

Resonance®
Educating for better tomorrow

JEE (MAIN) 2025

MEMORY BASED QUESTIONS & TEXT SOLUTION

SHIFT-2

DATE & DAY: 04th April 2025 & Friday

PAPER-1

Duration: 3 Hrs.
Time: 03:00 PM – 06:00 PM

SUBJECT: MATHEMATICS

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

52395

Selections in JEE (Main)/
AIEEE Since 2009

257576

Selections in NEET (UG)/
AIPT/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):

CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Rajasthan) - 324005

☎ 0144-2777777 | 📞 73400 10346 | ✉ contact@resonance.ac.in | 🌐 www.resonance.ac.in | Follow Us: [Facebook](#) [Twitter](#) [Instagram](#) [LinkedIn](#) [YouTube](#) [WhatsApp](#)

This solutions was download from Resonance JEE (Main) 2025 Solution Portal

PART : MATHEMATICS

1. $\cot^{-1}\left(\frac{7}{4}\right) + \cot^{-1}\left(\frac{19}{4}\right) + \cot^{-1}\left(\frac{39}{4}\right) + \dots = ?$

(1) $\cot^{-1}\left(\frac{1}{2}\right)$

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

(3) $\cot^{-1}(2)$

(4) $\cot^{-1}(3)$

Ans. (1)

Sol. $\sum_{r=1}^{\infty} \cot^{-1}\left(r^2 + \frac{3}{4}\right)$

$$T_r = \cot^{-1}\left(r^2 + \frac{3}{4}\right) = \tan^{-1}\left(\frac{1}{r^2 + \frac{3}{4}}\right) = \tan^{-1}\left(\frac{1}{1 + r^2 - \frac{1}{4}}\right) = \tan^{-1}\left(\frac{\left(r + \frac{1}{2}\right) - \left(r - \frac{1}{2}\right)}{1 + \left(r + \frac{1}{2}\right)\left(r - \frac{1}{2}\right)}\right)$$

$$= \tan^{-1}\left(r + \frac{1}{2}\right) - \tan^{-1}\left(r - \frac{1}{2}\right)$$

$$T_1 = \tan^{-1}\left(\frac{3}{2}\right) - \tan^{-1}\left(\frac{1}{2}\right)$$

$$T_2 = \tan^{-1}\left(\frac{5}{2}\right) - \tan^{-1}\left(\frac{3}{2}\right)$$

$$T_3 = \tan^{-1}\left(\frac{7}{2}\right) - \tan^{-1}\left(\frac{5}{2}\right)$$

...

$$T_n = \tan^{-1}\left(n + \frac{1}{2}\right) - \tan^{-1}\left(n - \frac{1}{2}\right)$$

$$\sum T_n = \tan^{-1}\left(n + \frac{1}{2}\right) - \tan^{-1}\left(\frac{1}{2}\right)$$

$$\sum_{n=1}^{\infty} T_n = \frac{\pi}{2} - \tan^{-1}\left(\frac{1}{2}\right) = \cot^{-1}\left(\frac{1}{2}\right)$$

2. Let $L_1 : \frac{x-1}{3} = \frac{y}{4} = \frac{z}{5}$ & $L_2 : \frac{x-p}{2} = \frac{y}{3} = \frac{z}{4}$. If the shortest distance between L_1 & L_2 is $\frac{1}{\sqrt{6}}$. Then possible value of p is -

(1) 3

(2) 5

(3) 2

(4) 7

Ans. (3)

Sol. $\vec{r} = \vec{a} + \lambda \vec{p}$ $\vec{r} = \vec{b} + \mu \vec{q}$

$$\text{Shortest distance} = \frac{|(\vec{b} - \vec{a}) \cdot (\vec{p} \times \vec{q})|}{|\vec{p} \times \vec{q}|}$$

$$\vec{a} = (1, 0, 0) \quad \vec{p} = (3, 4, 5)$$

$$\vec{b} = (p, 0, 0) \quad \vec{q} = (2, 3, 4)$$

$$\vec{p} \times \vec{q} = \vec{i} - 2\vec{j} + \vec{k} \quad (\vec{b} - \vec{a}) = (p-1)\vec{i}$$

$$d = \frac{|(p-1) \cdot 1|}{\sqrt{1+4+1}} = \frac{1}{\sqrt{6}}$$

$$|p-1| = \pm 1 \quad p = \begin{matrix} < \\ > \end{matrix} 1$$

Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPHA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No. : +91-744-2777777, 2777700 | FAX No. : +91-022-39167222

