MEMORY BASED QUESTIONS JEE–MAIN EXAMINATION – APRIL 2026

(HELD ON SUNDAY 05th APRIL 2026) **TIME : 9:00 AM TO 12:00 NOON**

MATHEMATICS — TEST PAPER WITH SOLUTION

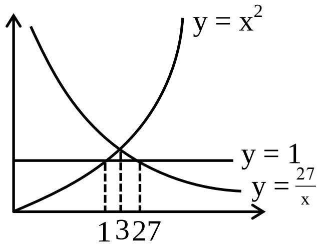
1. The area enclosed between the region given by $xy \le 27$ & $1 \le y \le x^2$ is

(1) $54\,\ell n\,3 - \frac{52}{3}$ (2) $52\,\ell n\,3 - \frac{52}{3}$

(3) $54\,\ell n\,2 - \frac{54}{3}$ (4) $52\,\ell n\,2 - \frac{52}{3}$

Ans. (1)

Sol.



$$\text{Area} = \int_1^3 (x^2-1)dx + \int_3^{27}\left(\frac{27}{x}-1\right)dx$$

$$= \left[\frac{x^3}{3} - x\right]_1^3 + \left[27\ell nx - x\right]_3^{27}$$

$$= \frac{26}{3} - 2 + 27\,\ell n\,9 - 24$$

$$= 27\,\ell n\,9 - \frac{26\times 2}{3}$$

$$= 54\,\ell n\,3 - \frac{52}{3}$$

2. If f(x) satisfy the relation $f\left(\frac{x+y}{3}\right) = \frac{f(x)+f(y)}{3}$ & $f'(0) = 3$, then the minimum value of $g(x) = 3 + e^x f(x)$ is

(1) $\frac{3(e-1)}{e}$ (2) $\frac{(e-1)}{e}$

(3) $\frac{(e-1)}{3}$ (4) $\frac{e(e-1)}{3}$

Ans. (1)

Sol. $f\left(\frac{x+y}{3}\right) = \frac{f(x)+f(y)}{3}$, put $x = y = 0$

$f(0) = \frac{2f(0)}{3}$

$\Rightarrow f(0) = 0......(1)$

$f'\left(\frac{x+y}{3}\right)\cdot\frac{1}{3} = \frac{1}{3}f'(x)$

put $x = 0$

$f'\left(\frac{y}{3}\right)\frac{1}{3} = \frac{1}{3}\times 3$

$f'\left(\frac{y}{3}\right) = 3$

put $y = 3x$

$f'(x) = 3$

integrate both sides

$f(x) = 3x + c$

from eq. (1)

$f(0) = 0$

$\Rightarrow f(x) = 3x$

Now

$g(x) = 3 + e^x \cdot 3x$

$g'(x) = 3[e^x + x\cdot e^x]$

$= 3e^x(x+1)$

$g'(x) = 0$, at $x = -1$

$(g(x))_{min} = 3 + e^{-1}(-3)$

$= 3\left[1 - \frac{1}{e}\right] = \frac{3(e-1)}{e}$

3. Let S_n is the sum of first n terms of an A.P. If $S_n = 3n^2 + 5n$, then the sum of square of first 10 terms of the given A.P. is

(1) 15220 (2) 14220

(3) 15320 (4) 15110

Ans. (1)

Sol. $S_n = 3n^2 + 5n$

$T_n = S_n - S_{n-1}$

$= 3(n^2 - (n-1)^2) + 5(n - (n-1))$

$= 3(2n - 1) + 5$

$= 6n + 2$

$$\sum_{n=1}^{10}(6n+2)^2 = \sum 36n^2 + \sum 4 + \sum 24n$$

$$= 36 \times \frac{10\times11\times21}{6} + 4 \times 10 + 24\,\frac{10\times11}{2}$$

$= 15220$

4. A and B play a tennis match which will not result in a draw. The player who wins 5 rounds first, will be the winner of the match then the number of ways such that A can win the match is

(1) 126 (2) 252

(3) 63 (4) 216

Ans. (1)

