



JEE (MAIN) 2025

MEMORY BASED QUESTIONS & TEXT SOLUTION

SHIFT-1

DATE & DAY: 04th April 2025 & Friday

PAPER-1

Duration: 3 Hrs.

Time: 09:00 – 12:00 IST

SUBJECT: MATHEMATICS

Selections in JEE (Advanced)/
IIT-JEE Since 2002

52395

Selections in JEE (Main)/
AIEEE Since 2009

257576

Selections in NEET (UG)/
AIPMT/AIIMS Since 2012

22494

Admission Open for 2025-26

Target: JEE (Advanced) | JEE (Main) | NEET (UG) | PCCP (Class V to X)

100% Scholarship on the basis of Class 10th & 12th
& JEE (Main) 2025 %ile/ AIR

 **REGISTERED & CORPORATE OFFICE (CIN: U80302RJ2007PLC024029):**

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TARGET: JEE (Adv.) 2024



**AIR
31**

JEE (Adv.) 2024

ISHAAN GUPTA

SCHOLARSHIP UPTO 100%

on the basis of Class 10th & 12th &
JEE (Main) 2025 %ile/ AIR

VISHESH COURSE

For 12th Passed Students

Course Features:

- ▶ Course Duration: **42 Weeks**
- ▶ Total No. of Lectures: **630** (P: 210 | C: 210 | M: 210)
- ▶ Duration of One Lecture: **1.5 Hrs.** (90 Minutes)
- ▶ Classroom Teaching Hours.: **945 Hrs.**
- ▶ Testing Duration: **51 Hrs.**
- ▶ Total Academic Hours.: **996 Hrs.**

*Tentative



CLASS STARTS
7th April 2025

TARGET: JEE (Main) 2026

ABHYAAS COURSE

For 12th Passed Students

Course Features:

- ▶ Course Duration: **39 Weeks**
- ▶ Total No. of Lectures: **577** (P: 192 | C: 193 | M: 192)
- ▶ Duration of One Lecture: **1.5 Hrs.** (90 Minutes)
- ▶ Classroom Teaching Hours.: **865 Hrs.**
- ▶ Testing Duration: **36 Hrs.**
- ▶ Total Academic Hours.: **901 Hrs.**

*Tentative

**AIR
102**

JEE (MAIN) 2024

RITAM BANERJEE



SCHOLARSHIP UPTO 100%

on the basis of Class 10th & 12th &
JEE (Main) 2025 %ile/ AIR



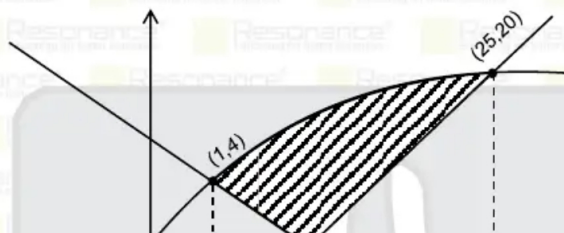
CLASS STARTS
7th April 2025

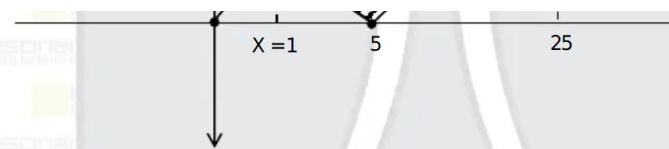
PART : MATHEMATICS

1. Area bounded by curves $|x - 5| < y \leq 4\sqrt{x}$ is A, then the value of 3A is equal to
(1) 368 (2) 81 (3) 225 (4) 96

Ans. (1)

Sol.





$$y = 5 - x \text{ \& } y = 4\sqrt{x}$$

$$4\sqrt{x} = 5 - x$$

$$x - 4\sqrt{x} - 5 = 0$$

$$\sqrt{x} = 5, \sqrt{x} = -1$$

$$x = 25$$

$$\text{Solving } y = 5 - x \text{ \& } y = 4\sqrt{x}$$

$$x + 4\sqrt{x} - 5 = 0$$

$$\sqrt{x} = 1 \Rightarrow x = 1$$

Required area

$$= \int_1^{25} 4\sqrt{x} \, dx - \frac{1}{2} \times 4 \times 4 - \frac{1}{2} \times 20 \times 20$$

$$= \left(4 \cdot x^{3/2} \cdot \frac{2}{3} \right)_1^{25} - 8 - 200$$

$$= \frac{8}{3} (25 \times 5 - 1) - 208$$

$$= \frac{8}{3} \times 124 - 208$$

$$A = \frac{992 - 624}{3}$$

$$\text{Now } 3A = 368$$

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2. In the expansion of $\left(2^{\frac{1}{3}} + 3^{\frac{1}{3}}\right)^n$, if $\frac{T_{15} \text{ from beginning}}{T_{15} \text{ from end}} = \frac{1}{6}$, then the value of nC_3 is equal to :

