1. X is a discrete random variable with
\[ P(X=-1) = a, \ P(X= -.5) = 0.25, \ P(X=2) = 0.35, \ P(X= 1) = 0.1 \]
   a. Find “a”
   b. Find \( P(X< 0) \)
   c. Find \( E[X] \)
   d. Find \( E[X^2] \)
   e. Find \( \text{Var}[X] \)

2. X is a random variable with
\[ f_X(x) = .1\delta(x) + .9u(x)e^{-x} \]
   where \( u(x) = 1 \) for \( x>0 \) and \( u(x) = 0 \) for \( x<0 \).
   a. Sketch \( f_X(x) \).
   b. Verify that the total probability is 1, i.e.,
\[ \int_{-\infty}^{\infty} f_X(x) \, dx = 1 \]
   c. What is \( P(X=0) \)?
   d. What is \( P(-1<X<1) \)?
   e. Find \( E[X] \)

3. X is a Gaussian random variable with \( \mu_X = 10 \) and \( \sigma_X=2 \),
   a. Find \( P(X>10) \)
   b. Find \( P(X<8) \)
   c. Find \( P(X<6) \)
   d. Find \( P(8<X<12) \)

4. X is a Gaussian random variable with \( \mu_X = 0 \) and \( \sigma_X \). Plot \( P(X>1) \) as a function of \( \sigma_X \).

5. X is a random variable with a uniform distribution [10, 20]
   a. Find \( P(X>19) \)
   b. Find \( P(X<5) \)
   c. Find \( \mu_X \) and \( \sigma_X \)

6. X and Y have the following joint distribution function
\[
\begin{array}{c|c|c|c}
X & X=-1 & X=0 & X=1 \\
\hline
Y=-1 & 1/8 & 0 & 1/4 \\
Y=0 & 0 & 1/4 & 0 \\
Y=1 & 1/8 & 1/8 & 1/8 \\
\end{array}
\]
   a. Is this a valid joint distribution function? YES or NO
   b. Find \( P(X=0). \)
   c. Find \( P(Y=-1). \)
   d. Find \( P(X=0|Y=-1). \)
   e. Find \( \rho_{XY}. \)

7. Chapter 2: Problem 2.18