To Know more : sms RESO at 56577 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555  7340010333  www.facebook.com/resonance  twitter.com/resonance  www.youtube.com/resonance  www.instagram.com/resonance

3. Let mean & variances of observations 2, 3, 3, 4, 5, 7, a, b is 4 & 2 then mean deviation about mole is observations is

Ans. (1)

Sol. mean = $4 = \frac{2+3+3+4+5+7+a+b}{8} = 4$

$$a+b+24=32$$

$$a+b=8 \quad \dots (1)$$

$$r^2 = \frac{4+9+9+16+25+49+a^2+b^2}{8} - 16 = 2$$

$$\frac{a^2+b^2+112}{8} = 18$$

$$a^2+b^2=144-112$$

$$a^2+b^2=32$$

$$(a+b)^2 - 2ab = 32$$

$$64 - 2ab = 32$$

$$2ab = 32$$

$$ab = 16$$

$$\therefore x^2 - 8x + 16 = 0$$

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

$$x = 4$$

$$\therefore a = b = 4$$

$$\therefore \text{observation is } 2, 3, 3, 4, 5, 7, 4, 4$$

$$\text{Mode} = 4$$

$$\therefore \text{mean deviation} = \frac{\sum |x - \text{mod}|}{n} = \frac{2+1+1+0+1+3+0+0}{8} = 1$$

4. $\int \frac{(\sqrt{1+x^2} + x)^{10}}{\sqrt{1+x^2} - x} dx =$

(1) $\frac{1}{2} \left[\frac{(\sqrt{x^2+1}+x)^{21}}{21} + \frac{(\sqrt{x^2+1}-x)^{19}}{19} \right] + C$

(2) $\left[\frac{(\sqrt{x^2+1}-x)^{21}}{21} + \frac{(\sqrt{x^2+1}+x)^{19}}{19} \right] + C$

(3) $\left[\frac{(\sqrt{x^2+1}+x)^{20}}{20} + \frac{(\sqrt{x^2+1}-x)^{18}}{18} \right] + C$

(4) $\left[\frac{(\sqrt{x^2+1}+x)^{20}}{20} + \frac{(\sqrt{x^2+1}-x)^{18}}{18} \right] + C$

Ans. (1)

Sol. $x = \tan \theta$

$$dx = \sec^2 \theta \, d\theta$$

$$\int \frac{(\sec \theta + \tan \theta)^{10}}{\sec \theta - \tan \theta} \cdot \sec^2 \theta \, d\theta$$

$$\int (\sec \theta + \tan \theta)^{20} (\sec^2 \theta) \, d\theta$$

$$\sec \theta + \tan \theta = t$$

$$\sec \theta - \tan \theta = \frac{1}{t}$$

$$\tan \theta = \frac{1}{2} \left(t - \frac{1}{t} \right)$$

Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2777777, 2777700 | FAX No. : +91-022-39167222

To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555 | 7340010333 | [facebook.com/resonance](https://www.facebook.com/resonance) | twitter.com/resonance | www.youtube.com/resonance | www.resonance.ac.in

$$\begin{aligned}\sec^{20} t \, dt &= \frac{1}{2} \left(1 + \frac{1}{t^2} \right) dt \\ \frac{1}{2} \int t^{20} \left(1 + \frac{1}{t^2} \right) dt &= \frac{1}{2} \left[\frac{t^{21}}{21} + \frac{t^{19}}{19} \right] + C \\ &= \frac{1}{2} \left[\frac{(\sec t + \tan t)^{21}}{21} + \frac{(\sec t + \tan t)^{19}}{19} \right] + C \\ &= \frac{1}{2} \left[\frac{(\sqrt{x^2+1}+x)^{21}}{21} + \frac{(\sqrt{x^2+1}+x)^{19}}{19} \right] + C\end{aligned}$$

5. There are two sets A and B each has 3 elements which are in A.P. sum of the elements in each is 36 & difference of the elements of A & B is d & D respectively. Such that $D = 3 + d$ and $\frac{p+q}{p-q} = \frac{19}{5}$. Where p & q are product of the elements of A & B respectively. The value of $p - q$ is

