Integration Practice

In the following problems you should used the Fourier transform and inverse transform integrals:

$$X(\omega) = \int_{-\infty}^{\infty} x(t) e^{-j\omega t} dt$$

$$x(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} X(\omega) e^{j\omega t} d\omega$$

Try to derive your answers, do not just guess!

1) If $x(t) \leftrightarrow X(\omega)$, then $\alpha x(t-\beta)$ will have Fourier transform

a) $\alpha X(\omega)$ b) $\alpha X(\omega) e^{j\beta\omega}$ c) $\alpha X(\omega) e^{-j\beta\omega}$ d) none of these

2) If $x(t) \leftrightarrow X(\omega)$, then $\frac{d}{dt} x(t)$ will have Fourier transform

a) $\frac{d}{d\omega} X(\omega)$ b) $j\omega X(\omega)$ c) $-j\omega X(\omega)$ d) none of these

3) If $x(t) \leftrightarrow X(\omega)$, then $tx(t)$ will have Fourier transform

a) $\frac{d}{d\omega} X(\omega)$ b) $j\frac{d}{d\omega} X(\omega)$ c) $-j\frac{d}{d\omega} X(\omega)$ d) none of these

4) If $x(t) \leftrightarrow X(\omega)$, then $x(\alpha t)$ for $\alpha > 0$ will have Fourier transform

a) $X\left(\frac{\omega}{\alpha}\right)$ b) $X(\alpha\omega)$ c) $\frac{1}{\alpha} X\left(\frac{\omega}{\alpha}\right)$ d) $\alpha X\left(\frac{\omega}{\alpha}\right)$ e) none of these

5) If $x(t) \leftrightarrow X(\omega)$, then $x(t) e^{-j\beta t}$ will have Fourier transform

a) $X(\omega) e^{-j\beta t}$ b) $X(\omega+\beta)$ c) $X(\omega-\beta)$ d) none of these

6) If $x(t) = 2\delta(t+3)$, then $X(\omega)$ is

a) $2e^{j3\omega}$ b) $2e^{j3\omega} u(t)$ c) $2e^{j3\omega} u(\omega)$ d) $2e^{-j3\omega}$ e) none of these

7) If $X(\omega) = 3\delta(\omega-2)$, then $x(t)$ is

a) $3e^{j2t}$ b) $\frac{3}{2\pi} e^{j2t}$ c) $\frac{3}{2\pi} e^{j2t} u(t)$ d) $\frac{3}{2\pi} e^{-j2t}$ e) none of these

Impulse Response

8) Find the impulse response of the system defined by $\frac{dy(t)}{dt} = 5x(t)$, with IC of $y(-5) = 0$

a) $h(t) = 5\delta(t)$ b) $h(t) = 5$ c) $h(t) = 5u(t)$ d) $h(t) = \infty$

9) Find the impulse response of the system defined by $\frac{dy(t)}{dt} + 5y(t) = x(t)$, with IC of $y(-5) = 0$

a) $h(t) = \frac{1}{5}\delta(t)$ b) $h(t) = e^{-5t}$ c) $h(t) = e^{5t}u(t)$ d) $h(t) = e^{-5t}u(t)$

10) Find the impulse response of the system defined by $2\frac{dy(t)}{dt} + y(t) = 5x(t)$, with IC of $y(-5) = 0$

a) $h(t) = 2.5e^{-0.5t}u(t)$ b) $h(t) = 5e^{-t}$ c) $h(t) = 5\delta(t)$ d) $h(t) = e^{0.5t}u(t)$

11) Find the impulse response of the system defined by $\frac{dy(t)}{dt} + 5y(t) = x(t+6)$, with IC of $y(-5) = 0$

a) $h(t) = \frac{1}{5}\delta(t)$ b) $h(t) = e^{-5t}u(t+6)$ c) $h(t) = e^{-5(t+6)}u(t+6)$ d) $h(t) = 0$

12) Find the impulse response of the system defined by $5y(t) = \int_0^5 x(2+\lambda)d\lambda$

a) $h(t) = \frac{1}{5}$ b) $h(t) = 0$ c) $h(t) = \frac{1}{5}u(t)$ d) $h(t) = \frac{1}{5}\left[u(t) - u(t-5)\right]$

13) Find the impulse response of the system defined by $y(t) = \int_{-t+1}^5 x(2+\lambda)d\lambda$

a) $h(t) = u(-t+3)$ b) $h(t) = u(t+2)$ c) $h(t) = 0$ d) $h(t) = u(t-3)$

14) Find the impulse response of the system defined by $y(t) = \int_0^t e^{-(\lambda-2)}x(\lambda-4)d\lambda$

a) $h(t) = e^{-(t-2)}u(t-4)$ b) $h(t) = e^{-2}u(t-4)$ c) $h(t) = e^{-(t-2)}\delta(t-4)$ d) $h(t) = e^{-(t-2)}$

15) Find the impulse response of the system defined by $y(t) = e^{-(t-2)}x(t-4)$

a) $h(t) = e^{-2}$ b) $h(t) = e^{6}$ c) $h(t) = e^{-2}\delta(t-4)$ d) $h(t) = e^{-2}u(t-4)$

16) Find the impulse response of the system defined by $y(t) = x(2t) + \frac{1}{2}x(t)$

a) $h(t) = \delta(t)$ b) $h(t) = 1.5\delta(t)$ c) $h(t) = 2.5\delta(t)$ d) $h(t) = 0$

Answers:
1) c 2) b 3) b 4) c 5) b 6) a 7) b 8) c 9) d 10) a 11) c 12) b 13) d 14) b 15) c 16) a