

II PUC MID-TERM EXAMINATION OCTOBER 2025

Subject : Mathematics

Scheme of Valuation.

PART-A

1) (a). It is always an equivalence relation.

2) (d). neither one one nor onto.

3) (a) $-\frac{\pi}{6}$

4) (b) $x \in [-1, 1]$

5) (b) A is zero matrix

6) (d) 0

7) (c) ± 6

8) (b) 5

9) (c) 1

10) (b) 12π

11) (b) $(0, \frac{\pi}{2})$

12) (c) any vector

13) (d) $\sqrt{3}$

14) (a) 0, 0, 1

15) (b) $\frac{x}{1} = \frac{y}{0} = \frac{z}{0}$

II ~~Part B~~ Fill in the blanks

16) 0

17) 1

20) 2

18) ~~96~~ 126 or grade marks.

$\frac{c}{x+1} = \frac{y}{x+2}$

PART-B

III

21) $g \circ f(x) = 3 \cos^2 x$ — ①m
 $f \circ g(x) = \cos(3x^2)$ — ①m

22) put $x = \cos \theta$ in RHS — ①m

showing $RHS = LHS$ — ①m

23) Let $P(x, y)$ be any point on line joining $A(3, 1)$ & $B(9, 3)$.

$\therefore$ Area of $\Delta^{le} APB = 0$

$$\frac{1}{2} \begin{vmatrix} 3 & 1 & 1 \\ x & y & 1 \\ 9 & 3 & 1 \end{vmatrix} = 0 \text{ — ①m}$$

$$\textcircled{SD} \begin{vmatrix} 3 & 1 & 1 \\ x & y & 1 \\ 9 & 3 & 1 \end{vmatrix} = 0 \text{ — ①m}$$

getting $2x - 6y = 0$ $\textcircled{SD} x - 3y = 0$ — ①m

24) Finding 2A matrix — ①m

$2A - B$ matrix — ①m

25) $\lim_{x \rightarrow \pi} f(x) = \lim_{x \rightarrow \pi} x^2 \sin x + 5 = \pi^2 + 5$ — ①m

writing $\lim_{x \rightarrow \pi} f(x) = f(\pi)$

$\therefore f(x)$ is continuous at $x = \pi$ — ①m

26) put $x = \tan \theta$ — ①m $\textcircled{SD}$

$$y = \sin^{-1} \left(\frac{2 \tan \theta}{1 + \tan^2 \theta} \right) = \sin^{-1}(\sin 2\theta) = 2\theta \text{ — ①m}$$

$$y = 2 \tan^{-1} x$$

getting $\frac{dy}{dx} = \frac{2}{1+x^2}$ — ①m

$$27) f'(x) = 4x - 3 = 0 \Rightarrow x = \frac{3}{4} \text{ --- 1m (28)}$$

The intervals are $(-\infty, \frac{3}{4})$, $(\frac{3}{4}, \infty)$ --- 1m

$f(x)$ is increasing $\forall x \in (\frac{3}{4}, \infty)$ --- 1m

$$(28) \vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -1 & 3 \\ 2 & -7 & 1 \end{vmatrix} = \hat{i}(-1+21) - \hat{j}(1-6) + \hat{k}(-7+2)$$

getting, $\vec{a} \times \vec{b} = 20\hat{i} + 5\hat{j} + 5\hat{k}$ --- 1m

Area = $|\vec{a} \times \vec{b}| = \sqrt{450}$ --- 1m

(29) writing $\vec{r} = \vec{a} + \lambda \vec{b}$ --- 1m

(30) $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$ & $\left. \begin{array}{l} \vec{b} = 3\hat{i} + 2\hat{j} - 2\hat{k} \end{array} \right\}$ --- 1m

getting $\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(3\hat{i} + 2\hat{j} - 2\hat{k})$ --- 1m

PART-C

(30) $R = \{(T_1, T_2) \mid T_1 \text{ is Congruent to } T_2\}$ is an equivalence relation
writing ~~R~~ Reflexive Relation --- 1m
Symmetric --- 1m, Transitive --- 1m
or (grade marks)

