· Mean

$$E[x_1] = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} x_1 p(x_1, x_2)\, dx_1\, dx_2$$

$$E[x_1] = \int_{-\infty}^{\infty} x_1 \frac{1}{\sqrt{2\pi\sigma_1^2}} \exp\left(-\frac{(x_1-\mu_1)^2}{2\sigma_1^2}\right) dx_1$$

$$E[x_1] = \mu_1 \quad , \quad E[x_2] = \mu_2$$

$$\mu = \begin{bmatrix} \mu_1 \\ \mu_2 \end{bmatrix}$$

· Covariance Matrix

$$\Sigma = \begin{bmatrix} Var(x_1) & Cov(x_1, x_2) \\ Cov(x_1, x_2) & Var(x_2) \end{bmatrix}$$

$$Var(x_1) = E[(x_1 - \mu_1)^2]$$

$$= \int_{-\infty}^{\infty} (x_1 - \mu_1)^2 p(x_1)\, dx_1$$

$$= \sigma_1^2$$

$$Var(x_2) = \sigma_2^2$$

$$Cov(x_1, x_2) = E[(x_1 - \mu_1)(x_2 - \mu_2)]$$

x_1 and x_2 are independent

$$Cov(x_1, x_2) = 0$$

$$\Sigma = \begin{bmatrix} \sigma_1^2 & 0 \\ 0 & \sigma_2^2 \end{bmatrix}$$