FINAL JEE–MAIN EXAMINATION – SEPTEMBER, 2020

(On Thursday 03rd SEPTEMBER, 2020) TIME : 9 AM to 12 PM

MATHEMATICS

TEST PAPER WITH ANSWER

1. A die is thrown two times and the sum of the scores appearing on the die is observed to be a multiple of 4. Then the conditional probability that the score 4 has appeared atleast once is :

(1) $\frac{1}{8}$ (2) $\frac{1}{9}$

(3) $\frac{1}{3}$ (4) $\frac{1}{4}$

Official Ans. by NTA (2)

2. The lines

$\vec{r} = (\hat{i} - \hat{j}) + \ell(2\hat{i} + \hat{k})$ and

$\vec{r} = (2\hat{i} - \hat{j}) + m(\hat{i} + \hat{j} - \hat{k})$

(1) Intersect when $\ell = 1$ and $m = 2$

(2) Intersect when $\ell = 2$ and $m = \frac{1}{2}$

(3) Do not intersect for any values of ℓ and m

(4) Intersect for all values of ℓ and m

Official Ans. by NTA (3)

3. The foot of the perpendicular drawn from the point (4, 2, 3) to the line joining the points (1, –2, 3) and (1, 1, 0) lies on the plane :

(1) $x + 2y - z = 1$ (2) $x - 2y + z = 1$

(3) $x - y - 2z = 1$ (4) $2x + y - z = 1$

Official Ans. by NTA (4)

4. A hyperbola having the transverse axis of length $\sqrt{2}$ has the same foci as that of the ellipse $3x^2 + 4y^2 = 12$, then this hyperbola does not pass through which of the following points ?

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

(3) $\left(\frac{1}{\sqrt{2}}, 0\right)$ (4) $\left(-\sqrt{\frac{3}{2}}, 1\right)$

Official Ans. by NTA (2)

5. The area (in sq. units) of the region

$\{(x, y) : 0 \le y \le x^2 + 1, 0 \le y \le x + 1, \frac{1}{2} \le x \le 2\}$ is :

(1) $\frac{79}{16}$ (2) $\frac{23}{6}$

(3) $\frac{79}{24}$ (4) $\frac{23}{16}$

Official Ans. by NTA (3)

6. If the first term of an A.P. is 3 and the sum of its first 25 terms is equal to the sum of its next 15 terms, then the common difference of this A.P. is :

(1) $\frac{1}{4}$ (2) $\frac{1}{5}$

(3) $\frac{1}{7}$ (4) $\frac{1}{6}$

Official Ans. by NTA (4)

7. Let P be a point on the parabola, $y^2 = 12x$ and N be the foot of the perpendicular drawn from P on the axis of the parabola. A line is now drawn through the mid-point M of PN, parallel to its axis which meets the parabola at Q. If the y-intercept of the line NQ is $\frac{4}{3}$, then :

(1) MQ = $\frac{1}{3}$ (2) PN = 3

(3) MQ = $\frac{1}{4}$ (4) PN = 4

Official Ans. by NTA (3)

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8. For the frequency distribution :

Variate (x) : x_1 x_2 x_3 .....x_{15}

Frequency (f) : f_1 f_2 f_3 ....f_{15}

where $0 < x_1 < x_2 < x_3 < .... < x_{15} = 10$ and $\sum_{i=1}^{15} f_i > 0$, the standard deviation cannot be :

(1) 2 (2) 1

(3) 4 (4) 6

Official Ans. by NTA (4)

9. $\int_{-\pi}^{\pi} \left|\pi - |x|\right| dx$ is equal to :

(1) π^2 (2) $2\pi^2$

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

Official Ans. by NTA (1)

10. Consider the two sets :

$A = \{m \in R$: both the roots of $x^2 - (m + 1)x + m + 4 = 0$ are real$\}$ and

$B = [-3, 5)$.

Which of the following is not true ?