- (1) 2200 (2) 2300 (3) 2400 (4) none of these

Ans. (2)

$$\text{Sol. } \therefore T_{15} \text{ from beginning} = {}^nC_{14} \left(2^{\frac{1}{3}}\right)^{n-14} \left(3^{\frac{1}{3}}\right)^{14}$$

$$T_{15} \text{ from end} = {}^nC_{14} \left(3^{\frac{1}{3}}\right)^{n-14} \left(2^{\frac{1}{3}}\right)^{14}$$

$$\frac{{}^nC_{14} 2^{\frac{n-14}{3}} \cdot 3^{\frac{14}{3}}}{{}^nC_{14} 2^{\frac{14}{3}} \cdot 3^{\frac{(n-14)}{3}}} = \frac{1}{6}$$

$$2^{\frac{n-28}{3}} \cdot 3^{\frac{n-28}{3}} = \frac{1}{6} = 6^{-1}$$

$$\frac{n-28}{3} = -1 \quad n = 25$$

$$\therefore {}^nC_3 = {}^{25}C_3 = \frac{25 \times 24 \times 23}{3 \times 2 \times 1} = 2300$$

3. The sum of 40 terms of $1^2 + 3^2 + 5^2 + 7^2 + 9^2 + \dots$ is equal to

- (1) 39600 (2) 41880 (3) 43500 (4) 38500

Ans. (2)

$$\text{Sol. } \sum_{r=1}^{20} (4r-3)^2 + \sum_{r=1}^{20} (4r-1)^2$$

$$\begin{aligned}
 &= \sum_{r=1}^{20} (16r^2 - 24r + 9 + 4r - 1) \\
 &= \sum_{r=1}^{20} (16r^2 - 20r + 8) \\
 &= \frac{16 \times 20 \times 21 \times 41}{6} - \frac{20 \times 20 \times 21}{2} + 160 \\
 &= 16 \times 70 \times 41 - 10 \times 420 + 160 \\
 &= 41880
 \end{aligned}$$

4. If roots of $x^2 - 4x - n = 0$ are integral, $n \in \mathbb{N}$ and $n \in [20, 100]$ then number of values of 'n'

Ans. (6)

Sol. D = Perfect square

$$16 + 4n = \ell^2$$

$$n = \frac{\ell^2 - 16}{4}$$

ℓ	n
6	5
8	12
10	21

Values of n are 21, 32, 45, 60, 77, 86

So total values of n = 6

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5. If the arithmetic mean of binomial coefficient in the expansion of $(x+y)^{2n-3}$ is equal to 16, then the length of perpendicular drawn from the point $(2n-1, n^2-4n)$ to the line $x+y=8$, is equal to

- (1) $3\sqrt{2}$ (2) $4\sqrt{2}$ (3) $5\sqrt{2}$ (4) $6\sqrt{2}$

Ans. (1)

Sol. $\therefore \frac{{}^{2n-3}C_0 + {}^{2n-3}C_1 + {}^{2n-3}C_2 + \dots + {}^{2n-3}C_{2n-3}}{2n-2} = 16$

$$2^{2n-3} = 16(2n-2) = 2^5(n-1)$$

$$\Rightarrow 2^{2n-8} = (n-1)$$

$$\Rightarrow n = 5$$

$$\therefore (2n-1, n^2-4n) \equiv (9, 5)$$

$$\therefore \text{Required length} = \left| \frac{9+5-8}{\sqrt{1+1}} \right| = 3\sqrt{2}$$

6. Let $10 \sin^4 \theta + 15 \cos^4 \theta = 6$

Then value of

$$\frac{27 \operatorname{cosec}^6 \theta + 8 \sec^6 \theta}{16 \sec^8 \theta} \text{ is equal to}$$

- (1) $\frac{3}{5}$ (2) $\frac{2}{5}$ (3) $\frac{35}{16}$ (4) $\frac{19}{16}$

Ans. (2)

Sol. Let $\sin^2 \theta = t$

$$10t^2 + 15(1-t)^2 = 6$$

$$25t^2 - 30t + 9 = 0$$

$$t = \frac{3}{5}$$

$$\sin^2 \theta = \frac{3}{5}$$

$$\cos^2 \theta = \frac{2}{5}$$

Now

$$\frac{27 \operatorname{cosec}^6 \theta + 8 \sec^6 \theta}{16 \sec^8 \theta}$$

$$= 27 \left(\frac{125}{27} \right) + 8 \left(\frac{125}{8} \right)$$

$$= \frac{16 \times \frac{625}{16}}{\frac{125 + 125}{625}} = \frac{10}{25} \Rightarrow \frac{2}{5}$$

