{3}}(4 + \sqrt{6})$

Ans. Official answer NTA (1)

Sol.

Question ID : 444792688

15. If the distances of the point (1,2, a) from the line $\dfrac{x-1}{1} = \dfrac{y}{2} = \dfrac{z-1}{1}$ along the lines $L_1 : \dfrac{x-1}{3} = \dfrac{y-2}{4} = \dfrac{z-a}{b}$

and $L_2 : \dfrac{x-1}{1} = \dfrac{y-2}{4} = \dfrac{z-a}{c}$ are equal, then a + b + c is equal to :

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

Ans. Official answer NTA (4)

Sol.

Question ID : 444792693

16. The value of $\lim\limits_{x \to 0} \dfrac{\log_e \left(\sec(ex) \cdot \sec\left(e^2 x\right) \cdot \ldots \cdot \sec\left(e^{10} x\right) \right)}{e^2 - e^{2\cos x}}$ is equal to :

(1) $\dfrac{\left(e^{20} - 1\right)}{2\left(e^2 - 1\right)}$ (2) $\dfrac{\left(e^{10} - 1\right)}{2\left(e^2 - 1\right)}$ (3) $\dfrac{\left(e^{10} - 1\right)}{2e^2 \left(e^2 - 1\right)}$ (4) $\dfrac{\left(e^{20} - 1\right)}{2e^2 \left(e^2 - 1\right)}$

Ans. Official answer NTA (1)

Sol.

Question ID : 444792683

17. The mean and variance of 10 observations are 9 and 34.2 , respectively. If 8 of these observations are 2,3,5,10,11,13,15,21, then the mean deviation about the median of all the 10 observations is :

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

Ans. Official answer NTA (4)

Sol.

Question ID : 444792678

18. If α, β, where $\alpha < \beta$, are the roots of the equation $\lambda x^2 - (\lambda + 3)x + 3 = 0$ such that $\dfrac{1}{\alpha} - \dfrac{1}{\beta} = \dfrac{1}{3}$, then the sum

of all possible values of λ is :

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

Ans. Official answer NTA (3)

Sol.

Question ID : 444792686

19. Let y = x be the equation of a chord of the circle C_1 (in the closed half-plane $x \geq 0$) of diameter 10 passing through the origin. Let C_2 be another circle described on the given chord as its diameter. If the equation of the chord of the circle C_2, which passes through the point (2, 3) and is farthest from the center of C_2, is $x + a\,y + b = 0$, then a – b is equal to :

   (1) –6   (2) –2   (3) 6   (4) 10

Ans. Official answer NTA (2)

Sol.

Question ID : 444792676

20. Let $S = \left\{ x^3 + ax^2 + bx + c : a, b, c \in N \ \text{ and } \ a, b, c \leq 20 \right\}$ be a set of polynomials. Then the number of polynomials in S, which are divisible by $x^2 + 2$, is :

   (1) 10   (2) 120   (3) 20   (4) 6

Ans. Official answer NTA (1)

Sol.

SECTION – B

Question ID : 444792696

21. In a G.P., if the product of the first three terms is 27 and the set of all possible values for the sum of its first three terms is $\mathbb{R} - (a, b)$, then $a^2 + b^2$ is equal to _____.

Ans. Official answer NTA (90)

Sol.

Question ID : 444792700

22. For some $\theta \in \left(0, \dfrac{\pi}{2} \right)$, let the eccentricity and the length of the latus rectum of the hyperbola $x^2 - y^2 \sec^2 \theta = 8$ be e_1 and l_1, respectively, and let the eccentricity and the length of the latus rectum of the ellipse $x^2 \sec^2 \theta + y^2 = 6$ be e_2 and l_2, respectively. If $e_1^2 = e_2^2 \left(\sec^2 \theta + 1 \right)$, then $\left(\dfrac{l_1 l_2}{e_1 e_2} \right) \tan^2 \theta$ is equal to _____.

Ans. Official answer NTA (8)

Sol.

Question ID : 444792699

23. The value of $\sum_{r=1}^{20}\left(\left|\sqrt{\pi\left(\int_0^r x\,|\sin \pi x|\,dx\right)}\right|\right)$ is _____.

Ans. Official answer NTA (210)

Sol.

Question ID : 444792697

24. If $k = \tan\left(\dfrac{\pi}{4}+\dfrac{1}{2}\cos^{-1}\left(\dfrac{2}{3}\right)\right)+\tan\left(\dfrac{1}{2}\sin^{-1}\left(\dfrac{2}{3}\right)\right)$, then the number of solutions of the equation

$\sin^{-1}(kx-1) = \sin^{-1} x - \cos^{-1} x$ is _____.

Ans. Official answer NTA (1)

Sol.

Question ID : 444792698

25. Let PQR be a triangle such that $\overrightarrow{PQ} = -2\hat{i}-\hat{j}+2\hat{k}$ and $\overrightarrow{PR} = a\hat{i}+b\hat{j}-4\hat{k}, a, b \in Z$. Let S be the point on QR , which is equidistant from the lines PQ and PR . If $|\overrightarrow{PR}|= 9$ and $\overrightarrow{PS} = \hat{i}-7\hat{j}+2\hat{k}$, then the value of $3a - 4b$ is _____.

Ans. Official answer NTA (37)

Sol.

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