MEMORY BASED QUESTIONS JEE–MAIN EXAMINATION – APRIL 2026

(HELD ON THURSDAY 02nd APRIL 2026) **TIME : 3:00 PM TO 6:00 PM**

MATHEMATICS — TEST PAPER WITH SOLUTION

1. Let $x_1, x_2, x_3, \ldots, x_n$ be 'n' observations such that $\sum_{i=1}^{n-1} x_i = 48$ and $\sum_{i=1}^{n-1} x_i^2 = 496$. If mean and variance of the distribution are 8 and 16 respectively then value of n is :-

(1) 7 (2) 9 (3) 8 (4) 12

Ans. **(1)**

Sol. $x_1 + x_2 + \ldots + x_{n-1} + x_n = 8n$

$48 + x_n = 8n$

$\Rightarrow x_n = 8n - 48$ ...(1)

$\Rightarrow 16 = \frac{496 + x_n^2}{n} - (8)^2$

$\Rightarrow 80n = 496 + x_n^{\ 2}$

$\Rightarrow x_n^{\ 2} = 80n - 496$ ...(2)

$\Rightarrow (8n - 48)^2 = 80n - 496$

$\Rightarrow 64(n - 6)^2 = 8(10n - 62)$

$\Rightarrow 8(n - 6)^2 = 10n - 62$

$\Rightarrow 4(n - 6)^2 = 5n - 31$

$\Rightarrow 4(n^2 - 36 - 12n) = 5n - 31$

$\Rightarrow 4n^2 + 144 - 48n = 5n - 31$

$\Rightarrow 4n^2 - 53n + 175 = 0$

$\Rightarrow 4n^2 - 28n - 25n + 175 = 0$

$\Rightarrow 4n(n - 7) - 25(n - 7) = 0$

$n = 7$

2. Let f(x) be a polynomial of degree 5 having extreme values at x = 1 and x = –1. If $\lim_{x\to 0} \frac{f(x)}{x^3} = -5$, then the value of f(2) – f(–2) is

(1) 110 (2) 112 (3) 115 (4) 118

Ans. **(2)**

Sol. Given f(x) is a polynomial of degree 5

Also, $f'(1) = 0;\ f'(-1) = 0.$

Also $\because \lim_{x\to 0} \frac{f(x)}{x^3} = -5$ (fixed and finite)

$\therefore f(0) = 0;\ f'(0) = 0;\ f''(0) = 0$

$\frac{f'''(0)}{6} = -5 \Rightarrow f''(0) = -30$

Hence, let $f'(x) = (ax + b)(x - 0)(x - 1)(x + 1)$

$\Rightarrow f'(x) = ax^4 + bx^3 - ax^2 - bx$

$f''(x) = 4ax^3 + 3bx^2 - 2ax - b$

$\because f''(0) = 0 \Rightarrow b = 0$

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

$\because f''(0) = -2a = -30$

$\Rightarrow a = 15$

$\therefore f'(x) = 15x.x.(x - 1)(x + 1)$

$\Rightarrow f'(x) = 15x^4 - 15x^2$

$\Rightarrow f(x) = 3x^5 - 5x^3 + C$

$\because f(0) = 0 \Rightarrow C = 0$

$\therefore f(x) = 3x^5 - 5x^3$

$\therefore f(2) - f(-2) = 112$

3. Let $\overrightarrow{PS} = \hat{i} + \hat{j}$ and $\overrightarrow{PQ} = -\hat{j} + \hat{k}$. If $\overrightarrow{PS}$ must be rotated by an angle α such that $\overrightarrow{PS}$ is perpendicular to $\overrightarrow{PQ}$ then $\left(\sin^2\frac{5\alpha}{2} - \sin^2\frac{\alpha}{2}\right)$ equals

