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 A and B be two 3×3 non-zero real matrices such that $AB = O$. Then: *[2024]*

(A) $\det(A) = 0$ and $\det(B) = 0$

(B) $\det(A) \neq 0$ and $\det(B) = 0$

(C) $\det(A) = 0$ and $\det(B) \neq 0$

(D) Both can be non-singular

Q2. Value of $\int_{-1}^{1} \log_e\left(\frac{2-x}{2+x}\right) dx$: *[2023]*

(A) 0

(B) 1

(C) 2

(D) 1/2

Q3. Number of real roots of $f(x) = x^3 - 3x + 1$ in $[1, 2]$: *[2022]*

(A) 0

(B) 1

(C) 2

(D) 3

Q4. Length of perpendicular from origin to plane through $(1, 0, 0), (0, 2, 0), (0, 0, 3)$: *[2025]*

(A) 6/7

(B) 1/7

(C) 3/7

(D) $6/\sqrt{49}$

Q5. Lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{k}$ and $\frac{x-2}{1} = \frac{y-3}{2} = \frac{z-4}{3}$ intersect. $k =$: *[2021]*

(A) 4

(B) 5

(C) 0

(D) 2

Q6. $z = x + iy$, $|z-1| = |z+i|$. Locus of z is: *[2024]*

(A) $x + y = 0$

(B) $x - y = 0$

(C) $x + y = 1$

(D) $x - y = 1$

Q7. Sum of coefficients of $(1 - 2x + 5x^2)^n$ is 2^{10}. $n =$: *[2023]*

(A) 5

(B) 10

(C) 2

(D) 8

Q8. $\lim_{n\to\infty} \frac{1^k+2^k+\cdots+n^k}{n^{k+1}}$: *[2022]*

(A) $1/(k+1)$

(B) $1/k$

(C) $k/(k+1)$

(D) 1

Q9. Area of region bounded by $y^2 = 4ax$ and $x^2 = 4ay$ is $16/3$. Find a: *[2025]*

(A) 1

(B) 2

(C) 4

(D) $1/2$

Q10. Number of ways to arrange letters of "BANANA" with no two 'N's together: *[2021]*

(A) 40

(B) 60

(C) 20

(D) 100

Q11. Slope of tangent to $y = f(x)$ at (x, y) is $2y/x$, curve passes through $(1, 2)$. $f(2) =$: *[2024]*

(A) 8

(B) 4

(C) 2

(D) 1

Q12. Eccentricity of ellipse $9x^2 + 25y^2 = 225$: *[2023]*

(A) $4/5$

(B) $3/5$

(C) $3/4$

(D) $2/5$

Q13. $P(A) = 0.4$, $P(B) = 0.8$, $P(B|A) = 0.6$. $P(A \cup B) =$: *[2022]*

(A) 0.96

(B) 0.24

(C) 0.84

(D) 0.60

Q14. Value of $\tan(\cos^{-1}(4/5) + \tan^{-1}(2/3))$: *[2025]*

(A) $17/6$

(B) $6/17$

(C) $11/12$

(D) 1

Q15. Derivative of $\log_{10} x$ w.r.t x^2: *[2021]*

(A) $1/(2x^2 \log_e 10)$

(B) $1/(x \log_e 10)$

(C) $1/(2x \log_e 10)$

(D) $2x/\log_e 10$

Q16. A is 3×3, $|A| = 2$. $|\text{adj}(\text{adj}A)| =$: *[2024]*

(A) 16

(B) 8

(C) 4

(D) 64

Q17. Distance between parallel lines $y = 2x + 4$ and $y = 2x - 1$: *[2023]*

(A) $\sqrt{5}$
(B) $5/\sqrt{5}$
(C) $3/\sqrt{5}$
(D) 1

Q18. Sum of first n terms $S_n = 2n^2 + 3n$. r-th term: *[2022]*

(A) $4r + 1$
(B) $4r - 1$
(C) $2r + 1$
(D) $4r + 3$

Q19. Contrapositive of "If it rains, then I will not go to school": *[2025]*

(A) If I go to school, then it did not rain.
(B) If I do not go to school, then it rained.
(C) If it does not rain, then I will go to school.
(D) If I go to school, then it rains.

Q20. Angle between planes $2x - y + z = 6$ and $x + y + 2z = 3$: *[2024]*

(A) $\pi/3$
(B) $\pi/4$
(C) $\pi/6$
(D) $\pi/2$

Section B — Numerical Value Questions

Q21. Find the sum of the series $\sum_{r=1}^{10}(r^2 + 1)$. *[2024]*

Q22. $f(x) = \sin x + \cos x$. Find maximum value (express as $\sqrt{x}$, give x). *[2023]*

Q23. Number of common tangents to circles $x^2 + y^2 = 4$ and $x^2 + y^2 - 6x - 8y + 24 = 0$. *[2025]*

Q24. $y = e^{ax}$ satisfies $y'' - 5y' + 6y = 0$. Sum of all possible a. *[2022]*

Q25. Coefficient of x^2 in expansion of $(1 + x)^5(1 - x)^5$. *[2024]*

Answer Key

Section A

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

Section B

21. 395	22. 2	23. 4	24. 5	25. -5