JEE (Main) – Mathmatics
Sample Question Paper

Subject	Mathmatics
Total Number of Questions	25
Maximum Marks	100
Time Allowed	60 Minutes

Marking Scheme (As per JEE Main Pattern)

Each question carries **4 (four) marks**.

1 (one) mark will be deducted for each incorrect answer.

No marks will be deducted for unattempted questions.

Only one option is correct for each question.

Important Instructions

1. This Question Paper consists of **25 Multiple Choice Questions** from **Mathmatics** only.
2. All questions are compulsory.
3. Rough work should be done only in the space provided in the Question Paper.
4. Calculators, mobile phones, smart watches, or any electronic devices are strictly prohibited.

Name of the Candidate (Capital Letters)	
Roll Number	
Examination Centre Name	
Candidate's Signature	Date

Invigilator's Signature

MATHEMATICS

1. If the solution curve f(x, y) = 0 of the differential equation $(1+\log_e x) \frac{dx}{dy} - x \log_e x = e^y$, x > 0, passes through the points (1,0) and $(\alpha, 2)$ then α^a is equal to

   A) e^{e^2}

   B) $e^{\sqrt{2}e^2}$

   C) $e^{2e^{\sqrt{2}}}$

   D) e^{2e^2}

2. Let P = $\begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}$ A = $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ and Q = PAP^T. If P^{T}Q^{2007}P = $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then 2a+b-3c-4d equal to

   A) 2004

   B) 2005

   C) 2006

   D) 2007

3. Let f be a continuous function satisfying $\int_0^{t^2} (f(x) + x^2)dx = \frac{4}{3}t^3, \forall t > 0$. Then $f(\frac{\pi^2}{4})$ is equal to

   A) $-\pi^2(1 + \frac{\pi^2}{16})$

   B) $\pi^2(1 - \frac{\pi^2}{16})$

   C) $-\pi(1 + \frac{\pi^3}{16})$

   D) $\pi(1 - \frac{\pi^3}{16})$

4. The straight lines l_1 and l_2 pass through the origin and trisect the line segment of the line L: 9x + 5y = 45 between the axes. If m_1 and m_2 are the slopes of the lines l_1 and l_2, then the point of intersection of the line y = $(m_1 + m_2)$x with L lies on

   A) y-2x=5

   B) 6x-y=15

   C) y-x=5

   D) 6x+y=10

5. If the set $\left(Re\left(\frac{z - \bar{z} + z\bar{z}}{2 - 3z + 5\bar{z}} \right) : z \in C, Re(z) = 3 \right)$ is equal to the interval (α, β), then $24(\beta - \alpha)$ is equal to

   A) 27

   B) 30

   C) 36

   D) 42

6. Among the two statements
   (S1) : (p ⟹ q)∧(q ∧(~q)) is a contradiction and
   (S2) : (p∧q) ∨ ((~p)∧q) ∨ (p ∧ (~q)) ∨ ((~p) ∧ (~q)) is a tautology

   A) both are true

   B) both are false

   C) only (S1) is true

   D) only (S2) is true

7. Two integers x and y are chosen with replacement from the set $\{0, 1, 2, 3, \ldots, 10\}$. Then the probability that $|x - y| > 5$ is:

   A) $\frac{30}{121}$

   B) $\frac{62}{121}$

   C) $\frac{60}{121}$

   D) $\frac{31}{121}$

8. The range of f(x) = $4\sin^{-1}\left(\frac{x^2}{x^2+1}\right)$ is

   A) $[0, \pi]$

   B) $[0, \pi)$

   C) $[0, 2\pi]$

   D) $[0, 2\pi)$

9. If the tangent at a point P on the parabola $y^2 = 3x$ is parallel to the line $x + 2y = 1$ and the tangents at the points Q and R on the ellipse $\frac{x^2}{4} + \frac{y^2}{1} = 1$ are perpendicular to the line $x - y = 2$, then the area of the triangle PQR is :

A) $\frac{3}{2}\sqrt{5}$ **B)** $5\sqrt{3}$

C) $3\sqrt{5}$ **D)** $\frac{9}{\sqrt{5}}$

10. For, $\alpha, \beta, \gamma, \delta \in \mathbb{N}$, if $\int \left(\left(\frac{x}{e}\right)^{2x} + \left(\frac{e}{x}\right)^{2x} \right) \log_e x\, dx = \frac{1}{\alpha}\left(\frac{x}{e}\right)^{\beta x} - \frac{1}{\gamma}\left(\frac{e}{x}\right)^{\delta x} + c$, Where $e = \sum_{n=10}^{\infty} \frac{1}{n!}$ and C is constant of integration, then $\alpha + 2\beta + 3\gamma - 4\delta$ is equal to

A) -8   **B)** -4

C) 1   **D)** 4

11. Let the centre of a circle C be (α, β) and its radius $r < 8$. Let $3x + 4y = 24$ and $3x - 4y = 32$ be two tangents and $4x + 3y = 1$ be a normal to C. Then $(\alpha - \beta + r)$ is equal to

A) 5   **B)** 6

C) 7   **D)** 9

12. The letters of the word OUGHT are written in all possible ways and these words are arranged as in a dictionary, in a series. Then the serial number of the word TOUGH is