(1) $A - B = (-\infty, -3) \cup (5, \infty)$

(2) $A \cap B = \{-3\}$

(3) $B - A = (-3, 5)$

(4) $A \cup B = R$

Official Ans. by NTA (1)

11. If $y^2 + \log_e(\cos^2 x) = y$, $x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$, then :

(1) $|y''(0)| = 2$ (2) $|y'(0)| + |y''(0)| = 3$

(3) $|y'(0)| + |y''(0)| = 1$ (4) $y''(0) = 0$

Official Ans. by NTA (1)

12. The function, $f(x) = (3x - 7)x^{2/3}$, $x \in R$, is increasing for all x lying in :

(1) $(-\infty, 0) \cup \left(\frac{3}{7}, \infty\right)$

(2) $(-\infty, 0) \cup \left(\frac{14}{15}, \infty\right)$

(3) $\left(-\infty, \frac{14}{15}\right)$

(4) $\left(-\infty, -\frac{14}{15}\right) \cup (0, \infty)$

Official Ans. by NTA (2)

13. The value of $(2.{}^1P_0 - 3.{}^2P_1 + 4.{}^3P_2 - ....$ up to 51^{th} term) + (1! – 2! + 3! – ..... up to 51^{th} term) is equal to :

(1) 1 + (51)! (2) 1 – 51(51)!

(3) 1 + (52)! (4) 1

Official Ans. by NTA (3)

14. If $\Delta = \begin{vmatrix} x-2 & 2x-3 & 3x-4 \\ 2x-3 & 3x-4 & 4x-5 \\ 3x-5 & 5x-8 & 10x-17 \end{vmatrix} =$

$Ax^3 + Bx^2 + Cx + D$, then B + C is equal to :

(1) –1 (2) 1

(3) –3 (4) 9

Official Ans. by NTA (3)

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15. The solution curve of the differential equation, $(1 + e^{-x})(1 + y^2)\frac{dy}{dx} = y^2$, which passes through the point (0, 1), is :

(1) $y^2 = 1 + y \log_e\left(\frac{1+e^x}{2}\right)$

(2) $y^2 + 1 = y\left(\log_e\left(\frac{1+e^x}{2}\right)+2\right)$

(3) $y^2 = 1 + y \log_e\left(\frac{1+e^{-x}}{2}\right)$

(4) $y^2 + 1 = y\left(\log_e\left(\frac{1+e^{-x}}{2}\right)+2\right)$

Official Ans. by NTA (1)

16. If the number of integral terms in the expansion of $(3^{1/2} + 5^{1/8})^n$ is exactly 33, then the least value of n is :

(1) 264 (2) 256

(3) 128 (4) 248

Official Ans. by NTA (2)

17. If α and β are the roots of the equation $x^2 + px + 2 = 0$ and $\frac{1}{\alpha}$ and $\frac{1}{\beta}$ are the roots of the equation $2x^2 + 2qx + 1 = 0$, then $\left(\alpha-\frac{1}{\alpha}\right)\left(\beta-\frac{1}{\beta}\right)\left(\alpha+\frac{1}{\beta}\right)\left(\beta+\frac{1}{\alpha}\right)$ is equal to:

(1) $\frac{9}{4}(9 + p^2)$ (2) $\frac{9}{4}(9 - q^2)$

(3) $\frac{9}{4}(9 - p^2)$ (4) $\frac{9}{4}(9 + q^2)$

Official Ans. by NTA (3)

18. Let [t] denote the greatest integer $\le$ t. If for some $\lambda \in R - \{0, 1\}$, $\lim\limits_{x\to 0}\left|\frac{1-x+|x|}{\lambda - x + [x]}\right| = L$, then L is equal to :

(1) 1 (2) 2

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

Official Ans. by NTA (2)

19. $2\pi - \left(\sin^{-1}\frac{4}{5} + \sin^{-1}\frac{5}{13} + \sin^{-1}\frac{16}{65}\right)$ is equal to:

(1) $\frac{7\pi}{4}$ (2) $\frac{5\pi}{4}$

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

Official Ans. by NTA (3)

20. The proposition $p \to \sim (p \wedge \sim q)$ is equivalent to:

(1) $(\sim p) \vee q$ (2) q

(3) $(\sim p) \wedge q$ (4) $(\sim p) \vee (\sim q)$

Official Ans. by NTA (1)

21. Let $A = \begin{bmatrix} x & 1 \\ 1 & 0 \end{bmatrix}$, $x \in R$ and $A^4 = [a_{ij}]$. If $a_{11} = 109$, then a_{22} is equal to _____ .