(1) $\frac{1}{2}$ (2) 1 (3) $\frac{\sqrt{3}}{2}$ (4) 0

Ans. **(3)**

Sol. $\overrightarrow{PS} = \hat{i} + \hat{j}$ $\theta = \left(\overrightarrow{PS} \wedge \overrightarrow{PQ}\right)$

$\overrightarrow{PQ} = -\hat{j} + \hat{k}$

$\cos\theta = \frac{\overrightarrow{PS}.\overrightarrow{PQ}}{|\overrightarrow{PS}||\overrightarrow{PQ}|} = -\frac{1}{2} \Rightarrow \theta = \frac{2\pi}{3}$

$\alpha = 30°$

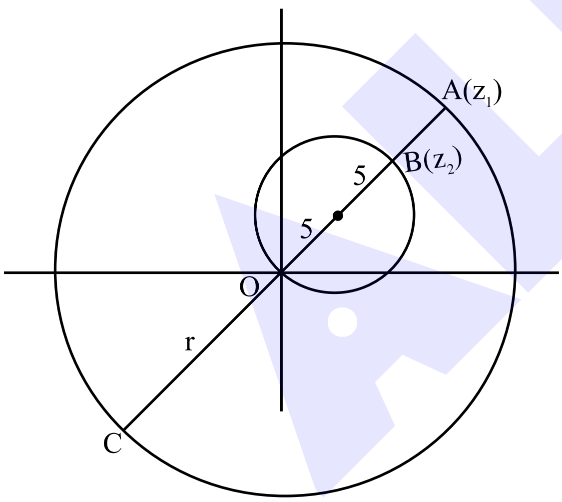
$\text{Sin}^2 75° - \sin^2 15° = \sin 60° = \frac{\sqrt{3}}{2}$

4. If z_1 lies on curve $|z| = r$ and z_2 lies on curve $|z - 3 - 4i| = 5$ if minimum of $|z_1 - z_2| = 2$, then the maximum of $|z_1 - z_2|$ is

(1) 12 (2) 18 (3) 20 (4) 22

Ans. **(4)**

Sol.



$|z| = r$

$OA = r$

minimum $|z_1 - z_2| = 2$

$\Rightarrow r - 10 = 2 \Rightarrow r = 12$

maximum value of CB

$|z_1 - z_2| = r + 10 = 12 + 10 = 22$

5. Parabola $y = x^2 + px + q$ is passing through $(1, -1)$ and vertex of parabola is at minimum distance from x-axis then $p^2 + q^2$ is

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

Ans. **(4)**

Sol. parabola passes through $(1, -1)$ so

$-1 = 1 + p + q$

$p + q = -2$

$q = -2 - p$ …(1)

Distance from x-axis

$\frac{-D}{4a} = \frac{-(p^2 - 4q)}{4(1)} = \frac{4q - p^2}{4}$

$= \frac{4(-2-p) - p^2}{4}$ from (1)

$= \frac{-8 - 4p - p^2}{4} = \frac{-(p^2 + 4p + 8)}{4} = \frac{-((p+2)^2 + 4)}{4}$

Minimum at $p = -2 \Rightarrow q = 0$

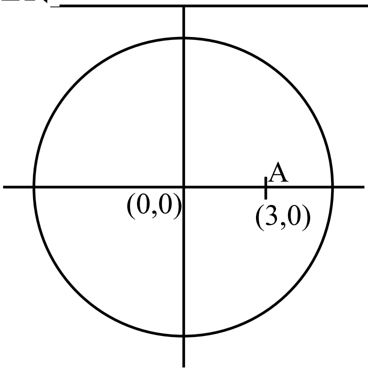
$p^2 + q^2 = 4 + 0 = 4$

6. Let 'C' be a circle with radius '6' units centred at origin. Let A(3, 0) be a point. If B is a variable point in xy-plane such that circle drawn taking AB as diameter touches the circle C then eccentricity of the locus of point 'B' is

(1) 2 (2) $\frac{1}{2}$ (3) 3 (4) $\frac{3}{4}$

Ans. **(2)**

Sol.



