MEMORY BASED QUESTIONS JEE–MAIN EXAMINATION – APRIL 2026

(HELD ON SUNDAY 05th APRIL 2026) **TIME : 3:00 PM TO 6:00 PM**

MATHEMATICS — TEST PAPER WITH SOLUTION

1. A bag contains 5 red balls, 6 blue balls and 4 black balls (balls of same colour are considered to be distinct). The number of ways in which 8 balls can be selected if atleast two balls of each colour is there, is

(1) 4250 (2) 3650

(3) 3200 (4) 4100

Ans. **(4)**

Sol. Red – 5 Blue – 6 Black – 4

Reqd. No. of ways

$= {}^5C_2 \times {}^6C_2 \times {}^4C_4 + {}^5C_2 \times {}^6C_3 \times {}^4C_3 + {}^5C_2 \times {}^6C_4 \times {}^4C_2$

$+ {}^5C_3 \times {}^6C_2 \times {}^4C_3 + {}^5C_3 \times {}^6C_3 \times {}^4C_2 + {}^5C_4 \times {}^6C_2 \times {}^4C_2$

$= 10 \times 15 \times 1 + 10 \times 20 \times 4 + 10 \times 15 \times 6 + 10 \times 15 \times 4 + 10 \times 20 \times 6 + 5 \times 15 \times 6$

$= 150 + 800 + 900 + 600 + 1200 + 450$

$= 4100$

2. Consider a parabola $y^2 = 8x$. The directrix of parabola cuts x-axis at A and PQ is a focal chord of parabola. If slope of PA = $\frac{3}{5}$ and abscissa of P is greater than 1, then the area of ΔAQP is

(1) 40 (2) $\frac{69}{2}$

(3) $\frac{80}{3}$ (4) 23

Ans. **(3)**

Sol. Let $P(2t^2,4t) \Rightarrow Q\left(\frac{2}{t^2},\frac{4}{t}\right)$

given $m_{PA} = \frac{4t}{2t^2+2} = \frac{3}{5}$

$20t = 6t^2 + 6$

$3t^2 - 10t + 3 = 0$

$t = 3, \frac{1}{3}$ but $t > 1$ (given)

$\Rightarrow P(18,12)$, $Q\left(\frac{2}{9},\frac{4}{3}\right)$

$$A = \frac{1}{2}\begin{vmatrix} 1 & -2 & 0 \\ 1 & 18 & 12 \\ 1 & \frac{2}{9} & \frac{-4}{3} \end{vmatrix} = \frac{80}{3}$$

3. Let $A_1, A_2, A_3, \ldots, A_{49}$ be 49 AM's between 49 and 149. Then the mean of A_1, A_{25}, A_{47} and A_{49} is

(1) 110 (2) 120

(3) 130 (4) 140

Ans. **(1)**

Sol. 49, $A_1, A_2, \ldots, A_{49}$, 149 are in A.P.

Common difference

$$d = \frac{149-49}{50} = 2$$

$$\frac{A_1 + A_{25} + A_{47} + A_{49}}{4}$$

$$= \frac{51+99+143+147}{4} = 110$$

4. If $3^a + 3^{-a}$, f(a) and $2^{1+a} + 2^{1-a}$ are in A.P. If α is the minimum value of f(x), then the value of $\int_{\ell n(\alpha-1)}^{\ell n \alpha} \frac{dx}{e^{2x} - e^{-2x}}$ is

(1) $\frac{1}{2}\ell n\left(\frac{4}{3}\right)$ (2) $\frac{1}{4}\ell n\left(\frac{4}{3}\right)$

(3) $\frac{1}{2}\ell n\frac{8}{9}$ (4) $\frac{1}{4}\ell n\frac{8}{9}$

Ans. **(1)**

Sol. $$f(a) = \frac{3^a + 3^{-a} + 2^{1+a} + 2^{1-a}}{2}$$

$$\Rightarrow f(a) = \frac{3^a + \frac{1}{3^a} + 2\left(2^a + \frac{1}{2^a}\right)}{2}$$

