H12-08

8. Given that the Fourier transform of the signal $x(t) = t\,e^{-2t}u(t)$ is

$$X(\omega) = \frac{1}{(2 + j\omega)^2}$$

sketch the magnitude and phase spectra for the signals

(a) $y(t) = \frac{d}{dt}x(t)$

(b) $y(t) = \int_{-\infty}^{t} x(\tau)\,d\tau$

(c) $y(t) = x(-2t + 4)$

(d) $y(t) = 2x(t) + \dot{x}(t)$

9. Two LTI systems are specified by the unit-impulse responses $h_1(t) = -2\delta(t) + 5e^{-2t}u(t)$ and $h_2(t) = 2te^{-t}u(t)$. Compute the responses of the two systems to the input signal $x(t) = \cos(t)$.

10. An input signal $x(t)$ applied to the LTI system with frequency response function

$$H(\omega) = \frac{j\omega}{1 + j\omega}$$

yields the output signal

$$y(t) = \delta(t) + 3e^{-t}u(t) - 7e^{-2t}u(t)$$

What is $x(t)$?

11. Suppose $y(t) = x(t)\cos(t)$ and the Fourier transform of $y(t)$ is described in terms of unit-step functions as

$$Y(\omega) = u(\omega + 2) - u(\omega - 2)$$

What is $x(t)$?

15. A continuous-time LTI system is described by the frequency response function

$$H(\omega) = \frac{2}{2 - \omega^2 + j\omega 3}$$

and the input signal has the Fourier transform

$$X(\omega) = e^{-j\omega 3}$$

Compute the response $y(t)$.

16. Use partial fraction expansion to compute the inverse Fourier transform for

(a) $X(\omega) = \dfrac{5j\omega + 12}{(j\omega)^2 + 5j\omega + 6}$

(b) $X(\omega) = \dfrac{4}{3 - \omega^2 + 4j\omega}$

17. Compute the inverse Fourier transform for

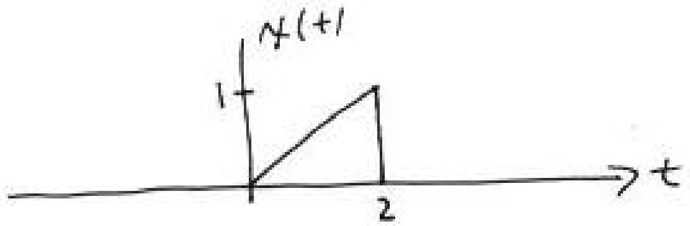
(a) $X(\omega) = \dfrac{e^{j(\pi - \pi\omega)}(5 - \omega^2 + j4\omega)}{(9 - \omega^2 + j6\omega)(2 + j\omega)}$

(b) $X(\omega) = e^{-j2\omega} + \dfrac{10 + 10e^{-j\omega}}{2 - \omega^2 + j3\omega}$

1. Using either the basic definition or tables and properties, compute the Laplace transforms of

(a) $x(t) = \delta(t-1) + \delta(t) + e^{-2(t+3)}u(t-1)$

(b)



2. For each of the following Laplace transforms, use the final value theorem to determine $\lim_{t\to\infty} x(t)$, and state whether the conclusion is valid.

(a) $X(s) = \dfrac{2s+4}{s^3 + 5s^2 + 6s}$

(b) $X(s) = \dfrac{2}{(s-1)^2}$

3. Given that the Laplace transform of $x(t) = \cos(2t)u(t)$ is $X(s) = \dfrac{s}{s^2+4}$ compute the Laplace transform of $dx(t)/dt$ by two methods: First, differentiate the signal and use the tables. Second, use the differentiation property.