(31) put $x = a \sin \theta$ --- 1m

$$\tan^{-1}\left(\frac{a \sin \theta}{\sqrt{a^2 \cos^2 \theta}}\right) = \tan^{-1}(\tan \theta) \text{ --- 1m}$$

$$= \theta = \sin^{-1}\left(\frac{x}{a}\right) \text{ --- 1m}$$

(32) writing $\cos^{-1} \frac{4}{5} = \sin^{-1} \frac{3}{5}$ --- 1m

(33) $\cos^{-1} \frac{12}{13} = \sin^{-1} \frac{5}{13}$ --- 1m

(34) $\cos^{-1} \frac{4}{5} = x \Rightarrow \cos x = \frac{4}{5} \therefore \sin x = \frac{3}{5}$
 $\cos^{-1} \frac{12}{13} = y \Rightarrow \cos y = \frac{12}{13} \therefore \sin y = \frac{5}{13}$ } --- 1m

writing $\cos(x+y) = \cos x \cos y - \sin x \sin y$

$x+y = \cos^{-1}\left(\frac{4}{5} \times \frac{12}{13} - \frac{3}{5} \times \frac{5}{13}\right)$ --- 1m

getting the Result 1m.

(33) Writing $A = P + Q$ where $P = \frac{1}{2}(A+A')$ &
 $Q = \frac{1}{2}(A-A')$ $A = \frac{1}{2}(A+A') + \frac{1}{2}(A-A')$ — ①m

(34) $A' = \begin{bmatrix} 1 & -1 \\ 5 & 2 \end{bmatrix}$ — ①m

showing $P' = P$ — ①m

$Q' = -Q$ — ①m

getting $P+Q = A$ — ①m

(35) Let $y = x^{\sin x}$

$\log y = \sin x \cdot \log x$ — ①m

$\frac{1}{y} y' = \frac{\sin x}{x} + \log x \cos x$ — ①m

$y' = x^{\sin x} \left[\frac{\sin x}{x} + \log x \cos x \right]$ — ①m

(36) Finding $\frac{dx}{d\theta}$ — ① $\frac{dy}{d\theta}$ — ①m

getting $\frac{dy}{dx} = \frac{\cos \theta - 2 \cos 2\theta}{-\sin \theta + 2 \sin 2\theta}$ — ①m

(37) Let 2 nos be x & $16-x=y$.

$\therefore f(x) = x^3 + (16-x)^3$ — ①m

getting $x=8$ & $y=8$ — ①m

showing $f''(8) \neq 0$ — ①m

(38) $|\vec{a} + \vec{b} + \vec{c}|^2 = |\vec{a}|^2 + |\vec{b}|^2 + |\vec{c}|^2 + 2(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a})$ — ①m

writing $|\vec{a} + \vec{b} + \vec{c}|^2 = 0$ — ①m

$3^2 + 4^2 + 2^2 + 2 \cdot 4 = 0$ — ①m

$2 \cdot 4 = -29$

$4 = -\frac{29}{2}$ — ①m

38 Let $\vec{a}_1 = \hat{i} + 2\hat{j} + \hat{k}$ $\vec{b}_1 = \hat{i} - \hat{j} + \hat{k}$
 $\vec{a}_2 = 2\hat{i} - \hat{j} - \hat{k}$ $\vec{b}_2 = 2\hat{i} + \hat{j} + 2\hat{k}$

$\vec{a}_2 - \vec{a}_1 = \hat{i} - 3\hat{j} - 2\hat{k}$ — (1) m

$\vec{b}_1 \times \vec{b}_2 = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -1 & 1 \\ 2 & 1 & 2 \end{vmatrix} = \hat{i}(-3) - \hat{j}(0) + \hat{k}(3) = -3\hat{i} + 3\hat{k}$ — (1) m

(or) $|\vec{b}_1 \times \vec{b}_2| = \sqrt{9+9} = 3\sqrt{2}$

getting, $d = \frac{|(\vec{a}_2 - \vec{a}_1) \cdot (\vec{b}_1 \times \vec{b}_2)|}{|\vec{b}_1 \times \vec{b}_2|} = \frac{|-3+0-6|}{3\sqrt{2}} = \frac{9}{3\sqrt{2}}$

(or) $d = \frac{3}{\sqrt{2}}$ — (1) m

PART-D

39 Showing 'f' is one-one — (2) m

Showing 'f' is onto. — (2) m

writing 'f' is bijective — (1) m

4 writing $f^{-1}(y) = \frac{y+3}{4}$ (or)