$\therefore f(a)_{min} = 3$ at $a = 0$

$\therefore \alpha = 3$

$$I = \int_{\ell n2}^{\ell n3} \frac{dx}{e^{2x} - e^{-2x}} \Rightarrow I = \int_{\ell n2}^{\ell n3} \frac{e^{2x}\,dx}{(e^{2x})^2 - 1}$$

$e^{2x} = t$

$$\Rightarrow I = \frac{1}{2}\int_4^9 \frac{dt}{t^2 - 1} \Rightarrow I = \frac{1}{2}\left[\ell n\left|\frac{t-1}{t+1}\right|\right]_4^9$$

$$I = \frac{1}{2}\left(\ell n\frac{4}{5} - \ell n\frac{3}{5}\right) \Rightarrow I = \frac{1}{2}\left(\ell n\frac{4}{3}\right)$$

5. Let $\overrightarrow{OP} = \vec{a}$, $\overrightarrow{OQ} = \vec{b}$. If R be a point on OP such that $5\overrightarrow{OR} = \overrightarrow{OP}$ and M be a point on OQ such that $5\overrightarrow{RM} = \overrightarrow{OQ}$, then $\overrightarrow{PM}$ is equal to

(where O is origin)

(1) $\frac{4\vec{b} - \vec{a}}{5}$ (2) $\frac{\vec{b} - 4\vec{a}}{5}$

(3) $\frac{5\vec{b} - \vec{a}}{4}$ (4) $\frac{\vec{b} - 5\vec{a}}{4}$

Ans. **(2)**

Sol. $\overrightarrow{OR} = \frac{\vec{a}}{5}$; $5\overrightarrow{RM} = \overrightarrow{OQ}$

$$\Rightarrow \vec{b} = 5(\overrightarrow{OM} - \overrightarrow{OR})$$

$$\Rightarrow \vec{b} = 5\left(\overrightarrow{OM} - \frac{\vec{a}}{5}\right)$$

$$\Rightarrow \overrightarrow{OM} = \frac{\vec{b} + \vec{a}}{5}$$

$$\overrightarrow{PM} = \overrightarrow{OM} - \overrightarrow{OP}$$

$$= \frac{\vec{b} + \vec{a}}{5} - \vec{a} = \frac{1}{5}(\vec{b} - 4\vec{a})$$

6. If $S = \{\theta : \theta \in [-\pi, \pi]$, $\cos\theta\cos\frac{5\theta}{2} = \cos 7\theta \cos\frac{7\theta}{2}\}$, then n(S) is equal to

(1) 17 (2) 19

(3) 21 (4) 23

Ans. **(2)**

Sol. $\cos\theta\cos\frac{5\theta}{2} = \cos 7\theta\cos\frac{7\theta}{2}$

$$\cos\frac{7\theta}{2} + \cos\frac{3\theta}{2} = \cos\frac{21\theta}{2} + \cos\frac{7\theta}{2}$$

$$\cos\frac{21\theta}{2} - \cos\frac{3\theta}{2} = 0$$

$$-2\sin 6\theta \sin\frac{9\theta}{2} = 0$$

$\sin 6\theta = 0$

$\theta = 0, \pm\frac{\pi}{6}, \pm\frac{2\pi}{6}, \ldots \pm\frac{5\pi}{6}, \pm\pi$ (13 solutions)

$\sin\frac{9\theta}{2} = 0$

$\theta = \pm\frac{2\pi}{9}, \pm\frac{4\pi}{9}, \pm\frac{8\pi}{9}$ (6 more solutions)

Total = 19 solutions

7. In a cricket team A and B can be chosen as captain, probability of A is to be chosen as captain is 0.6, and that of B is 0.4, if A is chosen as a captain then probability of winning team is 0.8 and that of B is 0.7 then total probability of winning of team is ?