Let B(h, k)

Equation of circle with AB as diameter

$(x-h)(x-3)+(y-k)(y-0)=0$

$x^2+y^2-(h+3)x-ky+3h=0$

Centre $\left(\frac{h+3}{2},\frac{k}{2}\right)$

Circle touches internally

$\therefore C_1C_2=|R-r|$

$$\sqrt{\left(\frac{h+3}{2}\right)^2+\left(\frac{k}{2}\right)^2}=\left|6-\frac{1}{2}\left(\sqrt{(h-3)^2+k^2}\right)\right|$$

$$\sqrt{(x+3)^2+y^2}+\sqrt{(x-3)^2+y^2}=12$$

$2a=12 \qquad \therefore a=6$

(–3, 0) and (3, 0) are foci

$2ae=6$

$12e=6$

$e=\frac{1}{2}$

7. Find sum up to 8 terms of the series

$$\frac{1^3}{1}+\frac{1^3+2^3}{1+3}+\frac{1^3+2^3+3^3}{1+3+5}+....$$

(1) 84 (2) 71

(3) 61 (4) 100

Ans. (2)

Sol. $T_r=\frac{1^3+2^3+3^3+......r^3}{1+3+5+.....+(2r-1)}=\frac{\left(\frac{r(r+1)}{2}\right)^2}{r^2}$

$=\frac{r^2+2r+1}{4}$

$S_n=\sum_{r=1}^{n}T_r$

$S_n=\frac{1}{4}\sum\left(r^2+2r+1\right)$

$=\frac{1}{4}\left[\frac{n(n+1)(2n+1)}{6}+2\frac{n(n+1)}{2}+n\right]$

$S_8=\frac{1}{4}\left[\frac{8\times9\times17}{6}+8\times9+8\right]$

$=\frac{1}{4}[204+72+8]=71$

8. If the system of equations x + 5y + 6z = 4, 2x + 2y + 4z = 1 and x + y + az = b has infinite numbers of solutions then point (a,b) lies on-

(1) $x-2y=1$ (2) $x-y=3$

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

Ans. (1)

Sol. $x+5y+6z=4$

$2x+2y+4z=1$

$x+y+az=b$

$$D=\begin{vmatrix}1&5&6\\2&2&4\\1&1&a\end{vmatrix}=0$$

$$\Rightarrow\begin{vmatrix}1&5&6\\1&1&2\\1&1&a\end{vmatrix}=0\Rightarrow a=2$$

$$D_z=\begin{vmatrix}1&5&4\\2&2&1\\1&1&b\end{vmatrix}=0\Rightarrow b=\frac{1}{2}$$

$a-2b=1$

9. The value of $\int_0^{20\pi}(\sin^4 x+\cos^4 x)\cdot dx$ is equal to

(1) 15π (2) $15\pi/2$

(3) 25π (4) $\frac{25\pi}{2}$

Ans. (1)

Sol. $I=\int_0^{20\pi}(1-2\sin^2 x\cos^2 x)\cdot dx$

$=20\pi-\frac{1}{2}\int_0^{20\pi}\sin^2 2x\ dx$

$20\pi-\frac{1}{2}(40)\int_0^{\frac{\pi}{2}}\sin^2 2x$

$20\pi-\frac{20}{2}\left(x-\frac{\sin 2x}{2}\right)_0^{\frac{\pi}{2}}$

$20\pi-10\left(\frac{\pi}{2}\right)=15\pi$

10. A regular polygon with n sides is given. P_n denotes no. of triangles formed by joining any three points of given regular polygon. If $P_{n+1}-P_n=66$, then the sum of all prime divisors of n is

(1) 9 (2) 5 (3) 11 (4) 23

Ans. (2)

