JEE MAIN Sample Paper Mathematics

Duration: 1 Hour **Maximum Marks: 100**

Instructions

1. This paper contains TWO sections: Section A and Section B.
2. Section A contains 20 Multiple Choice Questions (MCQs).
3. Section B contains 5 Numerical Value Questions.
4. All questions are compulsory.
5. Each correct answer carries **+4 marks**.
6. Each incorrect answer carries **-1 mark**.
7. No negative marking for unattempted questions.
8. Use $g = 9.8$ m/s^2 unless otherwise stated.

Section A — Multiple Choice Questions

Q1. Let $S = \{x \in \mathbb{R} : |x-2| > |x-3|\}$. Then S is given by: *[2024]*

(A) $(2.5, \infty)$
(B) $(-\infty, 2.5)$
(C) $(2, 3)$
(D) $(-\infty, 2) \cup (3, \infty)$

Q2. If $f(x) = \frac{x}{(1+x^n)^{1/n}}$ for $n \geq 2$ and $g(x) = (f \circ f \circ \cdots \circ f)(x)$ (f repeated n times), then $\int x^{n-2} g(x) dx$ is: *[2023]*

(A) $\frac{1}{n(n-1)}(1+nx^n)^{(n-1)/n} + C$
(B) $\frac{1}{n-1}(1+nx^n)^{(n-1)/n} + C$
(C) $\frac{1}{n(n+1)}(1+nx^n)^{(n+1)/n} + C$
(D) $\frac{1}{n^2}(1+nx^n)^{1/n} + C$

Q3. Value of c in Lagrange's MVT for $f(x) = \log_e x$ on $[1, e]$ is: *[2022]*

(A) $e - 1$
(B) $1/(e-1)$
(C) e
(D) 1

Q4. P on $x^2 + y^2 = 9$, Q on $7x + y + 50 = 0$. Minimum PQ: *[2025]*

(A) $5\sqrt{2} - 3$
(B) $10 - 3$
(C) $5\sqrt{2}$
(D) $3\sqrt{5}$

Q5. Number of solutions of $e^x = x^2$ is: *[2021]*

(A) 0
(B) 1
(C) 2
(D) 3

Q6. Vectors $\vec{a} = \hat{i} - \hat{j} + 2\hat{k}$, $\vec{b} = 2\hat{i} + 4\hat{j} + \hat{k}$, $\vec{c} = \lambda\hat{i} + \hat{j} + \mu\hat{k}$ mutually orthogonal. (λ, μ) is: *[2024]*

(A) $(-3, 2)$
(B) $(2, -3)$
(C) $(-2, 3)$
(D) $(3, -2)$

Q7. Probability leap year has 53 Sundays: *[2023]*

(A) 1/7
(B) 2/7
(C) 53/366
(D) 7/366

Q8. Plane containing line $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and point $(0, 0, 0)$: *[2022]*

(A) $x - 2y + z = 0$
(B) $x + 2y - 2z = 0$
(C) $2x + y - z = 0$
(D) $x - y + z = 0$

Q9. ω complex cube root of unity. Value of $\det \begin{bmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{bmatrix}$: *[2025]*

(A) 0
(B) 1
(C) 3
(D) ω

Q10. Eccentricity of ellipse $1/\sqrt{2}$, latus rectum = 10. Major axis: *[2021]*

(A) $20\sqrt{2}$
(B) $10\sqrt{2}$
(C) 20
(D) 15

Q11. $y = (x + \sqrt{x^2 + 1})^m$. Then $(x^2 + 1)y'' + xy' =$: *[2024]*

(A) m^2y
(B) $-m^2y$
(C) my
(D) 0

Q12. Sum of coefficients in $(1 - 3x + x^2)^{100}$: *[2023]*

(A) 1
(B) -1
(C) 3^{100}
(D) 0

Q13. Area bounded by $y = \sin x$ and $y = \cos x$ between $x = 0$ and $x = \pi/2$: *[2022]*

(A) $2\sqrt{2} - 2$
(B) $2\sqrt{2}$
(C) $\sqrt{2} - 1$
(D) $2(\sqrt{2} - 1)$

Q14. 5 boys, 3 girls in row, no two girls together. Number of ways: *[2025]*

(A) 14400
(B) 2400
(C) 720
(D) 120

Q15. Shortest distance between $y^2 = x - 1$ and $x^2 = y - 1$: *[2021]*

(A) $3\sqrt{2}/4$
(B) $3/(4\sqrt{2})$
(C) $1/\sqrt{2}$
(D) 0

Q16. If $\sin^{-1} x + \sin^{-1} y = \pi/2$, then dx/dy is: *[2024]*

(A) x/y

(B) $-y/x$

(C) $-x/y$

(D) $\sqrt{1-x^2}/\sqrt{1-y^2}$

Q17. $\lim_{x\to\infty}((x+6)/(x+1))^{x+4}$: *[2023]*

(A) e^5

(B) e^6

(C) e

(D) e^4

Q18. If $A^2 = I$, then $(A-I)^3 + (A+I)^3 - 7A$ is: *[2022]*

(A) A

(B) $I - A$

(C) $I + A$

(D) $3A$

Q19. Standard deviation of $6, 5, 9, 13, 12, 8, 10$: *[2025]*

(A) $\sqrt{52/7}$

(B) $52/7$

(C) 6

(D) 2

Q20. Image of point $(1, 2, 3)$ in plane $x + y + z = 12$: *[2024]*

(A) $(5, 6, 7)$

(B) $(3, 4, 5)$

(C) $(1, 2, 3)$

(D) $(2, 4, 6)$

Section B — Numerical Value Questions

Q21. System $x + y + z = 2$, $2x + 4y - z = 6$, $3x + 2y + \lambda z = \mu$ has infinitely many solutions. Find $\lambda + \mu$. *[2024]*

Q22. Number of points of non-differentiability of $f(x) = \max\{|x-1|, |x-2|, |x-3|\}$. *[2023]*

Q23. $A = \{1, 2, 3, 4\}$. Number of derangements $f : A \to A$ such that $f(i) \neq i$ for all i. *[2025]*

Q24. Line $y = mx + 1$ tangent to $y^2 = 4x$. Find m. *[2022]*

Q25. Sum of intercepts of plane through $(1, 2, 3)$ parallel to $x + 2y + 3z = 14$. *[2021]*

Answer Key

Section A

1.(A)	2.(A)	3.(A)	4.(A)	5.(B)
6.(A)	7.(B)	8.(A)	9.(A)	10.(A)
11.(A)	12.(B)	13.(D)	14.(A)	15.(B)
16.(C)	17.(A)	18.(A)	19.(A)	20.(A)

Section B

21. 15	22. 2	23. 9	24. 1	25. 25.66