Sol. required ways = ${}^9C_5 = 126$

5. If α, β are the roots of quadratic equation $ax^2 + bx + c = 0$ and $|\alpha - \beta| = \sqrt{11}$, $\alpha + \beta = 3i$, then the value of $(\alpha^3 - \beta^3)^2$ is

(1) 167 (2) 176

(3) 716 (4) 617

Ans. (2)

Sol. $|\alpha - \beta| = \sqrt{11}$

$\Rightarrow \alpha^2 + \beta^2 - 2\alpha\beta = 11$

$\alpha + \beta = 3i \Rightarrow \alpha^2 + \beta^2 + 2\alpha\beta = -9$

$\Rightarrow \alpha\beta = -5$

Now, $E = (\alpha^3 - \beta^3)^2$

$= (\alpha - \beta)^2 (\alpha^2 + \beta^2 + \alpha\beta)^2$

$$= \left(\sqrt{11}\right)^2 \left((\alpha+\beta)^2 - 2\alpha\beta + \alpha\beta\right)^2$$

$= 11\,(-9 - (-5))^2$

$= 176$

6. Consider

x_i	5	6	8	11	13
f_i	4	8	2	3	9

then mean deviation about mean is

(1) 4.23 (2) 5.23

(3) 2.32 (4) 3.23

Ans. (4)

Sol. $$\text{M.D.} = \frac{\sum f_i |x_i - \bar{x}|}{\sum f_i}$$

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$$

$$= \frac{20+48+16+33+117}{26}$$

$$= \frac{234}{26} = 9$$

$$\text{M.D.} = \frac{4(4)+8(3)+2(1)+3(2)+9(4)}{26}$$

$$= \frac{16+24+2+6+36}{26}$$

$$= \frac{84}{26} = 3.23$$

7. If $S_1 : x^2 + y^2 - 6x - 8y + 21 = 0$ and

$S_2 : x^2 + y^2 + 6x + 8y + \lambda = 0$

then the distance of centre of S_2 to the farthest point on S_1 is

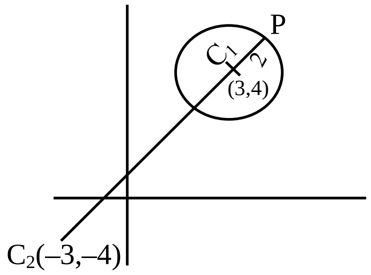
(1) 10 (2) 11

(3) 12 (4) 13

Ans. (3)

Sol. $S_1 : C_1\ (3,4)\ r = 2$

$S_2 : C_2\ (-3, -4)$



$C_1C_2 = 10$

So $C_2P = 12$

8. If $\alpha = \frac{\pi}{4} + \sum_{p=1}^{11} \tan^{-1}\left(\frac{2^{p-1}}{1+2^{2p-1}}\right)$

then the value of $\tan(\alpha)$ is

(1) 2^9 (2) 2^{10}

(3) 2^{11} (4) 2^{12}

Ans. (3)

Sol. $\alpha = \frac{\pi}{4} + \sum_{p=1}^{11} \tan^{-1}\left(\frac{2^{p-1}}{1+2^{2p-1}}\right)$

$= \frac{\pi}{4} + \sum_{p=1}^{11} \tan^{-1}\left(\frac{2^{p} - 2^{p-1}}{1+2^{p}2^{p-1}}\right)$

$= \frac{\pi}{4} + \sum_{p=1}^{11} (\tan^{-1}\left(2^{p}\right) - \tan^{-1}(2^{p-1}))$

$= \frac{\pi}{4} + \tan^{-1}\left(2^{11}\right) - \tan^{-1}(2^{0}) = 2^{11}$

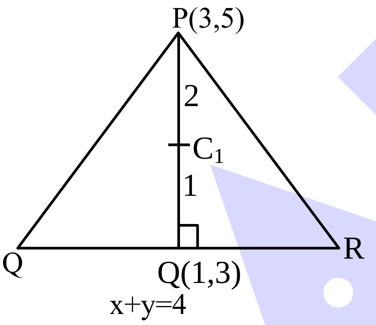
9. Consider an equilateral ΔPQR, where P(3,5) and QR is x + y = 4. If the orthocentre of ΔPQR is (α,β), then $9(\alpha + \beta)$ is equal to

(1) 46 (2) 48

(3) 50 (4) 52

Ans. (2)

Sol.



