



JEE (MAIN) 2025

MEMORY BASED QUESTIONS & TEXT SOLUTION

SHIFT-1

DATE & DAY: 02nd April 2025 & Wednesday

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

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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



CLASS STARTS
7th April 2025

**AIR
102**

JEE (MAIN) 2024

RITAM BANERJEE



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PART : MATHEMATICS

1. Let α, β are roots of quadratic equation and $P_n = \alpha^n + \beta^n$, $P_{10} = 123$, $P_9 = 76$, $P_8 = 47$ and $P_1 = 1$ the quadratic equation whose roots are $\frac{1}{\alpha}$ and $\frac{1}{\beta}$.

(1) $x^2 + x - 1 = 0$

(2) $x^2 - x + 1 = 0$

(3) $x^2 + x + 1 = 0$

(4) $x^2 - x - 1 = 0$

Ans. (1)

Sol. $P(x) = ax^2 + bx + c$, $P_1 = 1 \Rightarrow \alpha + \beta = 1 \Rightarrow -\frac{b}{a} = 1 \Rightarrow a = -b$

$aP_{10} + bP_9 + cP_8 = 0$

$123a + 76b + 47c = 0$

$47a + 47c = 0$

$a = -c = -b$

So, equation $x^2 - x - 1 = 0$.

$$\alpha + \beta = 1, \alpha\beta = -1$$

$$\text{Sum} = \frac{1}{-1} \text{ and Prod} = \frac{1}{-1}$$

$$x^2 - (-1)x + (-1) = x^2 + x - 1 = 0.$$

2. The total number of 10 digits numbers formed by only {0, 1, 2} where 1 should be used atleast 5 times and 2 should be used exactly three times, is

Ans. (2892)

	0 digit	1 digit	2 digit
Sol.	2	5	3
	1	6	3
	0	7	3

numbers when 0 is used two times

$$= \frac{9!}{4!3!2!} + \frac{9!}{2!5!2!}$$

when 0 is used 1 time.

$$\frac{10!}{1!6!3!} + \frac{9!}{6!3!}$$

$$= \frac{10!}{7!3!}$$

$$\text{Total} = 2892$$

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3. If $a_1, a_2, a_3, \dots$ is an A.P. and $\sum_{k=1}^{12} a_{2k-1} = -\frac{72}{5} a_1$ and $\sum_{k=1}^n a_k = 0$ then value of n is

(1) 8

(2) 9

(3) 10

(4) 11

Ans. (4)

$$\text{Sol. } \sum_{k=1}^{12} a_{2k-1} = -\frac{72}{5} a_1$$

$$\frac{12}{2} [2a_1 + 11(2d)] = -\frac{72}{5} a_1$$

$$12a_1 + 132d = -\frac{72}{5} a_1$$

$$60a_1 + 660d = -72a_1$$

$$132a_1 + 660d = 0$$

$$2a_1 + 10d = 0$$

$$a_1 + 5d = 0$$

$$\sum_{k=1}^n a_k = 0$$

$$\frac{n}{2} [2a_1 + (n-1)d] = 0$$

$$2a_1 + (n-1)d = 0$$

$$-10d + (n-1)d = 0$$

$$-10 + n - 1 = 0$$

$$n = 11$$

4. If $\lfloor 50 \rfloor$ is exactly divisible by 3^n then find maximum value of n .

(1) 20

(2) 22

(3) 18

(4) 16

Ans. (2)

Sol. $E(3) = \left[\frac{50}{3} \right] + \left[\frac{50}{3^2} \right] + \left[\frac{50}{3^3} \right] = 16 + 5 + 1 = 22$

$\therefore$ Exponent of 3 in 50 is 22.

$\therefore 50 = 3^{22} \cdot \lambda \quad \therefore n = 22.$

5. Let $f(x) = 2x^3 - 9ax^2 + 12a^2x + 1$, $f(x)$ has maxima at $x = p$ and minima at $x = q$ such that $p^2 = q$ then find $f(3)$.

