

**JEE (Main) – Mathematics
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. The complex number $z = \frac{i-1}{\cos \frac{\pi}{3} + i \sin \frac{\pi}{3}}$ is equal to :
- A) $\sqrt{2}i \left(\cos \frac{5\pi}{12} - i \sin \frac{5\pi}{12} \right)$ B) $\cos \frac{\pi}{12} - i \sin \frac{\pi}{12}$
C) $\sqrt{2} \left(\cos \frac{\pi}{12} + i \sin \frac{\pi}{12} \right)$ D) $\sqrt{2} \left(\cos \frac{5\pi}{12} + i \sin \frac{5\pi}{12} \right)$
2. The coefficient of x^7 in $(1 - 2x + x^3)^{10}$ is?
- A) 5140 B) 2080
C) 4080 D) 6234
3. Let $(a, b) \subset (0, 2\pi)$ be the largest interval for which $\sin^{-1}(\sin \theta) - \cos^{-1}(\sin \theta) > 0, \theta \in (0, 2\pi)$, holds. If $\alpha x^2 + \beta x + \sin^{-1}(x^2 - 6x + 10) + \cos^{-1}(x^2 - 6x + 10) = 0$ and $\alpha - \beta = b - a$, then α is equal to :
- A) $\frac{\pi}{8}$ B) $\frac{\pi}{48}$
C) $\frac{\pi}{16}$ D) $\frac{\pi}{12}$
4. Height of tower A is 30m where B is foot of tower. Angle of elevation from a point C on level ground to top of tower A is 30° and to top of tower B is 60° . Then the distance between A and B is
- A) $300(\sqrt{3}-1)$ B) $600(\sqrt{3}-1)$
C) $150(\sqrt{3}-1)$ D) $100(\sqrt{3}-1)$
5. The tangents at the point $A(1, 3)$ and $B(1, -1)$ on the parabola $y^2 - 2x - 2y = 1$ meet at the point P . Then the area (in unit 2) of $\triangle PAB$ is :-
- A) 4 B) 6
C) 7 D) 8
6. The value of $\int_{\frac{\pi}{3}}^{\frac{\pi}{2}} \frac{(2+3 \sin x)}{\sin x(1+\cos x)} dx$ is equal to
- A) $\frac{7}{2} - \sqrt{3} - \log_e \sqrt{3}$ B) $\frac{10}{3} - \sqrt{3} - \log_e \sqrt{3}$
C) $\frac{10}{3} - \sqrt{3} + \log_e \sqrt{3}$ D) $-2 + 3\sqrt{3} + \log_e \sqrt{3}$
7. The number of real solutions of the equation $3 \left(x^2 + \frac{1}{x^2} \right) - 2 \left(x + \frac{1}{x} \right) + 5 = 0$, is
- A) 4 B) 3
C) 2 D) 0
8. Let $R = \{a, b, c, d, e\}$ and $S = \{1, 2, 3, 4\}$. Total number of onto functions $f: R \rightarrow S$ such that $f(a) \neq 1$, is equal to:
- A) 240 B) 180
C) 204 D) 216
9. Let a and b are roots of $x^2 - 7x - 1 = 0$. The value of $\frac{(a_{21} + b_{21} + a_{17} + b_{17})}{(a_{19} + b_{19})}$ is?
- A) 29 B) 49
C) 53 D) 51