Sol. $P_n={}^nC_3$

$P_{n+1}-P_n=66$

${}^{n+1}C_3-{}^nC_3=66$

$\Rightarrow\frac{(n+1)n(n-1)}{6}-\frac{n(n-1)(n-2)}{6}=66$

$\Rightarrow\frac{n(n-1)}{6}[n+1-n+2]=66$

$\Rightarrow n(n-1)=132$

$n=12$

Prime divisors of 12 are 2 & 3

sum = 2 + 3 = 5

11. Let A = {2, 3, 4, 5, 6} be a set. Consider R be a relation of A × A such that (x, y) R(a, b) implies x divides 'a' and $y\le b$ then total number of elements in R is :

(1) 24 (2) 120 (3) 720 (4) 144

Ans. (2)

Sol. For x = 2, a = 2, 4, 6

x = 3 a = 3, 6

x = 4 a = 4

x = 5 a = 5

x = 6 a = 6

Total case = 8

and no. of combination of y and b satisfying $y\le b$

= 1 +2 + 3 + 4 + 5 = 15

No. of relations satisfying (x, y) R(a, b) is 8 × 15 = 120.

12. Find number of points of discontinuity of the function $f(x) = [x^2 - x + 2]$ in $x \in [2, 4]$

(where $[\cdot]$ denotes greatest integer function).

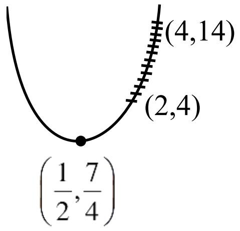
(1) 9 (2) 11

(3) 8 (4) 10

Ans. (4)

Sol. In the interval $x \in [2, 4]$ range of $x^2 - x + 2$ is $[4, 14]$

GIF is discontinuous at integers



Checking at $x = 4$

$f(4) = [4^2 - 4 + 2] = 14$

$$f(4^-) = \lim_{h \to 0}[(4-h)^2 - (4-h) + 2]$$

$$= \lim_{h \to 0}[16 + h^2 - 8h - 4 + h + 2]$$

$$= \lim_{h \to 0}[14 + h(h-7)]$$

$= 13$

Discontinuous at $x = 4$ and 9 other points

Total 10 points.

13. If $I(x) = \int \frac{16x + 24}{x^2 + 2x - 15}dx$, $I(4) = 14\ln 3$ and

$I(7) = \ln(2^\alpha \cdot 3^\beta)$, then $(\alpha + \beta)$ is equal to

(1) 39 (2) 33 (3) 36 (4) 42

Ans. (1)

Sol. $$I(x) = \int \frac{8(2x+2) + 8}{x^2 + 2x - 15}dx$$

$$I(x) = 8\ln|x^2 + 2x - 15| + \ln\left|\frac{x-3}{x+5}\right| + C$$

$I(4) = 14\ln 3 + C$

$C = 0$

$I(7) = 8\ln 48 - \ln 3$

$$= \ln\left(\frac{(48)^8}{3}\right)$$

$I(7) = \ln(2^{32} \times 3^7)$

$\alpha = 32, \beta = 7 \Rightarrow \alpha + \beta = 39$

14. If the lines $x + (k - 1)y + 3 = 0$ & $2x + k^2y - 4 = 0$ are perpendicular and their point of intersection is the centre of a circle which passes through origin. If chord $x - y + 2 = 0$ intersects this circle at A & B then $(AB)^2 = ?$

(1) 18 (2) 20 (3) 9 (4) 36

Ans. (1)

Sol. $x + (k - 1)y + 3 = 0$

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

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

$2 = k^2 - k^3$

$k^3 - k^2 + 2 = 0$

$k = -1$

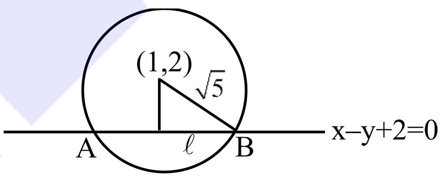
Solving :

