

p99-101

信号分析. 第二次作业.

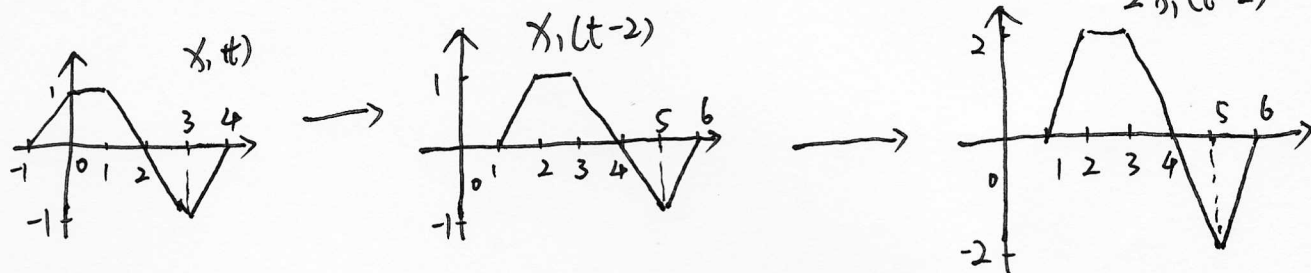
$$1. (1) \int_{-\infty}^{\infty} f(t-t_0) \delta(t) dt = f(t-t_0)/_{t=0} = f(-t_0)$$

$$(2) \int_{-\infty}^{\infty} (e^t + t) \cdot \delta(t+2) dt = 0$$

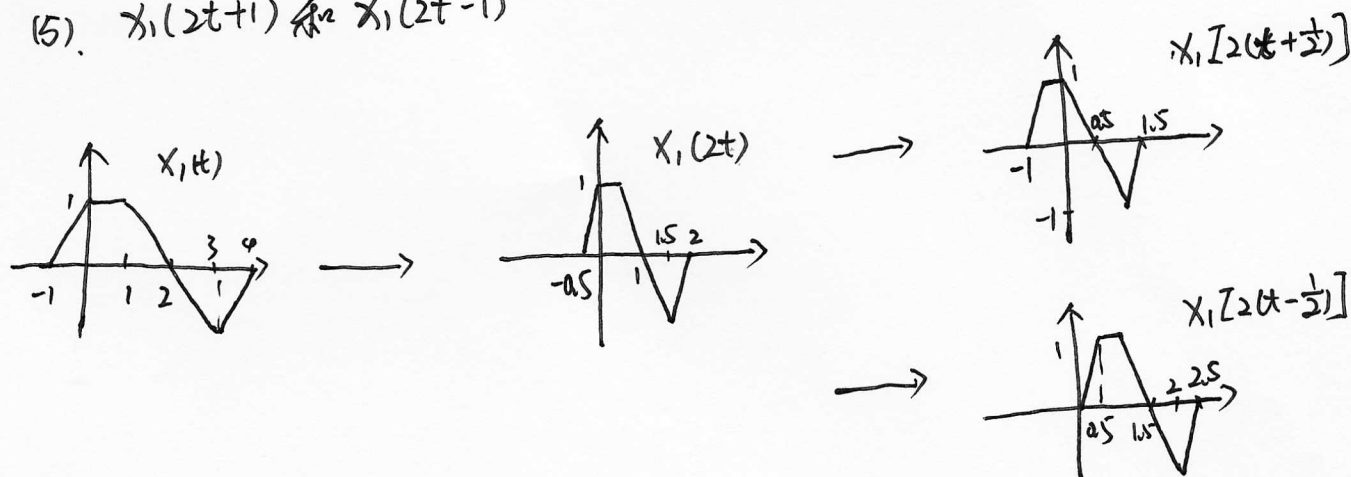
$$(4) \int_{-\infty}^{\infty} (t + \sin t) \delta(t - \frac{\pi}{6}) dt = t + \sin t /_{t=\frac{\pi}{6}} = \frac{\pi}{6} + \frac{1}{2}$$

$$(6) \int_{-\infty}^{\infty} e^{-j\omega t} [\delta(t) - \delta(t-t_0)] dt = \int_{-\infty}^{\infty} e^{-j\omega t} \delta(t) dt - \int_{-\infty}^{\infty} e^{-j\omega t} \delta(t-t_0) dt = 1 - e^{-j\omega t_0}$$