A) 79   **B)** 86

C) 84   **D)** 89

13. Let $S = \{1, 2, 3, 4, 5\}$
if $f : S \to P(S)$, where $P(S)$ is power set of S. Then number of one-one functions f can be made is

A) $(32)^5$ **B)** $\frac{32!}{27!}$

C) $^{32}C_{27}$ **D)** $^{32}P_{27}$

14. Two dice A and B are rolled, Let the numbers obtained on A and B be α and β respectively. If the variance of $\alpha - \beta$ is $\frac{p}{q}$, where p and q are coprime, then the sum of the positive divisors of p is equal to

A) 31   **B)** 36

C) 48   **D)** 72

15. Let α, β be the roots of the quadratic equation $x^2 + \sqrt{6}x + 3 = 0$. Then $\frac{\alpha^{23} + \beta^{23} + \alpha^{14} + \beta^{14}}{\alpha^{15} + \beta^{15} + \alpha^{160} + \beta^{10}}$ is equal to

A) 9   **B)** 12

C) 81   **D)** 729

16. If $\alpha > \beta > 0$ are the roots of the equation $ax^2 + bx + 1 = 0$, and $\lim\limits_{x \to \frac{1}{\alpha}} \left(\frac{1 - \cos(x^2 + bx + a)}{2(1 - ax)^2} \right)^{1/2} = \frac{1}{k}\left(\frac{1}{\beta} - \frac{1}{\alpha}\right)$, then k is equal to

A) α **B)** β

C) 2α **D)** 2β

17. Let $y = y(x)$ be the solution of the differential equation $x \log_e x \frac{dy}{dx} + y = x^2 \log_e x, (x > 1)$. If $y(2) = 2$, then $y(e)$ is equal to

A) $\frac{2 + e^2}{2}$ **B)** $\frac{1 + e^2}{2}$

C) $\frac{1 + e^2}{4}$ **D)** $\frac{4 + e^2}{4}$

18. If the system of equations

$2x + y - z = 5$

$2x - 5y + \lambda z = \mu$

$x + 2y - 5z = 7$

has infinitely many solutions, then $(\lambda + \mu)^2 + (\lambda - \mu)^2$ is equal to

A) 904 **B)** 912

C) 916 **D)** 920

19. Let N be the foot of perpendicular from the point P $(1, -2, 3)$ on the line passing through the points $(4, 5, 8)$ and $(1, -7, 5)$. Then the distance of N from the plane $2x - 2y + z + 5 = 0$ is

A) 6 **B)** 7

C) 8 **D)** 9

20. If the tangents at the points P and Q on the circle $x^2 + y^2 - 2x + y = 5$ meet at the point R $(\frac{9}{4}, 2)$ then the area of the triangle PQR is

A) $\frac{13}{8}$ **B)** $\frac{13}{4}$

C) $\frac{5}{8}$ **D)** $\frac{5}{4}$

21. Let $y = f(x)$ be the solution of the differential equation $y(x + 1)dx - x^2 dy = 0$, $y(1) = e$. Then $\lim_{x \to 0^-} f(x)$ is equal to

A) $1/e$ **B)** 0

C) $1/e2$ **D)** $e2$

22. If f : R $\to$ R be a continuous function satisfying $\int_0^{\frac{\pi}{2}} f(sin2x)sinxdx + \alpha \int_0^{\frac{\pi}{4}} f(cos2x)cosxdx = 0$, then the value of α is

A) $-\sqrt{3}$ **B)** $\sqrt{3}$

C) $-\sqrt{2}$ **D)** $\sqrt{2}$

23. Let for a triangle ABC,

$\vec{AB} = -2\hat{i} + \hat{j} + 3\hat{k}$

$\vec{CB} = \alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}$

$\vec{CA} = 4\hat{i} + 3\hat{j} + \delta\hat{k}$

If $\delta > 0$ and the area of the triangle ABC is $5\sqrt{6}$, then $\vec{CB} \cdot \vec{CA}$ is equal to

A) 60 **B)** 54

C) 120 **D)** 108

24. Let $|\vec{a}| = 2, |\vec{b}| = 3$ and the angle between the vectors $\vec{a}$ and $\vec{b}$ be $\frac{\pi}{4}$. Then $|(\vec{a} + 2\vec{b}) \times (2\vec{a} - 3\vec{b})|^2$ is equal to

A) 441 **B)** 882

C) 482 **D)** 841

25. Let $S = w_1, w_2, \ldots \ldots$ be the sample space associated to a random experiment. Let $P(w_n) = \frac{P(w_{n-1})}{2}, n \geq 2$. Let $A = (2k + 3l : k, l \in \mathbb{N})$ and $B = w_n : n \in A$. Then $P(B)$ is equal to

A) $\frac{3}{64}$ **B)** $\frac{1}{16}$

C) $\frac{1}{32}$ **D)** $\frac{3}{32}$

JEE MAIN MATHEMATICS ANSWER KEY

1. (D)	2. (B)	3. (D)	4. (C)	5. (B)
6. (A)	7. (A)	8. (D)	9. (C)	10. (D)
11. (C)	12. (D)	13. (B)	14. (C)	15. (C)
16. (C)	17. (D)	18. (C)	19. (B)	20. (C)
21. (B)	22. (C)	23. (A)	24. (B)	25. (A)