$2(x - 2y + 3) = 0$

$2x + y - 4 = 0$

$-5y + 10 = 0$

$y = 2$



$x = 1$

Centre (1, 2)

$r = \sqrt{5}$

So circle is $(x - 1)^2 + (y - 2)^2 = 5$

Chord $x - y + 2 = 0$

$$p = \frac{1}{\sqrt{2}}$$

$$\ell = \sqrt{5 - \frac{1}{2}} = \frac{3}{\sqrt{2}}$$

$$AB = \frac{6}{\sqrt{2}} \quad \therefore AB^2 = 18$$

15. Let x(y) be the solution of the given differential equation $2y^2\frac{dx}{dy}-2xy+x^2=0$. If x(e) = e, then $\frac{3x(e^2)}{e^2}$ equals.

(1) 1 (2) 2

(3) 3 (4) 4

Ans. (2)

Sol. $2y(ydx-xdy)+x^2dy=0$

$$-2yx^2\ d\left(\frac{y}{x}\right)+x^2dy=0$$

$$-2y\ d\left(\frac{y}{x}\right)+dy=0$$

$$\frac{-2y}{x}+\log_e y=C$$

Given x(e) = e

$\Rightarrow C=-1$

$$\frac{-2y}{x}+\log_e y=-1$$

$$\frac{2y}{x}-\log_e y=1$$

$$\frac{2e^2}{x}-2=1\Rightarrow\frac{2e^2}{x}=3\Rightarrow x=\frac{2e^2}{3}$$

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

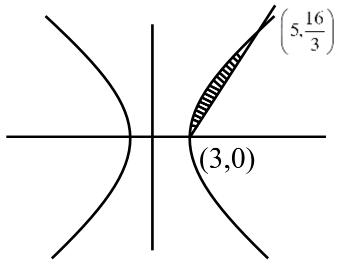
16. If the area bounded by two curves $\frac{x^2}{9}-\frac{y^2}{16}=1$ and $8x-3y=24$ is $A-6\log_e 3$, then A is equal to

(1) 5 (2) 6

(3) 7 (4) 8

Ans. (4)

Sol.



$16x^2-9y^2=144$

$16x^2-(8x-24)^2=144$

$16x^2-64(x-3)^2=144\Rightarrow x^2-4(x-3)^2=9$

$3x^2-24x+45\Rightarrow x^2-8x+15=0$

$x=3,5$

$$\text{Area}=\int_3^5\sqrt{\frac{16x^2-144}{9}}-\frac{1}{2}\cdot 2\cdot\frac{16}{3}$$

$$=\frac{4}{3}\int_3^5\sqrt{x^2-9}-\frac{16}{3}$$

$$=\frac{4}{3}\left(\frac{x}{2}\sqrt{x^2-9}-\frac{9}{2}\log_e(x+\sqrt{x^2-9})\right)_3^5-\frac{16}{3}$$

$$=\frac{4}{3}\left(\frac{5}{2}\cdot 4-\frac{9}{2}\log_e 9-\frac{3}{2}\cdot 0+\frac{9}{2}\log_e 3\right)-\frac{16}{3}$$

Area $=8-6\log_e 3=A-6\log_e 3$

$\Rightarrow A=8$

SECTION B

1. Let $P=\{\theta\in[0,4\pi],\tan^2\theta\neq 1\}$

$S=\{a\in z:(\cos^2\theta-\sin^2\theta)\sec 2\theta=a^2,\theta\in P\}$

then n(S) equals

Ans. (2.00)

Sol. $a^2=\cos 2\theta.\sec 2\theta=1\Rightarrow a=1,-1$

$n(S)=2$

2. If ${}^{30}C_{30-r}+3\cdot{}^{30}C_{31-2}+3\cdot{}^{30}C_{32-r}+{}^{30}C_{33-r}={}^{n}C_r$

then value of n is

Ans. (33)