(1) 37

(2) 38

(3) 40

(4) 45

Ans. (1)

Sol. $f(x) = 2x^3 - 9ax^2 + 12a^2x + 1$

$f'(x) = 6x^2 - 18ax + 12a^2$

$f'(x) = 6(x^2 - 3ax + 2a^2) = 6(x - a)(x - 2a)$



$\therefore x = p = a$ and $x = q = 2a$

Given $p^2 = q$

$\therefore a^2 = 2a$

$\Rightarrow a = 0$ or 2

$\Rightarrow a = 2 \quad (a \neq 0)$

$\therefore f(3) = 37$

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6. Let ABCD is a tetrahedron in which $\angle BAC, \angle CAD, \angle BAD$ is at right angle and area of faces. ABC, BAD & CAD are 5, 7 and 6 respectively then area of face BCD is -

(1) $\sqrt{55}$

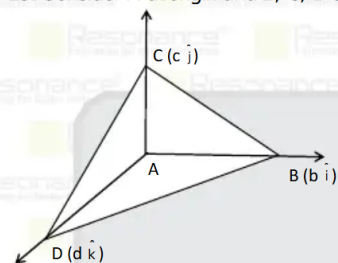
(2) $\sqrt{220}$

(3) $\sqrt{110}$

(4) $\sqrt{340}$

Ans. (3)

Sol. Let Consider A at origin and B, C, D at x, y & z axes



now

ar $\triangle ABC = \frac{1}{2}bc = 5$

ar $\triangle ABD = \frac{1}{2}bd = 7$

$\triangle ACD = \frac{1}{2}cd = 6$

Now area of $\triangle BCD$

$= \frac{1}{2}|\vec{BC} \times \vec{BD}| =$

$\vec{BC} \times \vec{BD} = (c\hat{j} - b\hat{i}) \times (d\hat{k} - b\hat{i})$

$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -b & c & 0 \\ -b & 0 & d \end{vmatrix}$

$= \hat{i}(cd) - \hat{j}(-bd) + \hat{k}(bc)$

are BCD $= \frac{1}{2}\sqrt{(cd)^2 + (bd)^2 + (bc)^2}$

$= \frac{1}{2}\sqrt{100 + 196 + 144}$

$$= \frac{2}{2} \sqrt{440}$$

$$= \sqrt{110}$$

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7. Three distinct numbers are selected from set $\{1, 2, 3, \dots, 40\}$, then find probability that they form an increasing G.P.

(1) $\frac{1}{520}$ (2) $\frac{3}{520}$ (3) $\frac{7}{520}$ (4) $\frac{11}{520}$

Ans. (1)

Sol. Given set is $\{1, 2, 3, \dots, 40\}$

$$h(s) = {}^{40}C_3$$

a, b, c is G.P. $\therefore b^2 = ac$

a = 1 then c = 4, 9, 16, 25, 36

a = 2 then c = 8, 18, 32

a = 3 then c = 12, 27

a = 4 then c = 9, 16, 25, 36

a = 5 then c = 20

a = 6 then c = 24

a = 7 then c = 28

a = 8 then c = 32

a = 9 then c = 36

Total cases = 19 = h(A)

$$\therefore P(A) = \frac{h(A)}{h(s)}$$

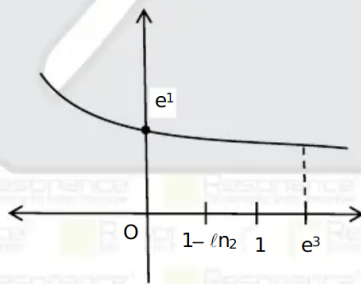
$$= \frac{19}{{}^{40}C_3} = \frac{19 \times 3.2.1}{40.39.38}$$

$$= \frac{1}{520}$$

8. $\int_0^{e^3} \left[\frac{1}{e^x - 1} \right] dx = \alpha - \ell n 2$ then α is equal to (where $[x]$ denotes greatest integer less than or equal to x).

(1) 2 (2) 3 (3) 4 (4) 5

Ans. (1)



Sol.

$$\int_0^{1-\ln 2} 2 dx + \int_{1-\ln 2}^1 1 dx + \int_1^{e^3} 0 dx$$

$$= (2x)_0^{1-\ln 2} + (x)_{1-\ln 2}^1 + 0$$

$$= 2 - 2\ln 2 + 1 - (1 - \ln 2)$$

$$= 2 - \ln 2 = \alpha - \ln 2$$

$$\text{So, } \alpha = 2$$

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9. The term independent of x in the expansion of $\left(\frac{x+1}{x^3+1-\frac{1}{x^3}} - \frac{x-1}{x-\sqrt{x}}\right)^{10}$ is

(1) 252

(2) 60

(3) 210

(4) 45

Ans. (3)

