HW #1 (2026)

[all numbered problems are from K.P. Murphy's vol. I]

1. Ex. 2.4
   Note that x_1 & x_2 are independent rv's

2. Ex. 2.6

3. Consider a 2D gaussian rv:

$$\vec{y} = (y_1, y_2)$$

$$\vec{Y} \sim \mathcal{N}(\vec{y} \mid \vec{\mu}, \Sigma)$$

$$\begin{cases} \vec{\mu} = \begin{pmatrix} \mu_1 \\ \mu_2 \end{pmatrix}, \\ \underbrace{\Sigma_{2\times2}}_{\text{covariance matrix}} = \begin{pmatrix} \Sigma_{11} & \Sigma_{12} \\ \Sigma_{12} & \Sigma_{22} \end{pmatrix}, \quad \underbrace{\Lambda_{2\times2}}_{\text{precision matrix}} = \Sigma^{-1} = \begin{pmatrix} \Lambda_{11} & \Lambda_{12} \\ \Lambda_{12} & \Lambda_{22} \end{pmatrix} \end{cases}$$

(a) Find marginal distributions $p(y_1)$ & $p(y_2)$.

(b) Find $p(y_1 \mid y_2)$. conditional distribution prior

4. Consider
$$\begin{cases} p(z) = \mathcal{N}(z \mid \mu_z, \sigma_z^2), \\ p(y \mid z) = \mathcal{N}(y \mid wz + b, \sigma_y^2) \end{cases}$$

likelihood

Find the posterior $p(z \mid y)$ and the model evidence $p(y)$.