$Q : \frac{x-3}{1} = \frac{y-5}{1} = -\frac{(3+5-4)}{1+1}$

Q(1, 3)

So orthocentre is $\left(\frac{2+3}{3}, \frac{6+5}{3}\right)$

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

So $9(\alpha + \beta) = 3(16) = 48$

10. If $\lim_{x\to 0} \frac{1-\cos(\alpha x)\cos((\alpha+1)x)\cos((\alpha+2)x)}{\sin((\alpha+1)x)^2} = 2$

Then the product of all possible values of α is

(1) 1 (2) –1

(3) 2 (4) –2

Ans. (2)

Sol. $\lim_{x\to 0} \frac{1-\cos\alpha x.\cos((\alpha+1)x)\cos((\alpha+2)x)}{(\alpha+1)^2 x^2}$

By using L.H. Rule we get

$\Rightarrow \frac{1}{2}(\alpha+1)^2[\alpha^2 + (\alpha+1)^2 + (\alpha+2)^2] = 2$

$\alpha^2 + (\alpha+1)^2 + (\alpha+2)^2 = 4(\alpha+1)^2$

$\alpha^2 + (\alpha+2)^2 = 3(\alpha+1)^2$

$\Rightarrow \alpha^2 + 2\alpha - 1 = 0$

Product = –1

11. On a postcard one of the two words either KANPUR or ANANTPUR is written. If only two consecutive letters AN are visible on the postcard, then the probability that the written word is ANANTPUR, is

(1) $\frac{3}{17}$ (2) $\frac{10}{17}$

(3) $\frac{2}{17}$ (4) $\frac{4}{17}$

Ans. (2)

Sol. $P(I) : \frac{1}{2}\ P(A/I) \rightarrow \frac{1}{5}$

$P(II) : \frac{1}{2}\ P(A/II) \rightarrow \frac{2}{7}$

$\therefore$ Reqd. Prob $= \frac{\frac{1}{2}\times\frac{2}{7}}{\frac{1}{2}\times\frac{1}{5}+\frac{1}{2}\times\frac{2}{7}} = \frac{\frac{2}{7}\times 5}{\frac{17}{7}} = \frac{10}{17}$

12. Consider differential equation

$$\sin\left(\frac{y}{x}\right)\frac{dy}{dx}+1=\frac{y}{x}\sin\left(\frac{y}{x}\right),\ y(1)=\frac{\pi}{2}$$

and $\alpha=\cos\left(\frac{y(e^{12})}{e^{12}}\right)$. Let r be the radius of the circle $x^2+y^2-2px+2py+\alpha+2=0$ (where $\alpha \le 6$) then the number of integral values of 'p' is

(1) 11 (2) 12

(3) 13 (4) 15

Ans. (1)

Sol. $\sin\frac{y}{x}\frac{dy}{dx}=\frac{y}{x}\sin\frac{y}{x}-1$

put $y=tx \Rightarrow \frac{dy}{dx}=t+x\frac{dt}{dx}$

$\sin t\left(t+x\frac{dt}{dx}\right)=t\sin t-1$

$x\sin t\frac{dt}{dx}+1=0$

$\sin t\,dt+\frac{dx}{x}=0$

$\Rightarrow -\cos t+\ell nx=C$

$\Rightarrow -\cos\left(\frac{y}{x}\right)+\ell nx=C$

$y(1)=\frac{\pi}{2} \Rightarrow C=0$

$\Rightarrow \cos\left(\frac{y}{x}\right)=\ell nx$

$\cos\left(\frac{y(e^{12})}{e^{12}}\right)=12 \Rightarrow \alpha=12$

$x^2+y^2-2px+2py+14=0$

$r=\sqrt{p^2+p^2-14}$

$\Rightarrow r\le 6 \Rightarrow r^2 \le 36$

$2p^2-14\le 36$

$p^2\le 25$

$p\in[-5,5]$

13. If system of equations (in variable x, y, z):

$x-2y+tz=0$

$3x+5y+t^2z=0$

$6x+ty+f(t)z=0$

have infinitely many solutions (where f(t) represents real function) then

(1) y = f(t) is strictly increasing

(2) y = f(t) is strictly decreasing

(3) y = f(t) is decreasing

(4) y = f(t) is increasing

Ans. (1)

