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

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1. Among the statements :
$(S1)$ $((p \vee q) \Rightarrow r) \Leftrightarrow (p \Rightarrow r)$
$(S2)((p \vee q) \Rightarrow r) \Leftrightarrow ((p \Rightarrow r) \vee (q \Rightarrow r))$

A) only (S2) is a tautology

B) both (S1) and (S2) are tautologies

C) only (S1) is a tautology

D) neither (S1) nor (S2) is a tautology

2. Let $z_1 = 2 + 3i$ and $z_2 = 3 + 4i$. The set $S = \left\{z \in C : |z - z_1|^2 - |z - z_2|^2 = |z_1 - z_2|^2\right\}$ represents a

A) straight line with the sum of its intercepts on the coordinate axes equals -18

B) hyperbola with eccentricity 2

C) hyperbola with the length of the transverse axis 7

D) straight line with the sum of its intercepts on the coordinate axes equals 14

3. If a_r is the coefficient of x^{10-r} in the Binomial expansion of $(1 + x)^{10}$, then $\sum_{r=1}^{10} r^3 \left(\frac{a_r}{a_{r-1}}\right)^2$ is equal to

A) 3025

B) 1210

C) 5445

D) 4895

4. The equation $x^2 - 4x + [x] + 3 = x[x]$, where $[x]$ denotes the greatest integer function, has :

A) no solution

B) exactly two solutions in $(-\infty, \infty)$

C) a unique solution in $(-\infty, 1)$

D) a unique solution in $(-\infty, \infty)$

5. If the functions $f(x) = \frac{x^3}{3} + 2bx + \frac{ax^2}{2}$ and $g(x) = \frac{x^3}{3} + ax + bx^2, a \neq 2b$ have a common extreme point, then $a + 2b + 7$ is equal to:

A) $\frac{3}{2}$

B) 3

C) 6

D) 4

6. For three positive integers $p, q, r, x^{pq^2} = y^{yr} = z^{p^2r}$ and $r = pq + 1$ such that $3, 3\log_y x, 3\log_z y\ 7\log_x z$ are in AP with common difference $\frac{1}{2}$ Then $r - p - q$ is equal to

A) 6

B) 2

C) 12

D) -6

7. The value of $\lim\limits_{n\to\infty} \dfrac{1 + 2 - 3 + 4 + 5 - 6 + \ldots + (3n - 2) + (3n - 1) - 3n}{\sqrt{2n^4 + 4n + 3} - \sqrt{n^4 + 5n + 4}}$ is :

A) $3(\sqrt{2} + 1)$

B) $\frac{3}{2}(\sqrt{2} + 1)$

C) $\frac{\sqrt{2}+1}{2}$

D) $\frac{3}{2\sqrt{2}}$

8. Let $f(x) = \begin{vmatrix} 1 + \sin^2 x & \cos^2 x & \sin 2x \\ \sin^2 x & 1 + \cos^2 x & \sin 2x \\ \sin^2 x & \cos^2 x & 1 + \sin 2x \end{vmatrix}, x \in \left[\frac{\pi}{6}, \frac{\pi}{3}\right]$ If α and β respectively are the maximum and the minimum values of f, then

A) $\beta^2 + 2\sqrt{\alpha} = \frac{19}{4}$

B) $\alpha^2 + \beta^2 = \frac{9}{2}$

C) $\alpha^2 - \beta^2 = 4\sqrt{3}$

D) $\beta^2 - 2\sqrt{\alpha} = \frac{19}{4}$

9. The number of real roots of the equation $\sqrt{x^2-4x+3}+\sqrt{x^2-9}=\sqrt{4x^2-14x+6}$, is:

A) 2 **B)** 3

C) 1 **D)** 0

10. Let N be the sum of the numbers appeared when two fair dice are rolled and let the probability that $N-2, \sqrt{3N}, N+2$ are in geometric progression be $\frac{k}{48}$, Then the value of k is

A) 16 **B)** 2

C) 8 **D)** 4

11. Let S be the set of all values of a_1 for which the mean deviation about the mean of 100 consecutive positive integers $a_1, a_2, a_3, \ldots, a_{100}$ is 25 Then S is

A) $\{99\}$ **B)** ϕ

C) N **D)** $\{9\}$

12. Let $y=x+2, 4y=3x+6$ and $3y=4x+1$ be three tangent lines to the circle $(x-h)^2+(y-k)^2=r^2$ Then $h+k$ is equal to :

A) 5 **B)** $5(1+\sqrt{2})$

C) 6 **D)** $5\sqrt{2}$

13. Let $y(x)=(1+x)\left(1+x^2\right)\left(1+x^4\right)\left(1+x^8\right)\left(1+x^{16}\right)$ Then $y'-y''$ at $x=-1$ is equal to :

A) 976 **B)** 944

C) 496 **D)** 464

14. Let $9=x_1<x_2<\ldots<x_7$ be in an A.P. with common difference d. If the standard deviation of $x_1, x_2 \ldots, x_7$ is 4 and the mean is $\bar{x}$, then $\bar{x}+x_6$ is equal to :

A) $18\left(1+\frac{1}{\sqrt{3}}\right)$ **B)** $2\left(9+\frac{8}{\sqrt{7}}\right)$

