Assignment-8

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Question

Papoulis book exercise 6

Q-39 The random variable x and y are independent, x is $N(0, \sigma^2)$. and y is uniform in the interval $(0.\pi)$. Show that if $z = x + acosy$, then

$$f_z(z) = \frac{1}{\pi\sigma 2\pi}$$

fig.jpg

Solution

From the assumption it follows that

$g'(-x) = -g'(x) \qquad g''(x) \geq 0 \qquad f(x-\eta) = f(\eta - x)$

Hence, if $I(a) = Eg(x-a)$, then

$I'(a) = -\int_{-\infty}^{\infty} g'(x-a)f(x)dx \qquad I'(\eta) = 0$

$I''(a) = \int_{-\infty}^{\infty} g''(x-a)f(x)dx \geq 0 \qquad$ all a

Hence, I(a) is minimum for $a = \eta$.