Sol. $\begin{vmatrix}1 & -2 & t\\ 3 & 5 & t^2\\ 6 & t & f(t)\end{vmatrix}=0$

$1(5f(t)-t^3)+2(3f(t)-6t^2)+t(3t-30)=0$

$f(t)=\frac{t^3+9t^2+30t}{11}$

$f'(t)=\frac{1}{11}(3t^2+18t+30)$

$D<0$

So function is strictly increasing

14. If tanA and tanB are roots of equation $x^2-2x-5=0$, then the value of $10\left(\sin^2\left(\frac{A+B}{2}\right)\right)$ is

(1) $5+\frac{3}{2}\sqrt{10}$ (2) $10+\frac{3}{2}\sqrt{10}$

(3) $5-\frac{3}{2}\sqrt{10}$ (4) $10-\frac{3}{2}\sqrt{10}$

Ans. (3)

Sol. $x^2-2x-5=0$

$\tan A+\tan B=2;\quad \tan A\tan B=-5$

$\therefore\ \tan(A+B)=\frac{2}{1-(-5)}=\frac{1}{3}$

$\Rightarrow\ \cos(A+B)=\frac{3}{\sqrt{10}}$

$\therefore\ 10\left(\sin^2\left(\frac{A+B}{2}\right)\right)=\frac{10}{2}(1-\cos(A+B))$

$=5\left(1-\frac{3}{\sqrt{10}}\right)$

15. If $\vec{r}\times\vec{a}+\vec{a}\times\vec{b}=\vec{0}$, $\vec{a}=\sqrt{7}\hat{i}+\hat{j}+\hat{k}$, $\vec{b}=\hat{j}-2\hat{k}$ and $\vec{r}.\vec{a}=0$, then the value of $|3\vec{r}|^2$ is

(1) 46 (2) 40

(3) 42 (4) 44

Ans. (4)

Sol. $\vec{r}\times\vec{a}-\vec{b}\times\vec{a}=\vec{0}$

$(\vec{r}-\vec{b})\times\vec{a}=\vec{0}$

$\vec{r}-\vec{b}=\lambda\vec{a}$

$\vec{r}=\vec{b}+\lambda\vec{a}$

$\vec{r}.\vec{a}=0 \Rightarrow \vec{a}.\vec{b}+\lambda|\vec{a}|^2=0$

$$\lambda=-\frac{\vec{a}.\vec{b}}{|\vec{a}|^2}=-\frac{(1-2)}{9}=\frac{1}{9}$$

$$\vec{r}=\vec{b}+\frac{\vec{a}}{9}$$

$$|3\vec{r}|^2=9|\vec{r}|^2=9\left(b^2+\frac{a^2}{81}+\frac{2(\vec{a}.\vec{b})}{9}\right)=44$$

16. The value of $\sum_{n=1}^{10}\frac{528}{n(n+1)(n+2)}$ is equal to

(1) 130 (2) 260 (3) 65 (4) 120

Ans. (1)

Sol. Let $T_n=\frac{1}{n(n+1)(n+2)}=\frac{1}{2}\left[\frac{(n+2)-n}{n(n+1)(n+2)}\right]$