Sol. $\left(\frac{\frac{1}{x^3}+1}{x^3+1-\frac{1}{x^3}} - \frac{\sqrt{x}+1}{\sqrt{x}}\right)^{10}$

$$\left(\frac{\frac{1}{x^3}-\frac{1}{x^2}}{x^2}\right)^{10}$$

$$T_{r+1} = {}^{10}C_r x^{\frac{r}{3}} \left(-\frac{1}{x^2}\right)^{10-r}$$

$$\frac{r}{3} - \frac{(10-r)}{2} = 0$$

$$2r - 30 + 3r = 0$$

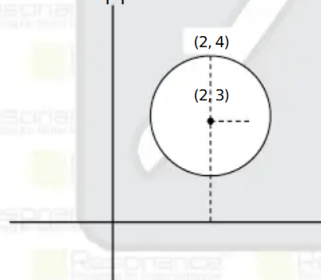
$$r = 6$$

$${}^{10}C_6 = {}^{10}C_4 = 210$$

10. If $|z| = 1$ and $\frac{2+k^2z}{\bar{z}+k} = kz$ where $k \in \mathbb{R}$ then the maximum value of $k + k^2i$ from $|z - (2+3i)| = 1$ is

Ans. (2)

Sol. $2 + k^2z = k|z|^2 + k^2z$



$$k = 2$$

$$2 + 4i = 2$$

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11. Area bounded by region $\{(x, y) : |4 - x^2| \leq y \leq x^2 \mid x \geq 0 \mid y \leq 4\}$ is

(1) $\frac{1}{3}[40\sqrt{2} - 48]$ (2) $\frac{1}{3}[40\sqrt{2} + 48]$

(3) $\frac{1}{2}[40\sqrt{2} - 48]$ (4) $\frac{1}{2}[40\sqrt{2} + 48]$

Ans. (1)

Sol. Solving $4 - x^2 = x^2$

$x = \pm\sqrt{2}$

Required region is as $x \geq 0$

$$= \int_{\sqrt{2}}^2 x^2 - (4 - x^2) dx + \int_2^{2\sqrt{2}} 4 - (x^2 - 4) dx$$

$$= \int_{\sqrt{2}}^2 (2x^2 - 4) dx + \int_2^{2\sqrt{2}} (8 - x^2) dx$$

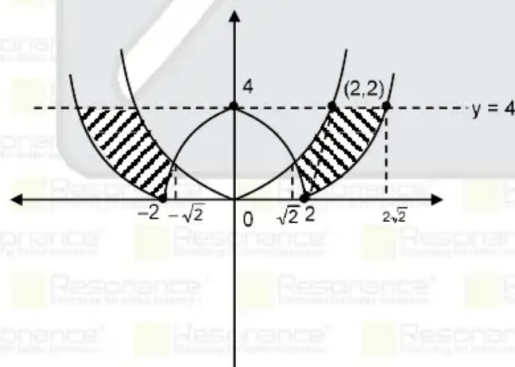
$$= \left[\frac{2x^3}{3} - 4x \right]_{\sqrt{2}}^2 + \left[8x - \frac{x^3}{3} \right]_2^{2\sqrt{2}}$$

$$= \left[\frac{16}{3} - 8 \right] - \left[\frac{4\sqrt{2}}{3} - 4\sqrt{2} \right] + \left[\left(16\sqrt{2} - \frac{16\sqrt{2}}{3} \right) - \left(16 - \frac{8}{3} \right) \right]$$

$$= \left[-\frac{8}{3} + \frac{8\sqrt{2}}{3} \right] + \left[\frac{32\sqrt{2}}{3} - \sqrt{2} \right]$$

$$= \frac{1}{3}[8\sqrt{2} - 8 + 32\sqrt{2} - 40]$$

$$= \frac{1}{3}[40\sqrt{2} - 48]$$



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12. If $\lim_{x \rightarrow 0} \frac{x^2 \sin(\alpha x) - (\gamma - 1)e^{x^2}}{\sin(2x) - \beta x} = 3$ then the value of $\beta + \gamma - \alpha$ is

(1) -1 (2) 7 (3) 4 (4) 3

Ans. (2)

$$\frac{\alpha^3 x^3}{3!} + \frac{1 - (\gamma - 1)1 + \gamma^2 + x^4}{4!} + \dots$$