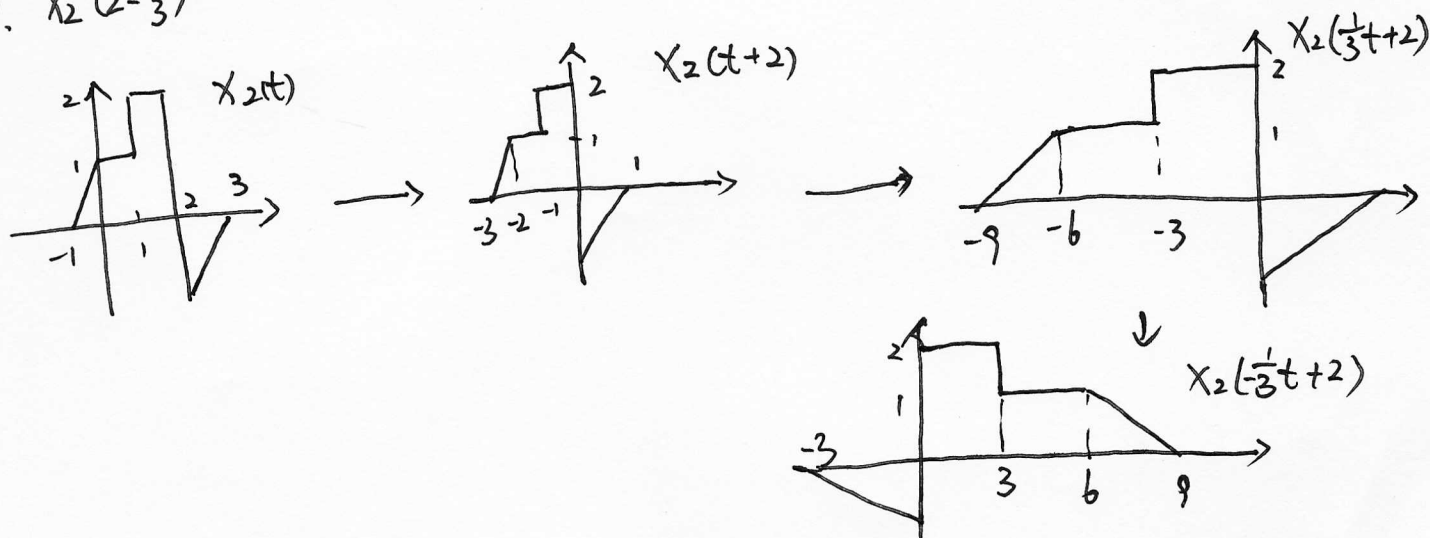
3. (3). $2x_1(t-2)$



(5). $x_1(2t+1)$ 和 $x_1(2t-1)$

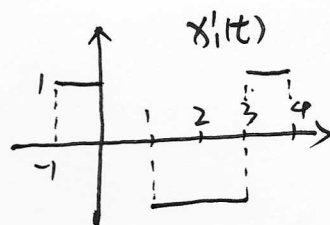
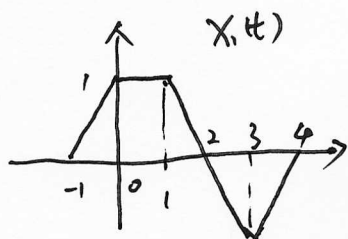


(7). $x_2(2-\frac{t}{3})$



p99.

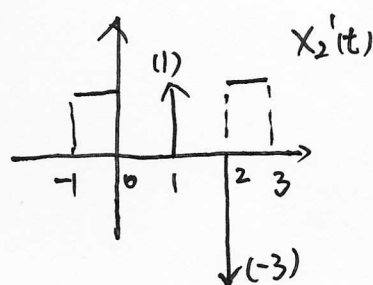
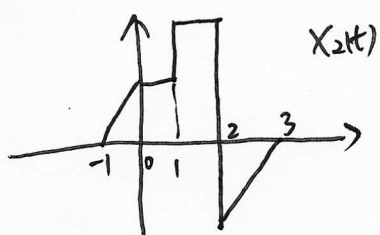
3. (10)



表达式: 1). 分段函数.

$$x_1'(t) = \begin{cases} 0 & t > 4 \\ 1 & 3 \leq t \leq 4 \\ -1 & 1 \leq t < 3 \\ 0 & 0 \leq t < 1 \\ 1 & -1 \leq t < 0 \\ 0 & t < -1 \end{cases}$$

$$(2). x_2'(t) = [u(t+1) - u(t)] - [u(t-1) - u(t-3)] + [u(t-3) - u(t-4)]$$



表达式: 2). 分段函数

$$x_2'(t) = \begin{cases} 0 & t > 3 \\ 1 & 2 < t \leq 3 \\ -3\delta(t) & t=2 \\ \delta(t) & t=1 \\ 1 & -1 \leq t \leq 0 \\ 0 & t < -1 \end{cases}$$

$$(2). x_2'(t) = [u(t-2) - u(t-3)] - 3\delta(t-2) + \delta(t-1) + [u(t+1) - u(t)]$$

p101. 傅里叶级数表达式.

17. (1). $x(t) = \cos 4t + \sin 6t$.

