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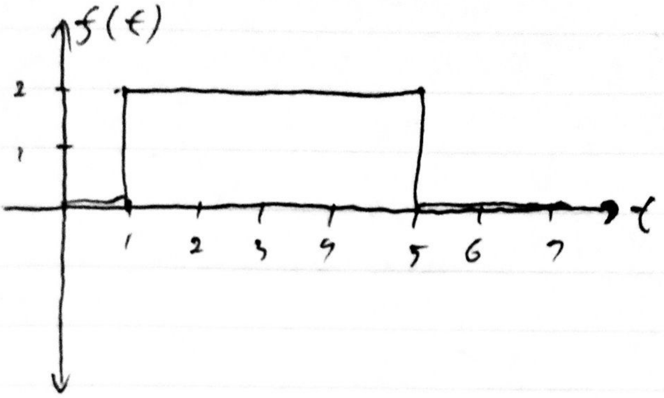
TT-43-4

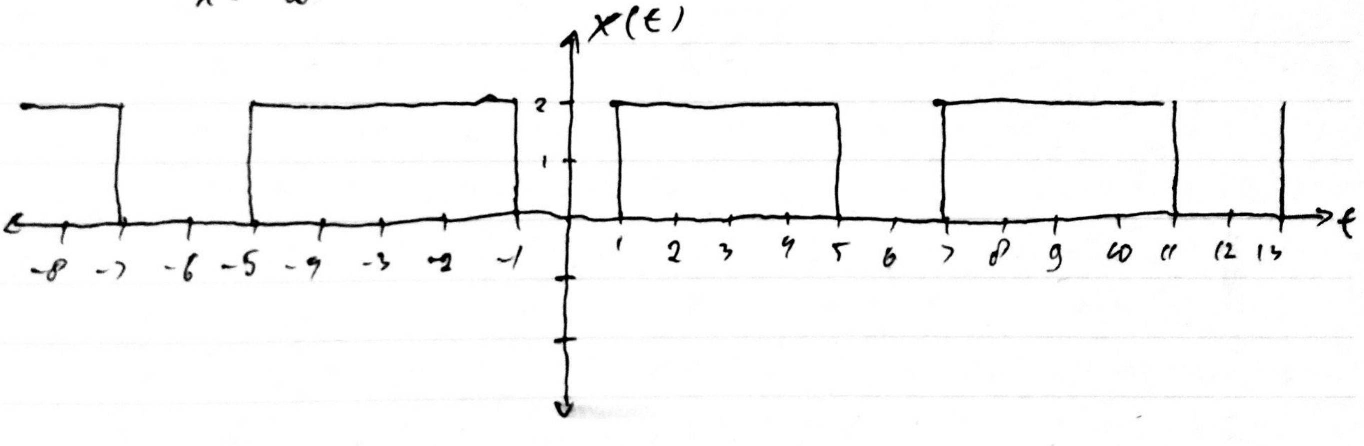
1. $f(t) = 2u(t-1) - 2u(t-5)$

a.



b.

$$x(t) = \sum_{k=-\infty}^{\infty} f(t-6k)$$



c.

$$X[k] = \frac{1}{T}\int_0^T x(t).e^{-jk\omega t}\,dt$$

$$X[k] = \frac{1}{6}\int_0^6 x(t).e^{-jk\omega t}\,dt$$

$$X[k] = \frac{1}{6}\left[\int_0^1 0.e^{-jk\omega t}\,dt + \int_1^5 2.e^{-jk\omega t}\,dt + \int_5^6 0.e^{-jk\omega t}\,dt\right.$$

$$X[k] = \frac{1}{6}\left[0 + \frac{2}{-jk\omega}\, e^{-jk\omega t}\Big|_1^5 + 0\right]$$

$$X[k] = \frac{-1}{3jk\omega}\left(e^{-5jk\omega} - e^{-jk\omega}\right)$$

$$\omega = \frac{2\pi}{T} = \frac{2\pi}{6} = \frac{\pi}{3}$$

$$X[k] = \frac{-1}{3jk\omega}\left(e^{-5jk\omega} - e^{-jk\omega}\right)$$

$$X[k] = \frac{-1}{3jk\cdot\frac{\pi}{3}}\left(e^{-5jk\frac{\pi}{3}} - e^{-jk\frac{\pi}{3}}\right)$$

$$X[k] = \frac{-1}{jk\pi}\left(e^{-\frac{5}{3}jk\pi} - e^{-\frac{1}{3}jk\pi}\right)$$

d. $B[0] = X[0]$

$$X[k] = \frac{-1}{jk\pi}\left(e^{-\frac{5}{3}jk\pi} - e^{-\frac{1}{3}jk\pi}\right)$$

$$= \frac{-1}{jk\pi}\left(\cos(-\tfrac{5}{3}k\pi) - j\sin(-\tfrac{5}{3}k\pi) - \cos(-\tfrac{1}{3}k\pi) + j\sin(-\tfrac{1}{3}k\pi)\right)$$

$$= \frac{-1}{jk\pi}\left(2\sin(-k\pi)\right)$$

d. $B[0] = \frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} x(t)\,dt = \frac{1}{6}\int_0^6 x(t)\,dt$

$$= \frac{1}{6}\int_1^5 2\,dt$$

$$= \frac{4}{3}$$

e. $B[k] = \frac{2}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} x(t)\cos(k\omega t)\,dt$

$= \frac{2}{6}\int_{1}^{5} 2\cos(k\omega t)\,dt$

$= \frac{1}{3}\cdot\frac{2}{k\omega}\sin(k\omega t)\Big|_{1}^{5}$

$= \frac{2}{3k\frac{\pi}{3}}\left(\sin(k\frac{\pi}{3}5) - \sin(k\frac{\pi}{3}1)\right)$

$= \frac{2}{k\pi}$