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

$$T_1=\frac{1}{2}\left[\frac{1}{1.2}-\frac{1}{2.3}\right]$$

$$T_2=\frac{1}{2}\left[\frac{1}{2.3}-\frac{1}{3.4}\right]$$

$\vdots$

$$T_{10}=\frac{1}{2}\left[\frac{1}{10.11}-\frac{1}{11.12}\right]$$

$$S=\frac{1}{2}\left[\frac{1}{2}-\frac{1}{11.12}\right]$$

$$\text{Final sum}=\frac{528}{2}\left[\frac{1}{2}-\frac{1}{11.12}\right]$$

$= 132 - 2 = 130$

17. The value of $\int_0^{\infty}\frac{\ell n x}{x^2+4}dx$ is equal to

(1) $\frac{\pi\ell n2}{4}$ (2) $\frac{\pi\ell n2}{2}$

(3) $\frac{\pi\ell n4}{3}$ (4) $\frac{3\pi\ell n2}{4}$

Ans. (1)

Sol. Put $x = 2t \Rightarrow dx = 2dt$

$$I=\int_0^{\infty}\frac{\ell n2t}{4t^2+4}(2dt)=\frac{1}{2}\int_0^{\infty}\frac{\ell n2+\ell nt}{t^2+1}dt$$

$$=\frac{1}{2}\int_0^{\infty}\frac{\ell n2}{t^2+1}dt+\frac{1}{2}\int_0^{\infty}\frac{\ell nt}{t^2+1}dt$$

$$\left[\frac{\ln 2}{2}\tan^{-1}t\right]_0^{\infty}+I_1$$

$$= \frac{\ell n 2}{2} \cdot \frac{\pi}{2} + I_1$$

$$I_2 = \frac{1}{2}\int_0^{\infty} \frac{\ell n t}{t^2+1} dt \qquad t = \frac{1}{u} \Rightarrow dt = -\frac{du}{u^2}$$

$$= \frac{1}{2}\int_{\infty}^{0} \frac{\ell n(1/u)}{\frac{1}{u^2}+1}\left(-\frac{du}{u^2}\right)$$

Add $\Rightarrow I_1 = 0$

$$I = \frac{\pi \ell n 2}{4}$$

18. Let p(x, y) is a variable point on the circle $x^2 + y^2 - 6x - 8y + 21 = 0$, then the maximum possible distance of p from the vertex of $y^2 + 6y + x + 13 = 0$ is

(1) $7+2\sqrt{2}$ (2) $2+7\sqrt{2}$

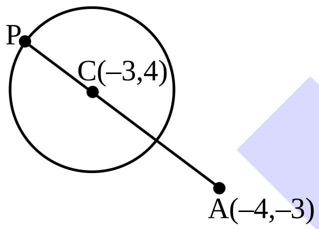
(3) $4+7\sqrt{2}$ (4) $3+2\sqrt{2}$

Ans. **(2)**

Sol. Centre : C(3,4) & r = 2

Parabola $(y+3)^2 = -(x+4)$

Vertex is A(–4,–3)



$$AP_{max} = AC + r = \sqrt{49+49} + 2 = \sqrt{98} + 2$$

$$= 2 + 7\sqrt{2}$$

19. Let $f : A \to A$ be function, where A ={1, 2, 3, 4, 5, 6}. The number of one-one functions such that

$f(1) \le 3$, $f(3) \le 4$ and $f(2) + f(3) = 5$, is

(1) 20 (2) 18 (3) 36 (4) 24

Ans. **(3)**

Sol. f(1) = 1, 2, 3 f(3) = 1, 2, 3, 4

f(1) = 1 f(3) = 2, f(2) = 3 $\to$ 6

f(3) = 3, f(2) = 2 $\to$ 6

f(1) = 2 f(3) = 1, f(2) = 4 $\to$ 6

f(3) = 4, f(2) = 1 $\to$ 6

f(1) = 3 f(3) = 1, f(2) = 4 $\to$ 6

f(3) = 4, f(2) = 1 $\to$ 6

Total = 36

20. The value of $I = \int_{\pi/6}^{\pi/3} \frac{4-\text{cosec}^2 x}{\cos^4 x} dx$ is

(1) $\frac{32\sqrt{3}}{3}$ (2) $\frac{32\sqrt{3}}{9}$

(3) $\frac{64\sqrt{3}}{3}$ (4) $\frac{64\sqrt{3}}{9}$

Ans. **(2)**

Sol. $= \int_{\pi/6}^{\pi/3} \frac{4}{\cos^4 x} dx - \int_{\pi/6}^{\pi/3} \frac{\text{cosec}^2 x}{\cos^4 x} dx$

