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 $f(x)$ be a polynomial of degree 3 such that $f(k) = 1/k$ for $k = 1, 2, 3, 4$. The value of $52f(5)$ is: *[2024]*

(A) 49
(B) 51
(C) 50
(D) 48

Q2. The area bounded by the curves $y = |x - 1|$ and $y = 3 - |x|$ is: *[2023]*

(A) 6
(B) 4
(C) 3
(D) 2

Q3. If the system of equations $x+y+z = 6$, $x+2y+3z = 10$, and $x+2y+\lambda z = \mu$ has infinite solutions, then $\lambda + \mu$ is: *[2022]*

(A) 13
(B) 10
(C) 12
(D) 11

Q4. Let z be a complex number such that $|z| = 1$. The maximum value of $|z^3 - z + 2|$ is: *[2025]*

(A) 4
(B) $\sqrt{13}$
(C) 3
(D) $2\sqrt{2}$

Q5. The value of $\lim_{n\to\infty} \sum_{k=1}^{n} \frac{n}{n^2+k^2}$ is: *[2021]*

(A) $\pi/2$
(B) $\pi/4$
(C) $\log 2$
(D) 1

Q6. The number of real roots of the equation $e^{4x} + e^{3x} - 4e^{2x} + e^x + 1 = 0$ is: *[2024]*

(A) 4

(B) 2

(C) 1

(D) 0

Q7. If the sum of the first 10 terms of an AP is 155 and the sum of the first 2 terms of a GP (with first term same as AP) is 9, find the common difference d if the common ratio $r = 2$: *[2023]*

(A) 2

(B) 3

(C) 4

(D) 5

Q8. The shortest distance between the line $y = x - 2$ and the parabola $y^2 = x$ is: *[2022]*

(A) $7\sqrt{2}/8$

(B) $7/4\sqrt{2}$

(C) $3\sqrt{2}/4$

(D) $5\sqrt{2}/8$

Q9. Let $\vec{a}, \vec{b}, \vec{c}$ be three unit vectors such that $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c} = 0$. If the angle between $\vec{b}$ and $\vec{c}$ is $\pi/6$, then $\vec{a}$ is equal to: *[2025]*

(A) $\pm 2(\vec{b} \times \vec{c})$

(B) $\pm(\vec{b} \times \vec{c})$

(C) $\pm\frac{1}{2}(\vec{b} \times \vec{c})$

(D) $\pm 2\sqrt{3}(\vec{b} \times \vec{c})$

Q10. The probability that a randomly chosen 5-digit number is a multiple of 3 and contains the digit '5' at least once is: *[2021]*

(A) 1/3

(B) 29/90

(C) 1/9

(D) 31/100

Q11. If $\int \frac{\sin x}{\sin(x-\alpha)} dx = Ax + B \log \sin(x - \alpha) + C$, then the value of (A, B) is: *[2024]*

(A) $(\cos\alpha, \sin\alpha)$

(B) $(\sin\alpha, \cos\alpha)$

(C) $(-\cos\alpha, \sin\alpha)$

(D) $(\cos\alpha, -\sin\alpha)$

Q12. The contrapositive of the statement "If n is even, then n^2 is divisible by 4" is: *[2023]*

(A) If n^2 is not divisible by 4, then n is not even.

(B) If n^2 is divisible by 4, then n is even.

(C) If n is odd, then n^2 is not divisible by 4.

(D) If n^2 is not divisible by 4, then n is odd.

Q13. The value of $\tan^{-1}(1/2) + \tan^{-1}(1/3)$ is: *[2022]*

(A) $\pi/4$

(B) $\pi/2$

(C) $\pi/3$

(D) $\pi/6$

Q14. If A is a 3×3 matrix such that $\det(A) = 4$, then $\det(\text{adj}(2A))$ is: *[2025]*

(A) 2^{12}

(B) 2^{10}

(C) 2^{16}

(D) 2^8

Q15. The differential equation representing the family of curves $y = c_1e^{2x} + c_2e^{-2x}$ is: *[2024]*

(A) $y'' - 4y = 0$

(B) $y'' + 4y = 0$

(C) $y'' - 2y = 0$

(D) $y'' + 2y = 0$

Q16. The number of ways to distribute 10 identical candies among 3 children such that each child gets at least one candy is: *[2021]*

(A) 36

(B) 45

(C) 55

(D) 120

Q17. The eccentricity of the hyperbola whose latus rectum is 8 and conjugate axis is equal to half the distance between the foci is: *[2023]*

(A) $2/\sqrt{3}$

(B) $\sqrt{3}/2$

(C) $4/3$

(D) $3/4$

Q18. If $f(x) = \min\{x, x^2\}$ for every real number x, then: *[2022]*

(A) f is continuous everywhere

(B) f is differentiable everywhere

(C) f' exists at $x = 1$

(D) f is not continuous at $x = 0$

Q19. The coefficient of x^7 in the expansion of $(1 - x - x^2 + x^3)^6$ is: *[2025]*

(A) -132

(B) -144

(C) 132

(D) 144

Q20. The variance of first 10 multiples of 3 is: *[2024]*

(A) 74.25

(B) 84.5

(C) 68.75

(D) 90.25

Section B — Numerical Value Questions

Q21. If the term independent of x in the expansion of $(x^k + 1/x^2)^{10}$ is 45, find the value of k. *[2023]*

Q22. Let A and B be two 3×3 matrices such that $AB = I$ and $|A| = 1/3$. Then $|\text{adj}(3B)|$ is equal to: *[2024]*

Q23. The number of points of non-differentiability of the function $f(x) = ||x|-1|$ in the interval $(-2, 2)$ is: *[2025]*

Q24. If the line $x - 1 = y - 2 = z - 3$ is parallel to the plane $x + 2y + kz = 5$, find the value of k. *[2022]*

Q25. Find the sum of all real values of x satisfying the equation $(x^2 - 5x + 5)^{x^2+4x-60} = 1$. *[2021]*

Answer Key

Section A

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

Section B

21. 8	22. 729	23. 3	24. -5	25. 3