$\omega = 2$. $\cos 4t = \cos 2 \cdot \omega t$. $a_2 = 1$
 $\sin 6t = \sin 3 \cdot \omega t$. $b_3 = 1$.

三角形式: $x(t) = \frac{a_0}{2} + \sum_{n=1}^{\infty} (a_n \cos n\omega t + b_n \sin n\omega t)$
 $= 0 + a_2 \cdot \cos 2\omega t + b_3 \cdot \sin 3\omega t$
 $= \cos 2\omega t + \sin 3\omega t$

直接用欧拉公式展开

$\cos 2\omega t + \sin 3\omega t$
 $= \frac{1}{2}e^{j2\omega t} + \frac{1}{2}e^{-j2\omega t} - \frac{1}{2}je^{j3\omega t} + \frac{1}{2}je^{-j3\omega t}$

指数形式: $x(t) = \sum_{n=-\infty}^{\infty} X(n\omega_0) \cdot e^{jn\omega_0 t}$

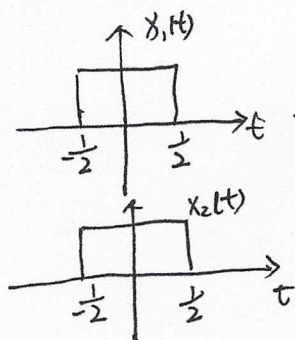
$X(n\omega_0) = \frac{1}{2}(a_n - jb_n)$

$n = \pm 2$. $X(n\omega_0) = \frac{1}{2}(a_2 - jb_2) = \frac{1}{2}$

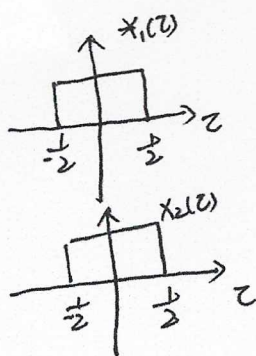
$n = -3$. $X(-3\omega_0) = \frac{1}{2}(a_{-3} - jb_{-3})$
 $= \frac{1}{2}[0 - j(-1)] = \frac{1}{2}j$
 $n = 3$. $X(3\omega_0) = \frac{1}{2}(a_3 - jb_3) = -\frac{1}{2}j$

$\therefore x(t) = \frac{1}{2}e^{j2\omega t} + \frac{1}{2}e^{-j2\omega t} - \frac{1}{2}je^{j3\omega t} + \frac{1}{2}je^{-j3\omega t}$

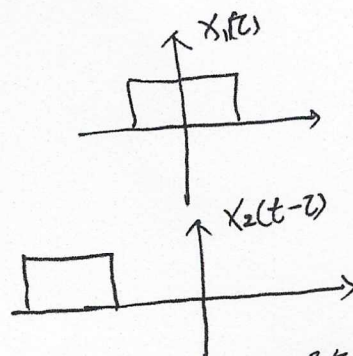
补充. 求卷积.



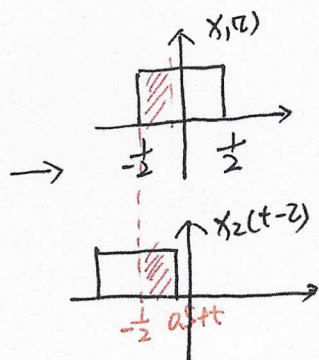
① 变量替换.



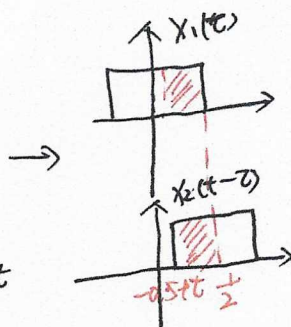
② 平移



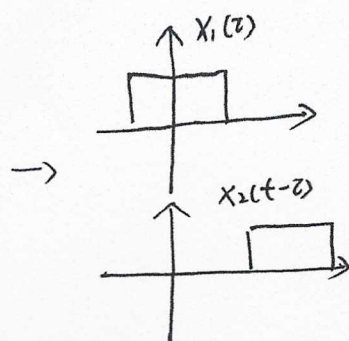
① 当 $-1 < t < 0$ 没有重叠部分
 $x_1(t) * x_2(t) = 0$



② 当 $-1 < t < 0$
 $x_1(t) * x_2(t) = \int_{-a_5+t}^{a_5+t} 1 \cdot 1 dt = 1+t$



③ 当 $0 < t < 1$
 $x_1(t) * x_2(t) = \int_{0.5+t}^{0.5} 1 \cdot 1 dt = 1-t$



② 当 $t > 1$ 无重叠.

$$x_1(t) * x_2(t) = 0$$

$$\therefore x_1(t) * x_2(t) = \begin{cases} 0 & t < -1 \\ 1+t & -1 < t < 0 \\ 1-t & 0 < t < 1 \\ 0 & t > 1 \end{cases}$$