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7. The value of $\int_{-1}^1 \left(\frac{(1+\sqrt{|x|-x})e^x + (\sqrt{|x|-x})e^{-x}}{e^x + e^{-x}} \right) dx$ is equal to

- (1) $2 - \frac{\sqrt{2}}{3}$ (2) $2 + \frac{2\sqrt{2}}{3}$ (3) $1 + \frac{2\sqrt{2}}{3}$ (4) $1 + \frac{\sqrt{2}}{3}$

Ans. (3)

Sol. Using $\int_{-a}^a f(x) dx = \int_0^a f(x) + f(-x) dx$, we obtain

Given integral

$$= \int_0^1 \frac{(1+\sqrt{|x|-x})e^x + (\sqrt{|x|-x})e^{-x} + (1+\sqrt{|x|+x})e^{-x} + (\sqrt{|x|+x})e^x}{e^x + e^{-x}} dx$$

$$= \int_0^1 \frac{e^x + e^{-x} + (\sqrt{|x|-x})(e^x + e^{-x}) + (\sqrt{|x|+x})(e^{-x} + e^x)}{e^x + e^{-x}} dx$$

$$= \int_0^1 (1 + \sqrt{|x|-x} + \sqrt{|x|+x}) dx = \int_0^1 (1 + \sqrt{2x}) dx$$

$$= 1 + \sqrt{2} \cdot \frac{x^{3/2}}{(3/2)} \Big|_0^1 = 1 + \frac{2\sqrt{2}}{3}$$

8. If two foci of an ellipse are (2, 5) and (2, -3) and its $e = 4/5$, then the length of latus rectum of this ellipse is equal to

- (1) $\frac{18}{5}$ (2) $\frac{9}{5}$ (3) $\frac{16}{5}$ (4) $\frac{12}{5}$

Ans. (1)

Sol. $\therefore 2ae = \sqrt{64} = 8$

$$\Rightarrow ae = 4 \Rightarrow a = 5 \text{ (as } e = 4/5)$$

$$\therefore ae = 4$$

$$a^2 - b^2 = 16 \Rightarrow b^2 = 9$$

$$\therefore \ell \text{ (L. R)} = \frac{2b^2}{a} = \frac{18}{5}$$

9. Let $A = \{1, 6, 11, 16, \dots \text{ upto } 2025 \text{ terms}\}$ & $B = \{9, 16, 23, \dots \text{ upto } 2025 \text{ terms}\}$ then $n(A \cup B)$ is ____.

- (1) 3761 (2) 3650 (3) 3810 (4) 3619

Ans. (1)

Sol. Common first term = 16

and common difference of common term be 35

$$\text{Last term of set A is } = 1 + 2024 \times 5$$

$$= 10121$$

$$\text{Last term of set B } = 9 + 2024 \times 9$$

$$= 14168 + 9$$

$$= 14177$$

Now Let number of common term be n.

$$16 + (n-1) \times 35 \leq 10121$$

$$35n - 19 \leq 10121$$

$$35n \leq 10140$$

$$n \leq 289.7$$

So 289 terms are common

$$\text{Now } n(A \cup B) = 2025 + 2025 - 289 = 3761$$

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10. There are 10 pens in which 3 are defective. 2 samples of pen are selected randomly. Let x be number of defective pen, then variance of probability distribution of number of defective pen is equal to

- (1) $\frac{28}{75}$ (2) $\frac{37}{75}$ (3) $\frac{26}{75}$ (4) $\frac{23}{75}$

Ans. (1)

Sol.

x	0	1	2
$P(x)$	$\frac{{}^7C_2}{{}^{10}C_2}$	$\frac{{}^7C_1 \times {}^3C_1}{{}^{10}C_2}$	$\frac{{}^3C_2}{{}^{10}C_2}$

$$\text{Variance} = \sum P_i(x_i)^2 - \left(\sum P_i x_i \right)^2$$

$$= \left(0 + \frac{21}{45} \times 1^2 + \frac{3}{45} \times 2^2 \right) - \left(0 + \frac{21}{45} \times 1 + \frac{3}{45} \times 2 \right)^2$$

$$= \frac{33}{45} - \left(\frac{27}{45} \right)^2$$

$$= \frac{11}{15} - \left(\frac{3}{5} \right)^2$$

$$= \frac{55 - 27}{75}$$

$$= \frac{28}{75}$$

11. A committee of 12 members is formed randomly out of 4 Engineers, 2 Doctors and 10 Professors. Find the probability that the committee has atleast 3 Engineers and atleast 1 Doctor.

