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Courses » Probability and Random Variables / Processes for Wireless Communications

Announcements Course Ask a Question Progress

Unit 4 - Basics of Random Processes, Wireless Fading Channel Modeling

Assignment 3

The due date for submitting this assignment has passed. **Due on 2017-02-14, 23:59 IST.**
As per our records you have not submitted this assignment.

1) Consider the random variable $Y = g(X)$. Let g be a one to one function. Let $f_X(x)$ denote the PDF of X. The probability density function of the random variable Y is, *1 point*

- $f_X(x)\,|_{x=g^{-1}(y)}$
- $\dfrac{f_X(x)|_{x=g^{-1}(y)}}{\left|\frac{dy}{dx}\right|_{x=g^{-1}(y)}}$
- $f_X(x)|_{x=g^{-1}(y)} \times \left|\frac{dy}{dx}\right|_{x=g^{-1}(y)}$
- $f_X\left(g^{-1}(y)\right)$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\dfrac{f_X(x)|_{x=g^{-1}(y)}}{\left|\frac{dy}{dx}\right|_{x=g^{-1}(y)}}$

2) Consider the random variable X with PDF $f_X(x) = Ke^{-\beta|x|}$ for $-\infty < x < \infty$. Let $Y = X^2$. The PDF of the random variable Y is, *1 point*

- $\frac{\beta}{2\sqrt{y}}e^{-\beta\sqrt{y}}$
- $\frac{\beta^2}{2\sqrt{y}}e^{-\beta\sqrt{y}}$
- $\beta^2 e^{-\beta\sqrt{y}}$
- $\frac{\beta}{4\sqrt{y}}e^{-\beta\sqrt{y}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$\frac{\beta}{2\sqrt{y}}e^{-\beta\sqrt{y}}$$

3) Consider a Gaussian random variable X with mean 0 and variance σ^2. Let $Y = 2X$. The probability density function $f_Y(y)$ of the random variable Y is, *1 point*

$$\frac{1}{\sqrt{8\pi\sigma^2}}e^{-\frac{y^2}{8\sigma^2}}$$

$$\frac{1}{\sqrt{2\pi\sigma^2}}e^{-\frac{y^2}{2\sigma^2}}$$

$$\sqrt{\frac{2}{\pi\sigma^2}}e^{-\frac{2y^2}{\sigma^2}}$$

$$\frac{1}{\sqrt{2\pi\sigma^2}}e^{-\frac{2y^2}{\sigma^2}}$$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$\frac{1}{\sqrt{8\pi\sigma^2}}e^{-\frac{y^2}{8\sigma^2}}$$

4) Let X be a Gaussian random variable with mean 0 and variance σ^2. The fourth moment of X i.e. $E\{X^4\}$ is, *1 point*

σ^4

$3\sigma^4$

$5\sigma^4$

$7\sigma^4$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$3\sigma^4$

5) Consider independent Gaussian random variables X_n distributed as $\mathcal{N}\left(\frac{1}{2^n}, \frac{1}{2^n}\right)$, $n = 0, 1, 2, \cdots$. The random variable $Y = \sum_{n=0}^{\infty} \frac{1}{2^n} X_n$ is distributed as, *1 point*

$\mathcal{N}\left(\frac{4}{3}, \frac{4}{3}\right)$

$\mathcal{N}(2, 2)$

$\mathcal{N}\left(\frac{4}{3}, \frac{8}{7}\right)$

$\mathcal{N}\left(1, \frac{8}{7}\right)$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$\mathcal{N}\left(\frac{4}{3}, \frac{8}{7}\right)$

6) Consider an additive Gaussian noise channel $y = x + n$, where x is +1 or -1 with probability 0.5 each and the noise is Gaussian with mean 0 and variance σ^2. What is the probability density function of the output y, ***1 point***

$\frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{y^2}{2\sigma^2}}$

$\frac{1}{\sqrt{8\pi\sigma^2}} e^{-\frac{(y-1)^2}{2\sigma^2}} + \frac{1}{\sqrt{8\pi\sigma^2}} e^{-\frac{(y+1)^2}{2\sigma^2}}$

$\frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(y-1)^2}{2\sigma^2}} + \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(y+1)^2}{2\sigma^2}}$

$\frac{1}{2} \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{y^2}{2\sigma^2}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$\frac{1}{\sqrt{8\pi\sigma^2}} e^{-\frac{(y-1)^2}{2\sigma^2}} + \frac{1}{\sqrt{8\pi\sigma^2}} e^{-\frac{(y+1)^2}{2\sigma^2}}$

7) Consider an antenna array with three antennas and inter antenna spacing d=1cm. Let y_1, y_2, y_3 be the signals received at antennas 1, 2, 3 respectivey. For a radio signal of frequency 1 GHz arriving at an angle of 30° with respect to the vertical, what is the optimal combined signal for this antenna array? ***1 point***

$y_1 + y_2 + y_3$

$y_1 + (0.6349 + 0.2549j)y_2 + (0.9836 - 1804j)y_3$

$y_1 + (\frac{1}{\sqrt{2}} + \frac{j}{\sqrt{2}})y_2 + (\frac{1}{\sqrt{2}} - \frac{j}{\sqrt{2}})y_3$

- $y_1 + (0.9836 + 0.1804j)y_2 + (0.9349 - 0.3549j)y_3$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$y_1 + (0.9836 + 0.1804j)y_2 + (0.9349 - 0.3549j)y_3$

8) Consider an antenna array with three antennas and inter antenna spacing d=1cm. Let y_1, y_2, y_3 be the signals received at antennas 1, 2, 3 respectivey. For a radio signal of frequency 1 GHz arriving at an angle of 30° with respect to the vertical, what is the array gain of the optical combined signal for this antenna array?? ***1 point***

- 3 dB
- 4.77 dB
- 5.32 dB
- 6 dB

No, the answer is incorrect.
Score: 0

Accepted Answers:
4.77 dB

9) Consider an antenna array with three antennas and inter antenna spacing d=1cm. Let y_1, y_2, y_3 be the signals received at antennas 1, 2, 3 respectivey. For a radio signal of frequency 1 GHz arriving at an angle of 30° with respect to the vertical, signal power 4 dB, and IID zero-mean noise power -2dB, what is the noise power at the output of the optimal combiner? ***1 point***

- 3 dB
- -2 dB
- 2.77 dB
- 2.32 dB

No, the answer is incorrect.
Score: 0

Accepted Answers:
2.77 dB

10) Consider an antenna array with three antennas and inter antenna spacing d=1cm. Let y_1, y_2, y_3 be the signals received at antennas 1, 2, 3 respectively. For a radio signal of frequency 1 GHz arriving at an angle of 30° with respect to the vertical, signal power 4 dB, and IID zero-mean noise power -2dB, what is the SNR at the output of the optimal combiner? ***1 point***

- 10.77 dB
- 8.32 dB
- 6 dB
- 3.32 dB

No, the answer is incorrect.
Score: 0

Accepted Answers:
10.77 dB

Previous Page End