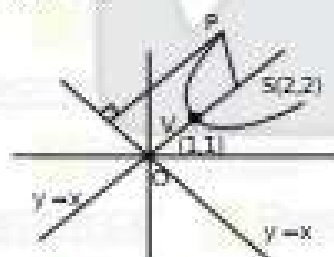
Ans. (510)

Sol. $A = \{12-d, 12, 12+d\}$
 $A = \{9-d, 12, 15+d\}$
 $\frac{p+q}{p-q} = \frac{19}{5} \quad \frac{p}{q} = \frac{12}{7}$
 $\frac{(12-d)(12(12+d))}{(q-d)(12(15+d))} = \frac{12}{7}$
 $d = 6$
 $A = \{6, 12, 18\} \quad B = \{3, 12, 21\}$
 $p - q = 6 \times 12 \times 18 - 3 \times 12 \times 21$
 $= 12 \times 3 \times 3 (12 - 7) = 540$ Ans.

6. If $y = x$ is axis of parabola whose vertex & focus are at distances $\sqrt{2}$ & $2\sqrt{2}$ from origin respectively in first quadrant. If $(1, k)$ lies on parabola then possible value of k is
 (1) 7 (2) 8 (3*) 9 (4) 10

Ans. (3)

Sol. $y = x$ is axis & distances of vertex & focus from origin are $\sqrt{2}$ & $2\sqrt{2}$ respectively.
 $OV = \sqrt{2}$



$V(r \cos \theta, r \sin \theta)$
 $V(1, 1), S(2, 2)$
 equation of directrix is
 $x + y + \lambda = 0$ at O, $\lambda = 0 \quad x + y = 0$
 $P(1, k)$ lies on parabola
 $\therefore SP = PM$
 $\sqrt{(2-1)^2 + (2-k)^2} = \left| \frac{1+k}{\sqrt{2}} \right|$

Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPHA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2377777, 2377700 | FAX No. : +91-022-39167222

To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555 | 7340010333 | Facebook : www.facebook.com/resonance | Instagram : www.instagram.com/resonance | Blog : www.blog.resonance.ac.in

$$1+4-4k+k^2 = \frac{1+k^2+2k}{2}$$

$$\Rightarrow k^2 - 10k + 9 = 0$$

$$\Rightarrow (k-1)(k-9) = 0 \quad K = 1 \text{ or } 9$$

7. Let $f(x)$ and $g(x)$ satisfies the functional equation

$$2g(x) + 3g\left(\frac{1}{x}\right) = x \text{ and } 2f(x) + 3f\left(\frac{1}{x}\right) = x^2 + 5$$

$$\text{If } \alpha = \int_1^2 f(x) dx \text{ \& } \beta = \int_1^2 g(x) dx. \text{ Then } 30\alpha + 5\beta.$$

$$(1) 8 + \ln 9$$

$$(2) 8 + \ln 8$$

$$(3) 11 + \ln 8$$

$$(4) 11 + \ln 3$$

Ans. (2)

$$\text{Sol. } 2g(x) + 3g\left(\frac{1}{x}\right) = x \quad \dots (1)$$

$$2g\left(\frac{1}{x}\right) + 3g(x) = \frac{1}{x} \quad \dots (2)$$

$$(1) \times 2 - (2) \times 3$$

$$-5g(x) = 2x - \frac{3}{x}$$

$$g(x) = \frac{3}{5x} - \frac{2x}{5}$$

Similarly

$$f(x) = \frac{3}{5x^2} - \frac{2x^2}{5} + 1$$

$$\alpha = \left[-\frac{3}{5x} - \frac{2x^3}{15} + x \right]_1^2 = \left[-\frac{3}{10} - \frac{16}{15} + 2 - \left(-\frac{3}{5} - \frac{2}{15} + 1 \right) \right]$$

$$= \frac{-9 - 32 + 60 + 18 + 4 - 30}{30}$$

$$= \frac{11}{30}$$

$$\beta = \left[\frac{3}{5} \ln x - \frac{2x^2}{5 \times 2} \right]_1^2 = \frac{3}{5} \ln 2 - \frac{4}{5} - 0 + \frac{1}{5} = \frac{3}{5} \ln 2 - \frac{3}{5}$$

$$30\alpha + 5\beta = 11 + 3 \ln 2 - 3 = 8 + \ln 8$$

8. $\sum_{r=1}^{15} r^2 \cdot {}^{15}C_r = 2^m \cdot 3^n \cdot 5$ then $l + m + n =$