Official Ans. by NTA (10)

22. If $\lim\limits_{x\to 0}\left\{\frac{1}{x^8}\left(1-\cos\frac{x^2}{2}-\cos\frac{x^2}{4}+\cos\frac{x^2}{2}\cos\frac{x^2}{4}\right)\right\} = 2^{-k}$, then the value of k is _____ .

Official Ans. by NTA (8)

23. The diameter of the circle, whose centre lies on the line x + y = 2 in the first quadrant and which touches both the lines x = 3 and y = 2, is _____ .

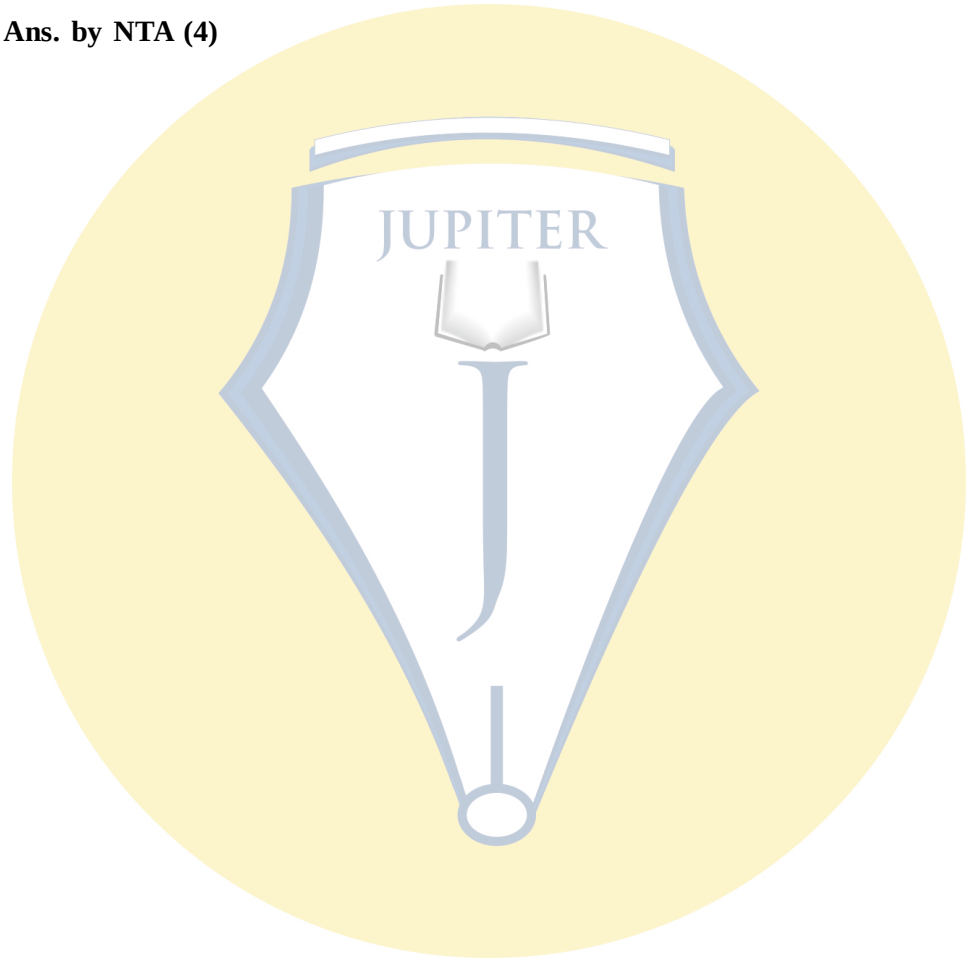
Official Ans. by NTA (3)

24. The value of $(0.16)^{\log_{2.5}\left(\frac{1}{3}+\frac{1}{3^2}+\frac{1}{3^3}+\ldots\text{to }\infty\right)}$ is equal to _____ .

Official Ans. by NTA (4)

25. If $\left(\frac{1+i}{1-i}\right)^{\frac{m}{2}}=\left(\frac{1+i}{i-1}\right)^{\frac{n}{3}}=1$, (m, n $\in$ N) then the greatest common divisor of the least values of m and n is _____ .

Official Ans. by NTA (4)



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