(1) 0.76 (2) 0.67

(3) 0.78 (4) 0.87

Ans. **(1)**

Sol. P(Win) = P(A $\cap$Win) + P(B $\cap$Win)

= (.6) (.8) + (.4) (.7) = .76

8. Let y(x) is the solution of differential equation $\sqrt{\tan x}\,dy = (\sec^3 x - y(\tan x)^{3/2})dx$ and $y(\pi/4) = \frac{6\sqrt{2}}{5}$ then the value of $y\left(\frac{\pi}{3}\right)$ is

(1) $\frac{8}{5}.3^{1/4}$ (2) $\frac{8}{3}.3^{1/4}$

(3) $\frac{8}{5}.5^{1/4}$ (4) $\frac{7}{5}.3^{1/4}$

Ans. **(1)**

Sol. $\frac{dy}{dx} + y\tan x = \frac{\sec^3 x}{\sqrt{\tan x}}$

$IF = e^{\int \tan x dx} = \sec x$

$y \sec x = \int \frac{\sec^4 x}{\sqrt{\tan x}} dx$

$y \sec x = \int \frac{(1+\tan^2 x)}{\sqrt{\tan x}} \sec^2 x dx$

$\tan x = t$

$y \sec x = 2\sqrt{\tan x} + \frac{2}{5}(\tan x)^{5/2} + c$

$y\left(\frac{\pi}{4}\right) = \frac{6\sqrt{2}}{5}$

$\frac{6\sqrt{2}}{5} \times \sqrt{2} = 2 + \frac{2}{5} + c \Rightarrow \frac{12}{5} = \frac{12}{5} + c$

$\Rightarrow c = 0$

$y(\pi/3) = \frac{8}{5}.3^{1/4}$

9. If Z_1 and Z_2 are roots of equation $Z^2 + 4Z - (1 + 12i) = 0$, where $Z \in$ complex number, then the value of $|Z_1|^2 + |Z_2|^2$ is

(1) 34 (2) 37

(3) 42 (4) 45

Ans. **(1)**

Sol. $Z^2 + 4Z - (1 + 12i) = 0$

$\Rightarrow Z = \frac{-4 + \sqrt{16 + 4(1+12i)}}{2}$

$\Rightarrow Z = -2 \pm \sqrt{5+12i}$

$\Rightarrow Z = -2 \pm (3 + 2i)$

$\Rightarrow Z = 1 + 2i, -5 - 2i$

$\therefore |Z_1|^2 + |Z_2|^2$

$= 5 + 29$

$= 34$

10. Let $f(x) = \lim_{y \to 0} \frac{(1-\cos(xy))\tan(xy)}{y^3}$ then the number of point of intersection of $f(x) = \sin x$ is

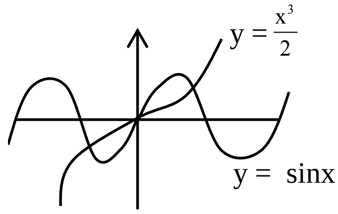
(1) 1 (2) 2

(3) 3 (4) 4

Ans. **(3)**

Sol. $f(x) = \lim_{y \to 0} \frac{(1-\cos(xy))}{(xy)^2} \times \frac{\tan(xy)}{xy} \times \frac{x^3}{1}$

$f(x) = \frac{x^3}{2}$



No. of point of intersection = 3

11. If f(x) satisfy the equation

$f(x) = \int_1^x f(t)dt + (1-x)(\log_e x - 1) + e$

then f(f(1)) is equal to

(1) $1 - e^{2-e}$ (2) $1 + e^{2+e}$

(3) $1 + e^e$ (4) $1 - e^{2+e}$

Ans. **(3)**

Sol. $f(x) = \int_1^x f(t)dt + (1-x)(\log_e x - 1) + e$

$f'(x) = f(x) - (\log_e x - 1) + \frac{(1-x)}{x}$

$\frac{dy}{dx} - y = \frac{1}{x} - \log_e x$

$IF = e^{-x}$

solution is $y e^{-x} = \int e^{-x}\left(\frac{1}{x} - \log_e x\right)dx$

$y e^{-x} = \int \left(\frac{e^{-x}}{x}\right)dx - \int e^{-x} \log_e x dx$

$y e^{-x} = e^{-x} \log_e x + c$

$f(x) = y = \log_e x + ce^x$

$f(1) = e = ce \Rightarrow c = 1$

$f(x) = \log_e x + e^x$

$f(1) = e$

$f(f(1)) = f(e) = 1 + e^e$

12. If α, β are the roots of the equation $x^2 - 4x + p = 0$ and γ, δ are the roots of the equation $x^2 - x + q = 0$. When $\alpha, \beta, \gamma, \delta$ form a GP with positive common ratio. then the value of $(p + q)$ equals

