a)

$$g_1(\underline{x}) = 2\underline{\mu_1}^T\underline{x} - \underline{\mu_1}^T\underline{\mu_1} = 2\begin{bmatrix}0 & -2\end{bmatrix}\begin{bmatrix}x_1\\x_2\end{bmatrix} - 4 = -4x_2 - 4$$

$$g_2(\underline{x}) = 2\underline{\mu_2}^T\underline{x} - \underline{\mu_2}^T\underline{\mu_2} = 2\begin{bmatrix}0 & 1\end{bmatrix}\begin{bmatrix}x_1\\x_2\end{bmatrix} - 1 = 2x_2 - 1$$

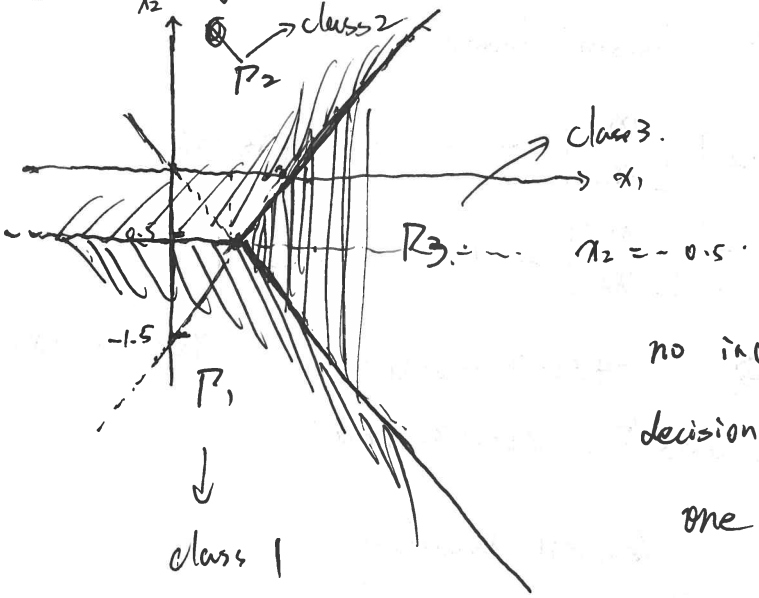
$$g_3(\underline{x}) = 2\underline{\mu_3}^T\underline{x} - \underline{\mu_3}^T\underline{\mu_3} = 2\begin{bmatrix}2 & 0\end{bmatrix}\begin{bmatrix}x_1\\x_2\end{bmatrix} - 4 = 4x_1 - 4$$

decision boundary $g_1(\underline{x}) = g_2(\underline{x}) \Rightarrow -4x_2 - 4 = 2x_2 - 1$.

$x_2 = -0.5$

$g_1(\underline{x}) = g_3(\underline{x}) = -4x_2 - 4 = 4x_1 - 4$ $\quad x_1 = -x_2 \quad x_2 = -x_1$

$g_2(\underline{x}) = g_3(\underline{x}) = 2x_2 - 1 = 4x_1 - 4$ $\quad 4x_1 - 2x_2 - 3 = 0$.



no indeminate decision region

decision boundary is intersected at one point. $(\frac{1}{2}, -\frac{1}{2})$

decision boundary
$$\begin{cases} x_2 = -0.5 \\ x_2 + x_1 = 0 \\ 4x_1 - 2x_2 - 3 = 0. \end{cases}$$