10. Plane P_3 is passing through $(1,1,1)$ and line of intersection of P_1 and P_2 where $P_1 : 2x - y + z = 5$ and $P_2 : x + 3y + 2z + 2 = 0$. Then distance of $(1,1,10)$ from P_3 is:
 A) $\frac{53}{85}$ B) $\sqrt{85}$
 C) $\frac{52}{\sqrt{85}}$ D) 53
11. Eight persons are to be transported from city A to city B in three cars of different makes. If each car can accommodate at most three persons, then the number of ways in which they can be transported is:
 A) 1120 B) 560
 C) 1680 D) 3360
12. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \alpha & \beta \\ 0 & \beta & \alpha \end{bmatrix}$ and $|2A|^3 = 2^{21}$ where $\alpha, \beta \in \mathbb{Z}$. Then a value of α is:
 A) 5 B) 3
 C) 9 D) 17
13. Let the mean and standard deviation of marks of class A of 100 students be respectively 40 and $\alpha (> 0)$, and the mean and standard deviation of marks of class B of n students be respectively 55 and $30 - \alpha$. If the mean and variance of the marks of the combined class of $100 + n$ students are respectively 50 and 350, then the sum of variances of classes A and B is :
 A) 500 B) 450
 C) 650 D) 900
14. 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) $\beta^2 - 2\sqrt{\alpha} = \frac{19}{4}$
15. Equivalent statement to $(p \rightarrow q) \vee (r \rightarrow q)$ will be
 A) $(p \wedge r) \rightarrow q$ B) $(p \vee r) \rightarrow q$
 C) $(q \rightarrow r) \vee (p \vee r)$ D) $(r \rightarrow p) \wedge (q \rightarrow r)$
16. 7 boys and 5 girls are to be seated around a circular table such that no two girls sit together is?
 A) $126(5!)^2$ B) $720(5!)$
 C) $720(6!)$ D) 720
17. Consider the word INDEPENDENCE. The number of words such that all the vowels are together is?
 A) 16800 B) 15800
 C) 17900 D) 14800
18. Let T and C respectively be the transverse and conjugate axes of the hyperbola $16x^2 - y^2 + 64x + 4y + 44 = 0$. Then the area of the region above the parabola $x^2 = y + 4$, below the transverse axis T and on the right of the conjugate axis C is:
 A) $4\sqrt{6} + \frac{44}{3}$ B) $4\sqrt{6} - \frac{28}{3}$
 C) $4\sqrt{6} + \frac{28}{3}$ D) $4\sqrt{6} - \frac{44}{3}$

19. For the system of linear equations

$$x + y + z = 6$$

$$\alpha x + \beta y + 7z = 3$$

$$x + 2y + 3z = 14.$$

which of the following is NOT true ?

A) The system is inconsistent for $\alpha = -5$ and $\beta = 8$

B) The system has a unique solution for $\alpha = -5$ and $\beta = 8$

C) The system has infinitely many solutions for $\alpha = -6$ and $\beta = 9$

D) The system has infinitely many solutions for $\alpha = -5$ and $\beta = 9$

20. The integral $16 \int_1^2 \frac{dx}{x^3(x^2+2)^2}$ is equal to

A) $\frac{11}{6} + \log_e 4$

B) $\frac{11}{12} + \log_e 4$

C) $\frac{11}{6} - \log_e 4$

D) $\frac{11}{12} - \log_e 4$

21. If a plane passes through the points $(-1, k, 0)$, $(2, k, -1)$, $(1, 1, 2)$ and is parallel to the line $\frac{x-1}{1} = \frac{2y+1}{2} = \frac{z+1}{-1}$, then the value of $\frac{k^2+1}{(k-1)(k-2)}$ is

A) $\frac{13}{6}$

B) $\frac{5}{17}$

C) $\frac{17}{5}$

D) $\frac{6}{13}$

22. The number of ways to distribute 20 chocolates among three students such that each student gets at least one chocolate is

A) ${}^{22}C^2$

B) ${}^{19}C^2$

C) ${}^{19}C^3$

D) ${}^{22}C^3$

23. The set of all values of a for which $\lim_{x \rightarrow a} ([x - 5] - [2x + 2]) = 0$, where $[\alpha]$ denotes the greatest integer less than or equal to α is equal to

A) $[-7.5, -6.5]$

B) $(-7.5, -6.5)$

C) $(-7.5, -6.5]$

D) $[-7.5, -6.5]$

24. Let $\vec{\alpha} = 4\hat{i} + 3\hat{j} + 5\hat{k}$ and $\vec{\beta} = \hat{i} + 2\hat{j} - 4\hat{k}$. Let $\vec{\beta}_1$ be parallel to $\vec{\alpha}$ and $\vec{\beta}_2$ be perpendicular to $\vec{\alpha}$. If $\vec{\beta} = \vec{\beta}_1 + \vec{\beta}_2$, then the value of $5\vec{\beta}_2 \cdot (\hat{i} + \hat{j} + \hat{k})$ is

A) 9

B) 11

C) 7

D) 6

25. The integral $\int \frac{x^8 - x^2}{(x^{12} + 3x^6 + 1) \tan^{-1}\left(\frac{x^3+1}{x^3}\right)} dx$ is equal to:

A) $\log_e \left[\tan^{-1}\left(\frac{x^3+1}{x^3}\right) \right]^{1/3} + C$

B) $\log_e \left[\tan^{-1}\left(\frac{x^3+1}{x^3}\right) \right]^{1/2} + C$

C) $\log_e \left[\tan^{-1}\left(\frac{x^3+1}{x^3}\right) \right] + C$

D) $\log_e \left[\tan^{-1}\left(\frac{x^3+1}{x^3}\right) \right]^3 + C$

JEE MAIN MATHEMATICS ANSWER KEY

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