Sol. ${}^{3}C_3\cdot{}^{30}C_{30-r}+{}^{3}C_2\cdot{}^{30}C_{31-r}+{}^{3}C_1\cdot{}^{30}C_{32-r}+{}^{3}C_0\cdot{}^{30}C_{33-r}$

$={}^{33}C_{33-r}\equiv{}^{n}C_r\equiv{}^{n}C_{n-r}$

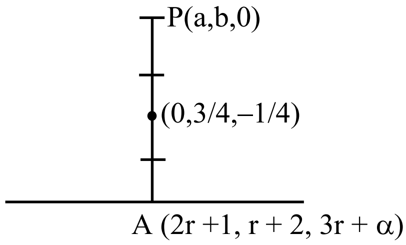
$\Rightarrow n=33$

3. If foot of the perpendicular from a point P(a,b,0) on the line $\frac{x-1}{2}=\frac{y-2}{1}=\frac{z-\alpha}{3}$ is A and mid- point of AP is (0, 3/4, – 1/4), then the value of $(a^2+b^2+\alpha^2)$ is -

Ans. (1)

Sol. $\frac{2r+1+a}{2}=0 \Rightarrow 2r+a=-1$

$\frac{r+2+b}{2}=\frac{3}{4} \Rightarrow r+b=-\frac{1}{2}$



$\frac{3r+\alpha}{2}=\frac{-1}{4} \Rightarrow 3r+\alpha=\frac{-1}{2}$

$2\cdot a+1\cdot(b-3/4)+3\cdot\frac{1}{4}=0 \Rightarrow a+b=0$

$\Rightarrow 2(-1-2r)+(-r-1/2)=0$

$\Rightarrow -3/2=3r=1 \Rightarrow r=-1/2,\ a=0,\ b=0,\ \alpha=1$

$\therefore a^2+b^2+\alpha^2=1$

4. If matrices $A=\begin{bmatrix}2 & -2\\ 4 & -2\end{bmatrix}$ and $B=\begin{bmatrix}1 & 3\\ 3 & 9\end{bmatrix}$ are such that PA = B and AQ = B then tr(2(P + Q)) is -

Ans. (10)

Sol. $A^{-1}=\frac{1}{4}\begin{bmatrix}-2 & 2\\ -4 & 2\end{bmatrix}=\frac{1}{2}\begin{bmatrix}-1 & 1\\ -2 & 1\end{bmatrix}$

$P=BA^{-1}=\frac{1}{2}\begin{bmatrix}1 & 3\\ 3 & 9\end{bmatrix}\begin{bmatrix}-1 & 1\\ -2 & 1\end{bmatrix}=\frac{1}{2}\begin{bmatrix}-7 & 4\\ -21 & 12\end{bmatrix}$

$Q=A^{-1}B=\frac{1}{2}\begin{bmatrix}-1 & 1\\ -2 & 1\end{bmatrix}\begin{bmatrix}1 & 3\\ 3 & 9\end{bmatrix}=\frac{1}{2}\begin{bmatrix}2 & 6\\ 1 & 3\end{bmatrix}$

$\therefore \text{tr}(2(P+Q))=10$

5. Ram is tossing a coin if head comes then 10 points will be given and if tail comes then 5 points will be given . If the probability of getting exactly 30 point is $\frac{m}{n}$ then (m + n) equals (Where m & n are co-prime numbers).

Ans. (107)

Sol. P = (6 tail) + (4 tail + 1 head) + (2 tail + 2 head) + (3 head)

$P=\left(\frac{1}{2}\right)^6+\frac{5!}{1!4!}\left(\frac{1}{2}\right)^5+\frac{4!}{2!2!}\left(\frac{1}{2}\right)^4+\left(\frac{1}{2}\right)^3$

$P=\frac{1}{64}+\frac{5}{32}+\frac{3}{8}+\frac{1}{8}$

$P=\frac{1+10+24+8}{64}=\frac{43}{64}=\frac{m}{n}$

$m+n=107$