1.3-1

$$f_2(t) = f(t-1) + f_1(t-1) \quad f_3(t) = f(t-1) + f_1(t+1) \quad f_4(t) = f(t-0.5) + f_1(t+0.5)$$

The signal $f_5(t)$ can be obtained by (i) delaying $f(t)$ by 1 second (replace t with $t-1$, (ii) then time-expanding by a factor 2 (replace t with $t/2$), (iii) then multiply with 1.5. Thus $f_5(t) = 1.5f(\frac{t}{2} - 1)$.

1.3-2 All the signals are shown in Fig. S1.3-2.

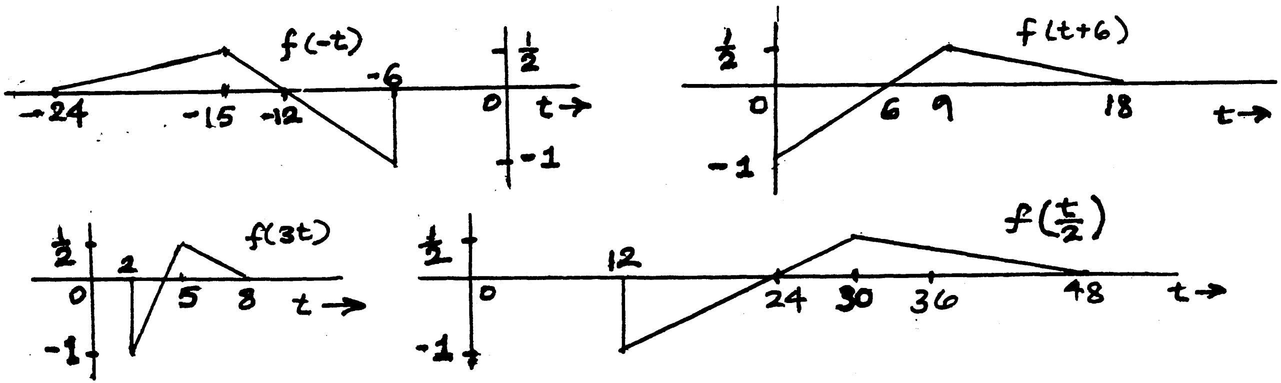

Fig. S1.3-2

1.3-3 All the signals are shown in Fig. S1.3-3

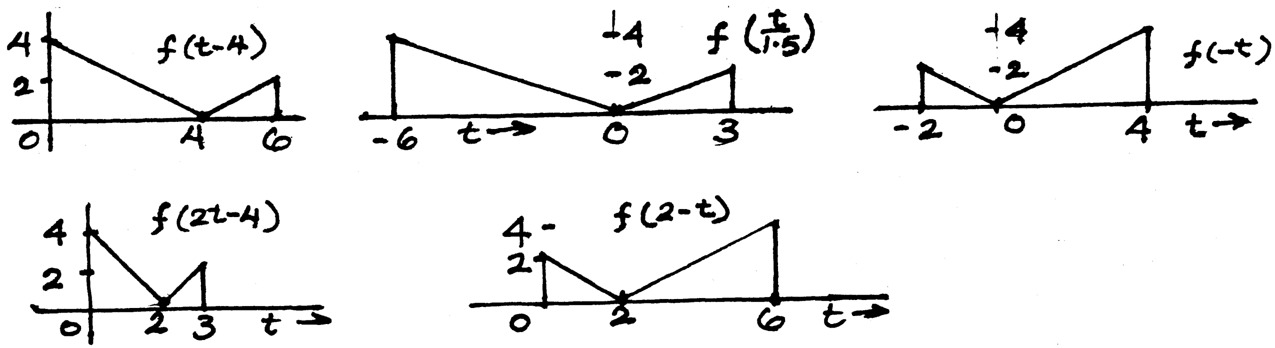

Fig. S1.3-3

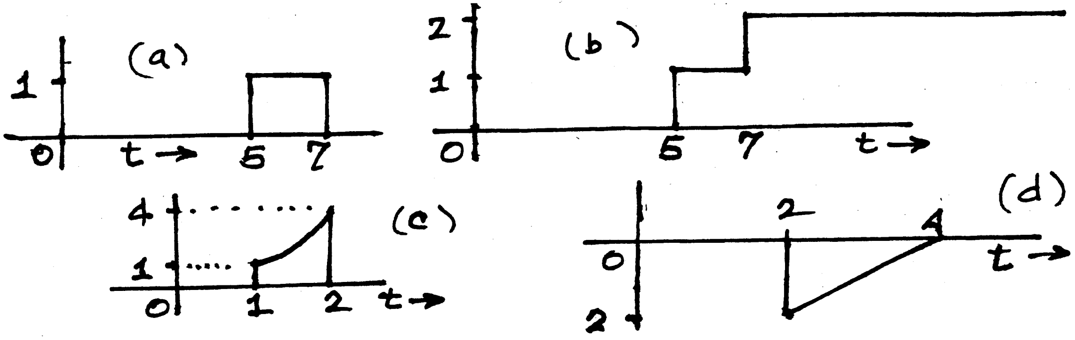

Fig. S1.4-1

1.4-1 All the signals are shown in Fig. S1.4-1.

1.4-2

$$f_1(t) = 4(t+1)[u(t+1) - u(t)] + (-2t+4)[u(t) - u(t-2)] = 4(t+1)u(t+1) - 6tu(t) + 3u(t) + (2t-4)u(t-2)$$

$$f_2(t) = t^2[u(t) - u(t-2)] + (2t-8)[u(t-2) - u(t-4)] = t^2 u(t) - (t^2 - 2t + 8)u(t-2) - (2t-8)u(t-4)$$

1.4-4 Using the fact that $f(x)\delta(x) = f(0)\delta(x)$, we have

(a) 0 **(b)** $\frac{2}{9}\delta(\omega)$ **(c)** $\frac{1}{2}\delta(t)$ **(d)** $-\frac{1}{5}\delta(t-1)$ **(e)** $\frac{1}{2-j3}\delta(\omega+3)$ **(f)** $k\delta(\omega)$ (use L' Hôpital's rule)

1.4-5 In these problems remember that impulse $\delta(x)$ is located at $x = 0$. Thus, an impulse $\delta(t-\tau)$ is located at $\tau = t$, and so on.

(a) The impulse is located at $\tau = t$ and $f(\tau)$ at $\tau = t$ is $f(t)$. Therefore

$$\int_{-\infty}^{\infty} f(\tau)\delta(t-\tau)\,d\tau = f(t)$$

(b) The impulse $\delta(\tau)$ is at $\tau = 0$ and $f(t-\tau)$ at $\tau = 0$ is $f(t)$. Therefore

$$\int_{-\infty}^{\infty} \delta(\tau)f(t-\tau)\,d\tau = f(t)$$

Using similar arguments, we obtain

(c) 1 **(d)** 0 **(e)** e^3 **(f)** 5 **(g)** $f(-1)$ **(h)** $-e^2$