(1) $\frac{22}{9}$ (2) $\frac{33}{9}$

(3) $\frac{21}{9}$ (4) $\frac{34}{9}$

Ans. (4)

Sol. $\alpha = a, \beta = ar, \gamma = ar^2, \delta = ar^3$

$$a + ar = 4$$
$$ar^2 + ar^3 = 1$$

$$r = \frac{1}{2}, a = \frac{8}{3}$$

$$p + q = a^2 r + a^2 r^5$$

$$= \frac{34}{9}$$

13. A line L : x + y = 0 is given. Two lines L_1 & L_2 are passing through (–1, –1) inclined at an angle of 45° from line L. Reflection of lines L_1 and L_2 in line 2y + x = 1 is ax + by = 9 and cx + dy = 1 then the value of $|ad + bc|$ is equal to

(1) 1 (2) 2

(3) 3 (4) 4

Ans. (1)

Sol. $\tan 45° = \left|\frac{m+1}{1-m}\right|$

$$\Rightarrow \pm 1 = \frac{m+1}{1-m}$$

$\Rightarrow$ m = 0 & one line is perpendicular to x axis.

$L_1 : x = -1, L_2 : y = -1$

Now taking mirror image of x + 1 = 0 in x + 2y = 1

$$A' : \frac{x+1}{1} = \frac{y+1}{2} = \frac{-2(-1-2-1)}{1^2 + 2^2}$$

$$x = \frac{3}{5}, y = \frac{11}{5} \quad A'\left(\frac{3}{5}, \frac{11}{5}\right)$$

line = 3x – 4y + 7 = 0

Now taking mirror image of y + 1 = 0 in x + 2y = 1

$$A'' : \frac{x+1}{1} = \frac{y+1}{2} = \frac{-2(-1-2-1)}{1^2 + 2^2}$$

$$x = \frac{3}{5}, y = \frac{11}{5}$$

$$A''\left(\frac{3}{5}, \frac{11}{5}\right)$$

$$\text{line} : (y + 1) = \frac{\left(\frac{11}{5} + 1\right)}{\left(\frac{3}{5} - 3\right)}(x - 3)$$

4x + 3y = 9

comparing 4x + 3y = 9 with ax + by = 9 &

3x – 4y = – 7 with cx + dy = 1

$$a = 4 \quad b = 3 \quad c = \frac{-3}{7} \quad d = \frac{4}{7}$$

$$|ad + bc| = \left|4 \times \left(\frac{4}{7}\right) + (3)\left(\frac{-3}{7}\right)\right| = 1$$

14. The coefficient of x^2 in the binomial expansion of $\left(2x^2+\frac{1}{x}\right)^{10}$ is

(1) 3360 (2) 2360

(3) 3260 (4) 3380

Ans. (1)

Sol. $T_{r+1} = {}^{10}C_r(2x^2)^{10-r}(1/x)^r$

$= {}^{10}C_r 2^{10-r} x^{20-2r-r}$

$= {}^{10}C_r 2^{10-r} x^{20-3r}$

$\Rightarrow 20-3r = 2$

$r = 6$

So required coefficient is ${}^{10}C_6 2^4$

15. If the sum of the first 10 terms of the series $\frac{1}{1+4\times1^4}+\frac{2}{1+4\times2^4}+\frac{3}{1+4\times3^4}+......$ is $\frac{m}{n}$ (where m, n are coprime), then (m + n) is

(1) 264 (2) 276 (3) 284 (4) 256

Ans. (2)

Sol. $T_r = \frac{r}{1+4r^4} = \frac{r}{4r^4+4r^2+1-4r^2} = \frac{r}{(2r^2+1)^2-(2r)^2}$