$f^{-1}(x) = \frac{x-3}{4}$ — (1) m

(H0) Showing 'f' is one-one — (2) m

Showing 'f' is onto — (2) m

writing 'f' is bijective — (1) m

(H1) Finding A' — (1) m

Finding B' — (1) m

Finding $A+B$ — (1) m

Finding $(A+B)'$ — (1) m

concluding $(A+B)' = A' + B'$ — (1) m

42) writing $A' = 1m$

$B' = 1m$

$AB = 1m$

$(AB)' = 1m$

& showing $(AB)' = B'A' = 1m$

43) writing $A = \begin{bmatrix} 3 & -2 & 3 \\ 2 & 1 & -1 \\ 4 & -3 & 2 \end{bmatrix}$ $x = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$ $B = \begin{bmatrix} 8 \\ 1 \\ 4 \end{bmatrix} = 1m$

44) $|A| = -17 = 1m$

$\text{adj } A = \begin{bmatrix} -1 & -5 & -1 \\ -8 & -6 & 9 \\ -10 & 1 & 7 \end{bmatrix} = 2m$

getting $x=1, y=2$ & $z=3 = 2m$

44) $y' = 1m$

$y'' = 1m$

substituting in $y'' - 5y' + 6y = 1$

& showing the result is zero $= 2m$

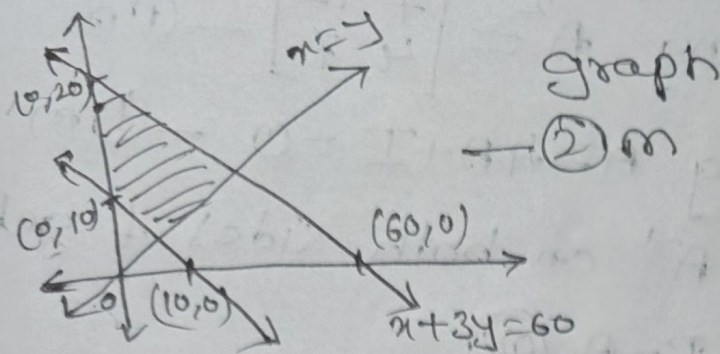
45) Getting $y_1 = 1m$

$y_2 = 1m$

substituting in $x^2 y_2 + x y_1 + y = 1m$

showing the result is zero $= 2m$

46



Corner point $(0,10)$, $(5,5)$, $(15,15)$ & $(0,20)$ — (1) m

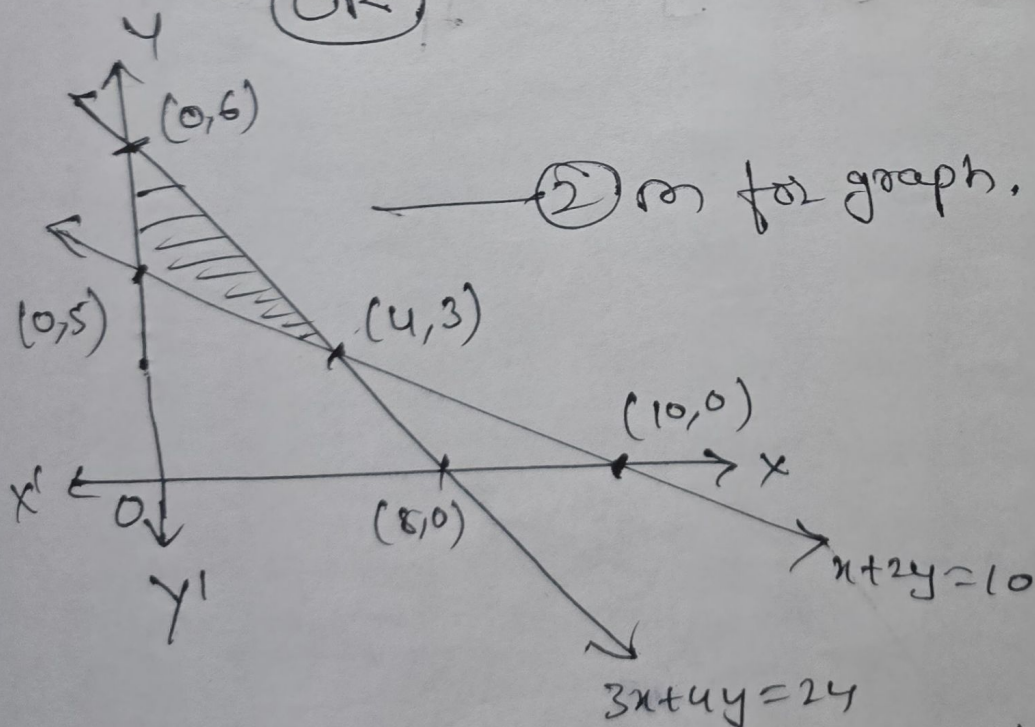
Substituting the corner points & evaluating Z — (2) m

