Assignment 7

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Outline

Question

The random variables x and y are N(0,4) and independent. Find $f_z(z)$ and $F_z(z)$ if (a) z=2x + 3y, and (b) z= $\frac{x}{y}$

Definition

For any two random variables x and y ,let
$\sigma_x^2 = Varx, \sigma_y^2 = Vary$ and $\sigma_{x+y}^2 Varx + y$
Then, $\frac{\sigma_{x+y}}{\sigma_x + \sigma_y} \leq 1$

Solution

(a) Given z=2x + 3y

$$E(z)=0$$

$$\sigma_z^2 = 4\sigma_x^2 + 9\sigma_y^2 = 5^2 \tag{1}$$

$\sigma_x = \sigma_y = 2$

$$\sigma_z^2 = 4(4) + 9(4) \tag{2}$$

Hence z is N(0,$\sqrt{52}$
(b) Given z=$\frac{x}{y}$

From definition $\sigma_1 = \sigma_2 = 2, r = 0$

$F_z(z)= \frac{1}{2} +\frac{1}{\pi}$arc tan z $\implies {}_z(z)= \frac{1}{\pi(1+z^2)}$ (3)