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

$S_{10} = \frac{1}{4}\left(\frac{1}{1}-\frac{1}{221}\right) = \frac{55}{221} = \frac{m}{n}$

$\therefore m+n = 276$

16. Let focii of a hyperbola are (3,5) and (3,–4). If eccentricity 'e' of the hyperbola satisfies the equation $3e^2 - 11e + 6 = 0$, then the length of the latus rectum of the hyperbola is

(1) 20 (2) 24 (3) 18 (4) 26

Ans. (2)

Sol. $S_1(3,5)$ & $S_2(3,-4)$

$\because S_1S_2 = 2ae$

$\Rightarrow 9 = 2ae$ ...(1)

and $\because 3e^2-11e+6=0$

$\Rightarrow e = 3,\ e = \frac{2}{3} < 1 (\text{rejected})$

From (1) $a = \frac{3}{2}$

$\Rightarrow LR = 2\cdot\frac{b^2}{a} = 2a(e^2-1) = 3[9-1] = 24$

17. Let A = {2, 3} and B = {5, 6}, then the number of relations from A × B to A × B are

(1) 2^{12} (2) 2^{14} (3) 2^{16} (4) 2^{18}

Ans. (3)

Sol. n(A × B) = 2 × 2 = 4

Number of relations = $2^{4\times4} = 2^{16}$

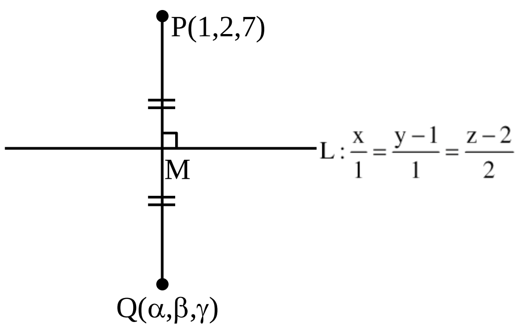
18. If distance of point (a,2,5) from image of point (1,2,7) in the line $\frac{x}{1}=\frac{y-1}{1}=\frac{z-2}{2}$ is 4, then sum of all possible values of a is

(1) 4 (2) 5 (3) 6 (4) 8

Ans. (3)

Sol. PQ⊥L ⇒ (α–1) + (β–2)+2(γ–7) = 0

$\Rightarrow \alpha+\beta+2\gamma = 17$ ...(1)



M is mid point of PQ which will satisfy L

$$\frac{\alpha+1}{2}=\frac{\frac{\beta+2}{2}-1}{1}=\frac{\frac{\gamma+7}{2}-2}{2}$$

$$\Rightarrow \frac{\alpha+1}{2}=\frac{\beta}{2}=\frac{\gamma+3}{4}$$

$\Rightarrow \alpha+1=\beta \quad \ldots(2)$

and $2\beta=\gamma+3 \quad \ldots(3)$

$\Rightarrow \alpha=3, \beta=4, \gamma=5$

Distance from (a, 2, 5) is $=\sqrt{(a-3)^2+4+0}=4$

$(a-3)^2+4=16 \Rightarrow a^2-6a-3=0 \Rightarrow$ sum of values of a = 6

19. Let $f(x)+3f\left(\frac{\pi}{2}-x\right)=\sin x$ & maximum value of f is α. If area bounded between $g(x)=x^2$ & $h(x)=bx^3(\beta>0)$ is α^2, then $30\beta^3$ is equal to

(1) 14 (2) 16 (3) 20 (4) 22

Ans. (2)

Sol. $f(x)+3f\left(\frac{\pi}{2}-x\right)=\sin x \quad \ldots(1)$

Put $x\to\frac{\pi}{2}-x$

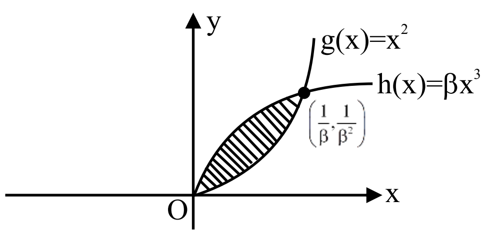
$\Rightarrow f\left(\frac{\pi}{2}-x\right)+3f(x)=\cos x \quad \ldots(2)$