Writing both Maximum & minimum value of Z — (1) m

$Z_{\max} = 180$ at $(15,15)$ & $(0,20)$

$Z_{\min} = 60$ at $(5,5)$.

(OR)



(2) m for graph.

Corner points $(0,5)$, $(4,3)$, $(0,6)$ — (1) m

Evaluation of Z at corner points — (2) m

Writing minimum value of Z — (1) m

$Z_{\min} = 2300$ at $(4,3)$.

47 Finding $A^2 = \begin{bmatrix} 7 & 12 \\ 4 & 7 \end{bmatrix} - \text{①m}$

showing $A^2 - 4A + I = 0 - \text{①m}$

x'ly by A^{-1} on both sides & getting

$A^{-1} = 4I - A \text{ ②m}$

$A^{-1} = -A + 4I - \text{①m}$

getting $A^{-1} = \begin{bmatrix} 2 & -3 \\ -1 & 2 \end{bmatrix} - \text{①m}$

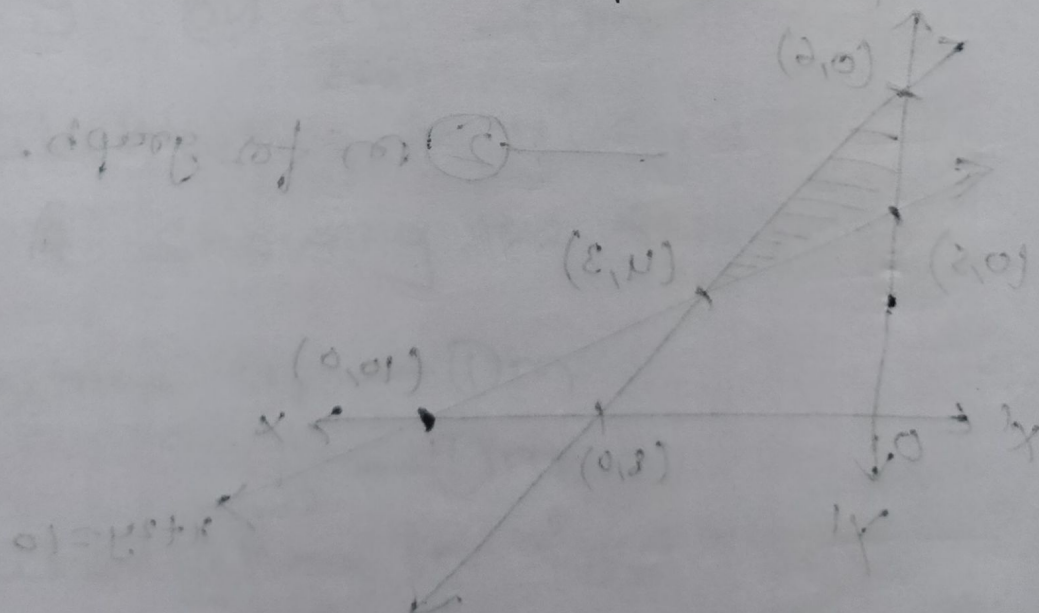
OR

$LAL = \text{getting } LHL = HK - \text{①m}$

$RHL = 3 - \text{①m}$

writing $LHL = RHL = f(2) - \text{①m}$

getting $K = \frac{3}{4} - \text{①m}$



① - (0, 0), (0, 3), (3, 0), (3, 3) - ①m
 Evaluation of Z at corner point - ②m
 ② - Z value minimum at (0, 0) - ①m
 $Z_{min} = 2500$ at (0, 0)