Ans. (19)

$$\text{Sol. } S = \sum_{r=1}^{15} r^2 \cdot {}^{15}C_r = \sum_{r=1}^{15} r^2 \cdot \frac{15}{r} \cdot {}^{14}C_{r-1}$$

$$= 15 \sum_{r=1}^{15} (r-1+1) \cdot {}^{14}C_{r-1}$$

$$= 15 \sum_{r=2}^{15} (r-1) \cdot \frac{14}{r-1} \cdot {}^{14}C_{r-2} + 15 \cdot \sum_{r=1}^{15} {}^{14}C_{r-1}$$

Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No. : +91-744-2777777, 2777700 | FAX No. : +91-022-39167222

To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555 | 7340010333 | [facebook.com/resonance](https://www.facebook.com/resonance) | [instagram.com/resonance](https://www.instagram.com/resonance) | www.youtube.com/resonance | www.resonance.ac.in

$$\begin{aligned}
 &= 15.14.2^{13} + 15.2^{14} \\
 &= 3.5.2.7.2^{13} + 3.5.2^{14} \\
 &= 3.5.7.2^{14} + 3.5.2^{14} \\
 &= 3.5.2^{14} (7+1) \\
 &= 31.51.2^{14} = 2^{17}.31.51 \\
 \therefore r + m + n &= 17 + 1 + 1 = 19
 \end{aligned}$$

9. A line passing through A (-2, 0) touches parabola $y^2 = x - 2$ at B, then area between parabola, line AB & x-axis is

(1) $\frac{5}{3}$

(2) $\frac{7}{3}$

(3) $\frac{8}{3}$

(4) $\frac{10}{3}$

Ans. (3)

Sol.

line through A(-2, 0) is

$$y - 0 = m(x + 2)$$

parabola is $y^2 = x - 2$

for point of intersection

$$m^2(x + 2)^2 = x - 2$$

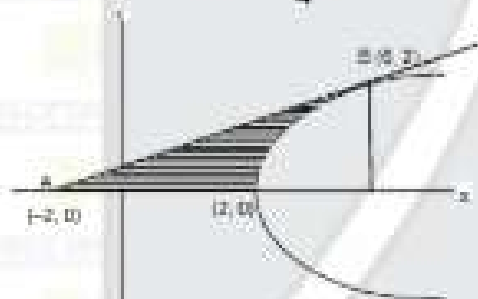
$$\Rightarrow m^2(x^2 + 4x + 4) = x - 2$$

$$\Rightarrow m^2x^2 + (4m^2 - 1)x + 4m^2 + 2 = 0$$

$$D = 0 \Rightarrow (4m^2 - 1)^2 - 4m^2(4m^2 + 2) = 0$$

$$\Rightarrow 16m^4 - 8m^2 + 1 - 16m^4 - 8m^2 = 0$$

$$\Rightarrow 16m^2 = 1 \quad m = \pm \frac{1}{4}$$



$$y = \frac{1}{4}(x + 2)$$

$$x - 4y + 2 = 0$$

$$\text{T. at B } y_1 = \frac{1}{2}(x + x_1) - 2$$

$$2y_1 = x + x_1 - 4$$

$$x - 2y_1 + x_1 - 4 = 0$$

$$2y_1 = 4 \text{ \& } x_1 - 4 = 2$$

$$y_1 = 2, \quad x_1 = 6$$

$$\text{Required Area} = \int_0^2 (y^2 + 2 - (4y - 2)) dy = \left[\frac{y^3}{3} - 2y^2 + 4y \right]_0^2 = \frac{8}{3} - 8 + 8 = \frac{8}{3}$$

Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IP1A, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2777777, 2777700 | FAX No. : +91-022-39167222

To Know more : sms RESO at 56577 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555 | 7340010333 | [Facebook](https://www.facebook.com/resonance) | [Instagram](https://www.instagram.com/resonance) | [YouTube](https://www.youtube.com/resonance) | www.resonance.ac.in

10. α is one root of equation $x^2 + x + 1 = 0$ and $\sum_{k=1}^n \left(\alpha^k + \frac{1}{\alpha^k} \right)^2 = 20$, then value of n is

Ans. (11)