From (1) & (2)

$$f(x)=\frac{1}{8}(3\cos x-\sin x)$$

$$f_{max}=\frac{\sqrt{10}}{8}$$

y = g(x) & y = h(x) intersect as shown in the figure



$\therefore$ Area bounded $=\Delta=\left|\int_0^{\frac{1}{\beta}}(\beta x^3-x^2)\,dx\right|$

$$=\frac{1}{12\beta^3}=\alpha^2 \text{ (given)}$$

$\Rightarrow 30\beta^3=16$

SECTION-B

1. Let $f(n)=\begin{vmatrix} n & -1 & -5 \\ -2n^2 & 3(2k+1) & 2k+1 \\ -3n^3 & 3k(2k+1) & 3k(k+2)+1 \end{vmatrix}$

If $\sum_{n=1}^{k} f(n)=98$ then find k.

Ans. (3)

Sol. $f(n)=\begin{vmatrix} n & -1 & -5 \\ -2n^2 & 3(2k+1) & 2k+1 \\ -3n^3 & 3k(2k+1) & 3k(k+2)+1 \end{vmatrix}$

$$\sum_{n=1}^{k} f(n)=\begin{vmatrix} \frac{k(k+1)}{2} & -1 & -5 \\ -2\frac{k(k+1)(2k+1)}{6} & 3(2k+1) & 2k+1 \\ -3\frac{k^2(k+1)^2}{4} & 3k(2k+1) & 3k(k+2)+1 \end{vmatrix}=98$$

$$\Rightarrow \frac{k(k+1)(2k+1)}{2}.\frac{7}{3}=98$$

$\Rightarrow k(k+1)(2k+1)=84$

$\Rightarrow k=3$

2. A 3^{rd} order square matrix M satisfy

$$M\begin{pmatrix}1\\0\\0\end{pmatrix}=\begin{pmatrix}1\\2\\3\end{pmatrix}; M\begin{pmatrix}0\\1\\0\end{pmatrix}=\begin{pmatrix}0\\1\\2\end{pmatrix} \;\&\; M\begin{pmatrix}0\\0\\1\end{pmatrix}=\begin{pmatrix}-1\\1\\2\end{pmatrix}.$$

If $M\begin{pmatrix}x\\y\\z\end{pmatrix}=\begin{pmatrix}2\\4\\7\end{pmatrix}$, then x + y + z is

Ans. (3)

Sol. Let $M=\begin{bmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{bmatrix}$

$M\begin{pmatrix}1\\0\\0\end{pmatrix}=\begin{pmatrix}1\\2\\3\end{pmatrix} \Rightarrow a_1=1, b_1=2, c_1=3$

Similarly $a_2 = 0, b_2 = 1, c_2 = 2$

& $a_3 = -1, b_3 = 1, c_3 = 2$

$M\begin{pmatrix}x\\y\\z\end{pmatrix}=\begin{pmatrix}2\\4\\7\end{pmatrix}$

$\Rightarrow x + 0y - z = 2$

$2x + y + z = 4$

$3x + 2y + 2z = 7$

$\Rightarrow D = -1, D_1 = -1, D_2 = -3, D_3 = 1$

$x = 1, y = 3, z = -1$

$x + y + z = 3$

3. $A = \{1, 4, 7\}$, $B = \{2, 3, 8\}$ let R be a relation defined as $\{((a_1, b_1), (a_2, b_2)) \in (A \times B) \times (A \times B): (a_2 + b_1)|(a_1 + b_2)\}$ then find number of relations.

Ans. **(18)**

Sol.

A / B	2	3	8
1	3	4	9
4	6	7	12
7	9	10	15

These are possible sum of $a_i + b_j$.

Now $b_1 + a_2$ divides $a_1 + b_2$

So,

$a_1 + b_2$	$a_2 + b_1$	No. of pairs
15	3,15	2
12	3,4,6,12	4
10	10	1
9	3,9	6
7	7	1
6	3,6	2
4	4	1
3	3	1
		18

Number of relations = 18