Q 3)

Ans The clean Image is $I(x, y)$. $(x, y) \in I$ (intensity of Image pixel).

$W(x, y) \sim N(0, \sigma^2)$

$I_n(x, y) = I(x, y) + W(x, y)$

↳ here the Image and noise are Independent.

PDF (P) :-

$P_{I,W}(K) = P_I(K) \cdot P_W(K)$ {PDF of noisy Image}.

CDF (I_n) :-

$$P(I_n \leq K) = P(I + W \leq K) = \int_{-\infty}^{\infty} \int_{-\infty}^{K-W} P_I(i)\, P_W(\omega)\, di\, d\omega$$

$$\boxed{PDF = \frac{d\,(CDF)}{dx}}$$

$$P_{I_n}(K) = \frac{\partial}{\partial K} \int_{-\infty}^{\infty} \int_{\infty}^{K-W} P_I(i) \cdot P_W(\omega)\, di\, d\omega$$

Leibniz theorem }.

$$P_{I_n}(K) = \int_{-\infty}^{\infty} P_I(K - \omega) \cdot P_\omega(\omega)\, d\omega$$

$$\boxed{\text{PDF of noisy Image} = \int_{-\infty}^{\infty} P_I(K - W)\, P_W(W)\, d\omega}$$

↳ It appear like PDF of noisy Image is convolution PDF of Clean and PDF of noise

$$\boxed{\text{PDF of gaussian distribution} = \frac{1}{\sigma\sqrt{2\pi}} e^{-x^2/2\sigma^2}}$$

↳ can't apply this formula as PDF of clean Image in form of distribution not given.