C) 34 **D)** 25

15. Let the system of linear equations $x+y+kz=2$ $2x+3y-z=1$ $3x+4y+2z=k$ have infinitely many solutions Then the system $(k+1)x+(2k-1)y=7$ $(2k+1)x+(k+5)y=10$ has:

A) infinitely many solutions **B)** unique solution satisfying$x-y=1$

C) no solution **D)** unique solution satisfying$x+y=1$

16. Let α be a root of the equation $(a-c)x^2+(b-a)x+(c-b)=0$where a, b, c are distinct real numbers such that the matrix $\begin{bmatrix}\alpha^2 & \alpha & 1 \\ 1 & 1 & 1 \\ a & b & c\end{bmatrix}$ is singular Then, the value of $\frac{(a-c)^2}{(b-a)(c-b)}+\frac{(b-a)^2}{(a-c)(c-b)}+\frac{(c-b)^2}{(a-c)(b-a)}$ is

A) 6 **B)** 3

C) 9 **D)** 12

17. A wire of length $20m$ is to be cut into two pieces A piece of length l_1 is bent to make a square of area A_1 and the other piece of length l_2 is made into a circle of area A_2 If $2A_1+3A_2$ is minimum then $(\pi l_1): l_2$ is equal to:

A) $6:1$ **B)** $3:1$

C) $4:1$ **D)** $1:6$

18. Let $\vec{a}$ and $\vec{b}$ be two vectors, Let $|\vec{a}|=1, |\vec{b}|=4$ and $\vec{a}\cdot\vec{b}=2$ If $\vec{c}=(2\vec{a}\times\vec{b})-3\vec{b}$, then the value of $\vec{b}\cdot\vec{c}$ is

A) -60 **B)** -48

C) -84 **D)** -24

19. For $\alpha, \beta \in R$, suppose the system of linear equations $x - y + z = 5$ $2x + 2y + \alpha z = 8$ $3x - y + 4z = \beta$ has infinitely many solutions Then α and β are the roots of

A) $x^2 - 18x + 56 = 0$ **B)** $x^2 + 14x + 24 = 0$

C) $x^2 - 10x + 16 = 0$ **D)** $x^2 + 18x + 56 = 0$

20. Let $f(x) = \int \frac{2x}{(x^2+1)(x^2+3)}dx$ If $f(3) = \frac{1}{2}(\log_e 5 - \log_e 6)$, then $f(4)$ is equal to

A) $\log_e 17 - \log_e 18$ **B)** $\log_e 19 - \log_e 20$

C) $\frac{1}{2}(\log_e 19 - \log_e 17)$ **D)** $\frac{1}{2}(\log_e 17 - \log_e 19)$

21. If $P(h, k)$ be a point on the parabola $x = 4y^2$, which is nearest to the point $Q(0, 33)$, then the distance of P from the directrix of the parabola $y^2 = 4(x + y)$ is equal to :

A) 4 **B)** 2

C) 8 **D)** 6

22. Let $z_1 = 2 + 3i$ and $z_2 = 3 + 4i$ The set $S = \left\{z \in C : |z - z_1|^2 - |z - z_2|^2 = |z_1 - z_2|^2\right\}$ represents a

A) straight line with the sum of its intercepts on the-18 coordinate axes equals **B)** hyperbola with eccentricity 2

C) hyperbola with the length of the transverse axis 7 **D)** straight line with the sum of its intercepts on the coordinate axes equals 14

23. If $y = y(x)$ is the solution curve of the differential equation $\frac{dy}{dx} + y\tan x = x\sec x, 0 \le x \le \frac{\pi}{3}, y(0) = 1$ then $y\left(\frac{\pi}{6}\right)$ is equal to

A) $\frac{\pi}{12} - \frac{\sqrt{3}}{2}\log_e\left(\frac{2}{e\sqrt{3}}\right)$ **B)** $\frac{\pi}{12} + \frac{\sqrt{3}}{2}\log_e\left(\frac{2}{e\sqrt{3}}\right)$

C) $\frac{\pi}{12} + \frac{\sqrt{3}}{2}\log_e\left(\frac{2\sqrt{3}}{e}\right)$ **D)** $\frac{\pi}{12} - \frac{\sqrt{3}}{2}\log_e\left(\frac{2\sqrt{3}}{e}\right)$

24. Let $a, b, c > 1, a^3, b^3$ and c^3 be in A.P., and $log_a\, b, log_c\, a$ and $log_b\, c$ be in G.P. If the sum of first 20 terms of an A.P., whose first term is $\frac{a+4b+c}{3}$ and the common difference is $\frac{a-8b+c}{10}$ is −444, then *abc* is equal to:

A) 343 **B)** 216

C) $\frac{343}{8}$ **D)** $\frac{125}{8}$

25. Let S_1 and S_2 be respectively the sets of all $a \in R - \{0\}$ for which the system of linear equations $ax + 2ay - 3az = 1$ $(2a + 1)x + (2a + 3)y + (a + 1)z = 2$ $(3a + 5)x + (a + 5)y + (a + 2)z = 3$ has unique solution and infinitely many solutions Then

A) $S_1 = \Phi$and$S_2 = R - \{0\}$ **B)** $S_1$is an infinite set and$n\left(S_2\right) = 2$

C) $S_1 = R - \{0\}$and$S_2 = \Phi$ **D)** $n\left(S_1\right) = 2$and$S_2$is an infinite set

JEE MAIN MATHEMATICS ANSWER KEY

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