$$= \int_{\pi/6}^{\pi/3} \frac{4}{\cos^4 x} dx - \left[-\frac{\cot x}{\cos^4 x} - \int_{\pi/6}^{\pi/3} (-\cot x)\frac{-4}{\cos^5 x}(-\sin x)\, dx\right]$$

$$= \left.\frac{\cot x}{\cos^4 x}\right|_{\frac{\pi}{6}}^{\frac{\pi}{3}}$$

$$= \frac{1/\sqrt{3}}{(1/2)^4} - \frac{\sqrt{3}}{\left(\frac{\sqrt{3}}{2}\right)^4}$$

$$= \frac{16}{\sqrt{3}} - \frac{\sqrt{3}.16}{9} = \frac{16}{\sqrt{13}} - \frac{16}{3\sqrt{3}} = \frac{16}{\sqrt{13}}\left(1-\frac{1}{3}\right)$$

$$\frac{32}{3\sqrt{3}} = \frac{32\sqrt{3}}{9}$$

21. If $3\sin^2 t - 12\sin t - 3 = p$, then the sum of all integral values of 'p' such that the equation has at least one real root, is

(1) –75 (2) –60

(3) –65 (4) –72

Ans. **(1)**

Sol. $3\sin^2 t - 12\cos t - 3 = p$

$\Rightarrow -3\cos^2 t - 12\cos t = p$

$\Rightarrow 3\cos^2 t + 12\cos t + p = 0$

$$\Rightarrow \cos t = \frac{-12 \pm \sqrt{144-12p}}{6}$$

$$\Rightarrow \cos t = -2 \pm \sqrt{4 - p/3}$$

But $-1 \le \cos\ t \le 1$

$$\Rightarrow -1 \le -2 + \sqrt{4-p/3} \le 1$$

$$1 \le \sqrt{4 - \frac{p}{3}} \le 3$$

$$1 \le 4 - \frac{p}{3} \le 9$$

$$-3 \le -\frac{p}{3} \le 5$$

$-15 \le p \le 9$

Sum = – 15 – 14………..+9

= –10 – 11 – 12………–15

= –75

SECTION-B

1. In the expansion of $\left(\frac{1}{x^3} - x^4\right)^n$, if sum of coefficient of x^7 & x^{14} is zero, then find n.

Ans. **(21)**

Sol. General term $= {}^nC_r \left(\frac{1}{x^3}\right)^{n-r} (-x^4)^r$

$= {}^nC_r (-1)^r x^{7r-3n}$

Coeff. of $x^7 \Rightarrow 7r_1 - 3n = 7 \Rightarrow r_1 = \frac{7+3n}{7}$

Coeff. of $x^{14} \Rightarrow 7r_2 - 3n = 14 \Rightarrow r_2 = \frac{14+3n}{7}$

Now, ${}^nC_{\frac{7+3n}{7}} (-1)^{\frac{7+3n}{7}} + {}^nC_{\frac{14+3n}{7}} (-1)^{\frac{7+3n}{7}} = 0$

Possible if $\left(\frac{7+3n}{7}\right) + \left(\frac{14+3n}{7}\right) = n$

$\frac{21+6n}{7} = n \Rightarrow n = 21$

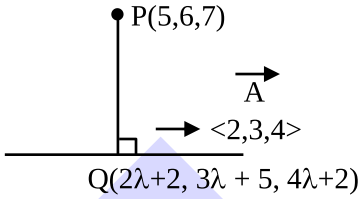
2. Find square of the distance of the point (5, 6, 7) from the line $\frac{x-2}{2} = \frac{y-5}{3} = \frac{z-2}{4}$

Ans. **(6)**

Sol. $\overrightarrow{PQ} \cdot \vec{A} = 0$

$\Rightarrow (2\lambda - 3)2 + (3\lambda - 1)3 + (4\lambda - 5)4 = 0$

$\Rightarrow \lambda = 1$



Point Q = (4, 8, 6)

$PQ^2 = 6$