- (1) $\frac{103}{182}$ (2) $\frac{129}{182}$ (3) $\frac{107}{182}$ (4) $\frac{109}{182}$

Ans. (2)

Sol. Engineers = 4, Doctors = 2, Professors = 10

$$n(S) = {}^{16}C_{12} = {}^{16}C_4 = 14 \times 13 \times 10$$

$\therefore$	$n(A) =$	Eng.	Dr.	Pr.	
	3	1	8		$= {}^4C_3 \times {}^2C_1 \times {}^{10}C_8 = 4 \times 2 \times 45 = 360$
	4	1	7		$= {}^4C_4 \times {}^2C_1 \times {}^{10}C_7 = 1 \times 2 \times 120 = 240$
	3	2	7		$= {}^4C_3 \times {}^2C_2 \times {}^{10}C_7 = 4 \times 1 \times 120 = 480$
	4	2	6		$= {}^4C_4 \times {}^2C_2 \times {}^{10}C_6 = 1 \times 1 \times 210 = 210$

$$\therefore n(A) = 1290$$

$$\therefore P(\text{Reqd.}) = \frac{n(A)}{n(S)} = \frac{1290}{14 \times 13 \times 10} = \frac{129}{14 \times 13} = \frac{129}{182}$$

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12. If $\lim_{x \rightarrow 1^+} \frac{(1-x)(1+\lambda \cos(x-1))+\mu \sin(1-x)}{(1-x)^3} = -1$, then $\lambda + \mu$ is equal to

- (1) -1 (2) 1 (3) 2 (4) 3

Ans. (1)

Sol. $\lim_{h \rightarrow 0} \frac{(-h)[1+\lambda \cosh] + \mu(\sin(-h))}{-h^3}$

$$= \lim_{h \rightarrow 0} \frac{-h \left[1 + \lambda \left(1 - \frac{h^2}{2!} + \dots \right) \right] + \mu \left(-h + \frac{h^3}{3!} \right)}{-h^3}$$

Now $\frac{-h(1+\lambda+\mu) + h^3 \left(\frac{\lambda}{2} + \frac{\mu}{6} \right)}{-h^3} = -1$

Now $\lambda + \mu = -1$ and $-\frac{\lambda}{2} - \frac{\mu}{6} = -1$

Now $\lambda + \mu = -1$

13. If $A = \begin{bmatrix} \cos \theta & 0 & -\sin \theta \\ 0 & 1 & 0 \\ \sin \theta & 0 & \cos \theta \end{bmatrix}$, such that $A^2 = A^T$, then find trace of $((A+I)^3 + (A-I)^3 - 6A)$

Ans. (6)

Sol. $A^2 = A^T \Rightarrow \begin{bmatrix} \cos \theta & 0 & -\sin \theta \\ 0 & 1 & 0 \\ \sin \theta & 0 & \cos \theta \end{bmatrix} \begin{bmatrix} \cos \theta & 0 & -\sin \theta \\ 0 & 1 & 0 \\ \sin \theta & 0 & \cos \theta \end{bmatrix} = \begin{bmatrix} \cos \theta & 0 & \sin \theta \\ 0 & 1 & 0 \\ -\sin \theta & 0 & \cos \theta \end{bmatrix}$

$\Rightarrow \begin{bmatrix} \cos 2\theta & 0 & -\sin 2\theta \\ 0 & 1 & 0 \\ \sin 2\theta & 0 & \cos 2\theta \end{bmatrix} = \begin{bmatrix} \cos \theta & 0 & \sin \theta \\ 0 & 1 & 0 \\ -\sin \theta & 0 & \cos \theta \end{bmatrix}$

$\Rightarrow \cos 2\theta = \cos \theta, \sin 2\theta = -\sin \theta \Rightarrow 2\cos^2 \theta - \cos \theta - 1 = 0, \sin \theta (2\cos \theta + 1) = 0$

$\Rightarrow (\cos \theta - 1)(2\cos \theta + 1) = 0, \sin \theta (2\cos \theta + 1) = 0$

$\Rightarrow \cos \theta = 1, \sin \theta = 0$ or $\cos \theta = -\frac{1}{2}$

$\Rightarrow \theta = 2n\pi$ or $\theta = 2m\pi \pm \frac{2\pi}{3}$

$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ or $A = \begin{bmatrix} -\frac{1}{2} & 0 & \frac{\sqrt{3}}{2} \\ 0 & 1 & 0 \\ \frac{\sqrt{3}}{2} & 0 & -\frac{1}{2} \end{bmatrix}$ or $A = \begin{bmatrix} -\frac{1}{2} & 0 & \frac{\sqrt{3}}{2} \\ 0 & 1 & 0 \\ \frac{\sqrt{3}}{2} & 0 & -\frac{1}{2} \end{bmatrix}$

$\Rightarrow AA^T = I \Rightarrow A(A^2) = AA^T \Rightarrow A^3 = I$
 $(A+I)^3 = A^3 + 3A^2 + 3A + I$
 $(A-I)^3 = A^3 - 3A^2 + 3A - I$
 $((A+I)^3 + (A-I)^3 - 6A) = 2A^3 = 2I \Rightarrow \text{Trace} = 6$

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