# 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.** If $f(x) = \begin{cases} \frac{\sin(a+1)x+\sin x}{x} & x<0 \\ c & x=0 \\ \frac{\sqrt{x+bx^2}-\sqrt{x}}{bx^{3/2}} & x>0 \end{cases}$ is continuous at $x=0$, then $(a,b,c)$ is: *[2024]*

(A) $(-3/2, \text{any}, 1/2)$

(B) $(-3/2, \text{any}, -1/2)$

(C) $(-5/2, \text{any}, 0)$

(D) $(-3/2, 1, -3/2)$

**Q2.** The value of $\int_0^1 \frac{8\log(1+x)}{1+x^2}dx$ is: *[2023]*

(A) $\pi \log 2$

(B) $\frac{\pi}{8}\log 2$

(C) $\frac{\pi}{2}\log 2$

(D) $\log 2$

**Q3.** If $2x^y + 3y^x = 5$, then the value of $\frac{dy}{dx}$ at $(1,1)$ is: *[2022]*

(A) $-1$

(B) $-2/3$

(C) $-1/3$

(D) $-5/2$

**Q4.** If the tangent at $(h,k)$ on $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ cuts $x^2+y^2=a^2$ at points whose velocities are perpendicular, then $e^2$ satisfies: *[2025]*

(A) $e^2 > 2$

(B) $1 < e^2 < 2$

(C) $e^2 = 2$

(D) $e^2 > 1$

**Q5.** Area of the region $\{(x,y) : 0 \le y \le x^2+1, 0 \le y \le x+1, 0 \le x \le 2\}$ is: *[2024]*

(A) 23/6

(B) 19/6

(C) 17/6

(D) 15/6

**Q6.** Number of real solutions of $\sin^{-1} x = 2\tan^{-1} x$ is: *[2023]*

(A) 1

(B) 2

(C) 3

(D) 0

**Q7.** The system $2x+3y-z=\alpha$, $x+y+z=\beta$, $3x+4y=\gamma$ is consistent if: *[2021]*

(A) $\alpha+\beta=\gamma$

(B) $\alpha-\beta=\gamma$

(C) $\alpha+\beta+\gamma=0$

(D) $\alpha+2\beta=\gamma$

**Q8.** If $\vec{a}=\hat{i}+\hat{j}+\hat{k}$, $\vec{b}=\hat{j}-\hat{k}$, find $\vec{c}$ such that $\vec{a}\times\vec{c}=\vec{b}$ and $\vec{a}\cdot\vec{c}=3$: *[2022]*

(A) $\frac{1}{3}(5\hat{i}+2\hat{j}+2\hat{k})$

(B) $\frac{1}{2}(5\hat{i}-2\hat{j}+\hat{k})$

(C) $\frac{1}{3}(2\hat{i}+5\hat{j}+2\hat{k})$

(D) $\hat{i}+\hat{j}+\hat{k}$

**Q9.** Coefficient of $x^{10}$ in $(1+x^2-x^3)^8$ is: *[2025]*

(A) 420

(B) 476

(C) 504

(D) 560

**Q10.** Line $\frac{x-2}{3}=\frac{y+1}{2}=\frac{z-1}{-1}$ intersects $xy=c^2, z=0$, then $c$ is: *[2024]*

(A) $\pm\sqrt{5}$

(B) $\pm\sqrt{7}$

(C) $\pm5$

(D) $\pm3$

**Q11.** Let $S$ be complex numbers $z$ with $|z-2+i|\geq\sqrt{5}$. If $z_0$ maximizes $1/|z_0-1|$, principal argument of $\frac{4-z_0-\bar{z}_0}{z_0-\bar{z}_0+2i}$ is: *[2023]*

(A) $\pi/2$

(B) $3\pi/4$

(C) $\pi/4$

(D) 0

**Q12.** Sum of $1+\frac{2}{3}+\frac{6}{3^2}+\frac{10}{3^3}+\ldots$ is: *[2022]*

(A) 2

(B) 3

(C) 4

(D) 6

**Q13.** Number of 6-digit numbers using $\{0,1,2,5,7,9\}$ divisible by 11 with no repetition is: *[2021]*

(A) 60

(B) 72

(C) 48

(D) 120

**Q14.** If $f(x)=x^3-3x+1$, distinct real roots of $f(f(x))=0$ are: *[2024]*

(A) 3

(B) 5

(C) 7

(D) 9

**Q15.** Distance between planes $2x+3y+4z=4$ and $4x+6y+8z=12$ is: *[2023]*

(A) $2/\sqrt{29}$

(B) $4/\sqrt{29}$

(C) $1/\sqrt{29}$

(D) $8/\sqrt{29}$

**Q16.** If $A$ and $B$ are 3x3 matrices with $|A|=3$, $|B|=2$, then $|\text{adj}(A^{-1}B^2)|$ is: *[2025]*

(A) 16/9

(B) 64/81

(C) 16/81

(D) 4/9

**Q17.** $k$ for which $f(x) = kx^3 - 9x^2 + 9x + 3$ is increasing on $\mathbb{R}$ is: *[2022]*

(A) $k \geq 3$

(B) $k > 3$

(C) $k \leq 3$

(D) $k < 3$

**Q18.** Mean of 5 observations is 5, variance 8, first 3 are 1,3,5, other two are: *[2024]*

(A) 7,9

(B) 8,8

(C) 6,10

(D) 5,11

**Q19.** If $(a, b, c)$ in AP and $(a, b, c+1)$ in GP, then: *[2021]*

(A) $(a-c)^2 = 8$

(B) $(a-c)^2 = 4$

(C) $a = c$

(D) None of these

**Q20.** Equation of director circle of $x^2 - y^2 = 9$ is: *[2023]*

(A) $x^2 + y^2 = 9$

(B) $x^2 + y^2 = 0$

(C) $x^2 + y^2 = 18$

(D) Does not exist

## Section B — Numerical Value Questions

**Q21.** If the area of triangle formed by $y = x$, $y = 2x$, $y = c$ is 6 units, find $c^2$. *[2024]*

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**Q22.** Let $y = y(x)$ satisfy $\frac{dy}{dx} = \frac{y^2 - x^2}{2xy}$ with $y(1) = 1$. Find $y^2(3)$. *[2023]*

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**Q23.** A bag contains 4 red and 6 black balls. Three balls drawn at random. If $X$ is the number of red balls, find $10 \times E(X)$. *[2025]*

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**Q24.** If line $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-2}{4}$ is parallel to plane $ax + by + cz = 10$ and $(1, -1, 2)$ lies on plane, find $2a + 3b + 4c$. *[2022]*

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**Q25.** Find the number of points in $[0, 2\pi]$ where $f(x) = \max\{\sin x, \cos x\}$ is not differentiable. *[2024]*

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## Answer Key

**Section A**

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

**Section B**

| | | | | |
|---|---|---|---|---|
| 21. 24 | 22. 10 | 23. 12 | 24. 0 | 25. 2 |