Information:

- The following shorthand notation is often used to relate the signal \( x(t) \) and its Fourier transform \( X(j\omega) \):
  \[
  \mathcal{F}\{x(t)\} = X(j\omega).
  \]
- We use the following properties of continuous-time Fourier transform:
  \[
  \mathcal{F}\{x(t - t_0)\} = e^{-j\omega t_0} X(j\omega).
  \]
  \[
  \mathcal{F}\{e^{j\omega_0 t} x(t)\} = X(j(\omega - \omega_0)).
  \]
- For a real signal \( x(t) \), its Fourier transform \( X(j\omega) \) is conjugate symmetric, that is,
  \[
  X(j\omega) = \left(X(-j\omega)\right)^*,
  \]
  where \((\cdot)^*\) denotes the conjugate operation.

Tutorial 6-1
Determine the Fourier transform of the following signals
(a) \( x(t) = e^{-\alpha t}u(t) \quad \alpha > 0 \)
(b) \( x(t) \) in Figure 1. Also express the Fourier transform in terms of sinc function defined as
\[
sinc(\theta) \triangleq \frac{\sin \pi \theta}{\pi \theta}.
\]

![Figure 1](image_url)

**Figure 1:** \( x(t) \) for Problem 6-1(b).
**Tutorial 6-2**

Using the Fourier transform synthesis equation, determine the inverse Fourier transform:

(a) \( X(j\omega) = \delta(w) \)

(b) \( X(j\omega) = 2\pi \delta(w) + \delta(w - 4\pi) + \delta(w + 4\pi) \)

**Tutorial 6-3**

Using the result of previous problem, determine the Fourier transform \( X(j\omega) \) of the continuous-time periodic signal \( x(t) \) in terms of its Fourier series coefficients denoted by \( a_k \).

**Tutorial 6-4**

Determine whether the Fourier transforms \( X(j\omega) \) in Figure 1(a) and 1(b) correspond to real continuous time signal \( x(t) \).

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**Figure 2: Problem 6-4**