Sol. $x^2 + x + 1 = 0 \Rightarrow \omega = \alpha$

$$\sum_{k=1}^n \left(\omega^k + \frac{1}{\omega^k} \right)^2 = 20$$

$$\left(\omega + \frac{1}{\omega} \right)^2 + \left(\omega^2 + \frac{1}{\omega^2} \right)^2 + \left(\omega^3 + \frac{1}{\omega^3} \right)^2 + \dots = 20$$

$$(-1)^2 + (-1)^2 + (2)^2 + \dots = 20$$

$$(1+1+4) + (1+1+4) + (1+1+4) + 1+1 = 20$$

$$n = 11$$

11. The sum $\frac{2.1}{4+3 \cdot 1^2+1^4} + \frac{2.2}{4+3 \cdot 2^2+2^4} + \frac{2.3}{4+3 \cdot 3^2+3^4} + \dots$ up to 20 this is $\frac{m}{n}$ (where m, n are co-prime) then $2m+n$ is equal to

Ans. (421)

Sol. Here $T_n = \frac{2n}{4+3n^2+n^4}$

$$= \frac{2n}{(n^2+2)^2 - n^2} = \frac{2n}{(n^2+2+n)(n^2+2-n)}$$

$$= \frac{1}{n^2-n+2} - \frac{1}{n^2+n+2}$$

$$T_1 = \frac{1}{2} - \frac{1}{4}$$

$$T_2 = \frac{1}{4} - \frac{1}{8}$$

$$T_3 = \frac{1}{8} - \frac{1}{14}$$

$$T_4 = \frac{1}{14} - \frac{1}{22}$$

$$T_{20} = \frac{1}{382} - \frac{1}{422}$$

$$\therefore S_{20} = \frac{1}{2} - \frac{1}{422} = \frac{211-1}{422} = \frac{210}{422} = \frac{105}{211} = \frac{m}{n}$$

$$\text{Then } 2m+n=421$$

Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPHA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2777777, 2777700 | FAX No.: +91-022-39167222

To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80301RJ2007PLC024029

Toll Free : 1800 258 5555 | 7340010333 | t.me/resonance | www.youtube.com/resonance | www.instagram.com/resonance

12. In triangle ABC, A is (2, -3, 1), B is (3, -1, -5) and C is (1, -4, -4). If G is the centroid of triangle ABC then the value of $6[(AG)^2 + (BG)^2 + (CG)^2]$ is equal to

(1) 164 (2) 184 (3) 82 (4) 41

Ans. (1)

Sol. $AB = \sqrt{41} = c$
 $BC = \sqrt{14} = a$
 $CA = \sqrt{27} = b$
 $AG = \frac{2}{3}$ (median)
 $(AG)^2 = \frac{4}{9} (m)^2$
 $6[(AG)^2 + (BG)^2 + (CG)^2] = 6 \times \frac{4}{9} (m^2 + m^2 + m^2)$
 $= \frac{8}{3} \times \frac{3}{4} (a^2 + b^2 + c^2)$
 $= 2 (41 + 14 + 27) = 164$

13. Let $A = \{-3, -2, -1, 0, 1, 2, 3\}$ & $xRy \Rightarrow 2x - y \in \{0, 1\}$. If r is number of elements in given relation, m & n are minimum number of elements to be added to make it reflexive & symmetric respectively then value of $r + m + n$ is

Ans. (17)

Sol. Let $A = \{-3, -2, -1, 0, 1, 2, 3\}$
 $xRy \Rightarrow 2x - y \in \{0, 1\}$
 $\therefore R = \{0, 0\}, \{0, -1\}, \{2, 3\}, \{1, 1\}, \{1, 2\}, \{-1, 2\}, \{-1, -3\}$
 $n = 7$
 for reflexive the $(-1, -1), (2, 2), (3, 3), (-3, -3), (-2, -2)$
 must be added $\therefore m = 5$
 for symmetric $(-1, 0), (3, 2), (2, 1), (2, -1), (-3, -1)$
 must be added $\therefore n = 5$
 $\therefore r + m + n = 7 + 5 + 5 = 17$

Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPHA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2777777, 2777700 | FAX No. : +91-022-39167222

To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555 | 7340010333 | [facebook.com/resonance](https://www.facebook.com/resonance) | [instagram.com/resonance](https://www.instagram.com/resonance) | www.youtube.com/resonance | info@resonance.ac.in