$$\frac{1}{2}\left[(x-\mu_j)^T \Sigma_j^{-1}(x-\mu_j) - (x-\mu_i)^T \Sigma_i^{-1}(x-\mu_i)\right] = \ln\frac{P(w_j)}{P(w_i)} + \frac{1}{2}\ln\frac{|\Sigma_i|}{|\Sigma_j|} \qquad \text{سؤال ٤:}$$

$$\Leftrightarrow \frac{1}{2}\left[\begin{bmatrix} x_1-5 \\ x_2-1 \end{bmatrix}^T \frac{1}{6}\begin{bmatrix} 3 & 0 \\ 0 & 2 \end{bmatrix}\begin{bmatrix} x_1-5 \\ x_2-1 \end{bmatrix} - \begin{bmatrix} x_1-2 \\ x_2-3 \end{bmatrix}^T \frac{1}{4}\begin{bmatrix} 1 & 0 \\ 0 & 4 \end{bmatrix}\begin{bmatrix} x_1-2 \\ x_2-3 \end{bmatrix}\right] = \ln\frac{0.4}{0.6} + \frac{1}{2}\ln\frac{4}{6}$$

$$\Leftrightarrow \frac{1}{6}[x_1-5 \quad x_2-1]\begin{bmatrix} 3x_1-15 \\ 2x_2-2 \end{bmatrix} - \frac{1}{4}[x_1-2 \quad x_2-3]\begin{bmatrix} x_1-2 \\ 4x_2-12 \end{bmatrix} = 3\ln\frac{2}{3}$$

$$\Leftrightarrow \frac{1}{6}\left(3x_1^2 - 30x_1 + 75 + 2x_2^2 - 4x_2 + 2\right) - \frac{1}{4}\left(x_1^2 - 4x_1 + 4 + 4x_2^2 - 24x_2 + 36\right) = 3\ln\frac{2}{3}$$

$$\overset{\times 12}{\Leftrightarrow} \left(6x_1^2 - 60x_1 + 150 + 4x_2^2 - 8x_2 + 4\right) - \left(3x_1^2 - 12x_1 + 12 + 12x_2^2 - 72x_2 + 108\right) = 36\ln\frac{2}{3}$$

$$\Leftrightarrow 3x_1^2 - 48x_1 + 138 - 8x_2^2 + 64x_2 - 104 = 36\ln\frac{2}{3}$$

$$\Leftrightarrow 3x_1^2 - 48x_1 + 34 = 8x_2^2 - 64x_2 + 36\ln\frac{2}{3}$$

$$\Leftrightarrow 3(x_1-8)^2 - 192 + 34 = 8(x_2-4)^2 - 128 + 36\ln\frac{2}{3}$$

$$\Leftrightarrow 3(x_1-8)^2 - 8(x_2-4)^2 = 30 + 36\ln\frac{2}{3}$$