Sol. $\lim_{x \rightarrow 0} \frac{31 - \frac{(2x)^3}{31} + \dots - \beta x}{-(\gamma - 1) - (\gamma - 1)x^2 + \alpha x^3 + \frac{(\gamma - 1)}{21}x^4 + \dots} = 3$

$\lim_{x \rightarrow 0} \frac{(2 - \beta)x - \frac{8}{6}x^3 + \dots}{-(\gamma - 1) - (\gamma - 1)x^2 + \alpha x^3 + \frac{(\gamma - 1)}{21}x^4 + \dots} = 3$

$\gamma = 1, \beta = 2, \frac{\alpha}{-4/3} = 3, \alpha = -4$

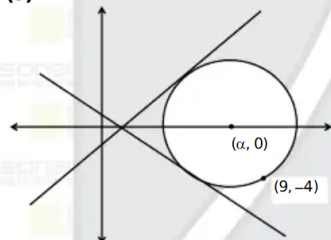
$\beta + \gamma - \alpha = 2 + 1 - (-4) = 7$

- 13.** Two circles touches line $x + y = 3$ & $x - y = 3$ also passes through $(9, -4)$ then absolute difference of radius of two circles is

- (1) $\sqrt{90}$ (2) $\sqrt{72}$ (3) $\sqrt{80}$ (4) $\sqrt{120}$

Ans. (3)

Sol.



Both circle touches lines
 $x + y = 3$ and $x - y = 3$
 so centre lies on x-axis. Let centre $(\alpha, 0)$ let radius r
 $(x - \alpha)^2 + y^2 = r^2$
 it passes through $(9, -4)$
 $(9 - \alpha)^2 + 16 = r^2$ (1)
 also it touches $x + y = 3$

so $\left| \frac{\alpha + 0 - 3}{\sqrt{2}} \right| = r$

$\alpha - 3 = \pm \sqrt{2} r$

$\alpha = \pm \sqrt{2} r + 3$

put in (1)

$(9 - (\pm \sqrt{2} r + 3))^2 = r^2 - 16$

$(36 + 2r^2 \pm 12\sqrt{2} r) = r^2 - 16$

$r^2 \pm 12\sqrt{2} r + 52 = 0$

Let radius r_1 & r_2

$(r_1 - r_2) = \sqrt{(12\sqrt{2})^2 - 4 \times 52} = \sqrt{288 - 208} = \sqrt{80}$

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- 14.** Let P is any point on ellipse $\frac{x^2}{18} + \frac{y^2}{9} = 1$ if S_1 and S_2 are foci of ellipse then product of maximum and minimum value of product of length PS_1 & PS_2 is -

Ans. (162)

Sol. Let P $(3\sqrt{2} \cos\theta, 3\sin\theta)$

$PS_1 \& PS_2 = (a - ex_1)(a - ex_2)$
 $= a^2 - e^2 x_1^2$

$= 18 - \frac{1}{2} \times (18 \cos^2\theta)$

$= 18 - 9 \cos^2\theta$

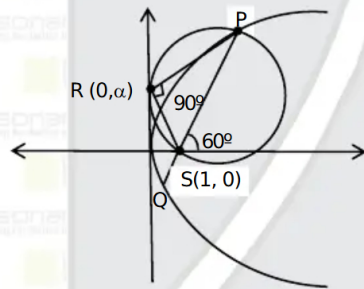
So maximum & minimum values are 18 & 9

$= 18 \times 9 = 162$

- 15.** Focal Chord PQ of the parabola $y^2 = 4x$ makes an angle 60° with positive x-axis where P in Ist quadrant. A circle is drawn with SP as diameter touches the tangent at the vertex of the parabola at $(0, \alpha)$ the α^2 is (where S is focus of parabola)

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

Ans. (3)
Sol.



Let $P(t^2, 2t)$
 $m_{sp} = \frac{2t-0}{t^2-1} = \tan 60^\circ$

$\Rightarrow \sqrt{3}t^2 - 2t - \sqrt{3} = 0$

$\Rightarrow (\sqrt{3}t+1)(t-\sqrt{3}) = 0$

$\Rightarrow t = \sqrt{3}$

$\therefore$ Point P is $(3, 2\sqrt{3})$

$\therefore$ tangent at P is

$2\sqrt{3}y = 2(x+3)$

at R $x = 0$

$\therefore \alpha = \sqrt{3}$

$\therefore \alpha^2 = 3$

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