

$$1.1b) \quad x(t) = \begin{cases} \frac{1}{4} - |t| & 0.25 \leq t \leq 0.25 \\ 0 & 0.25 < |t| \leq 0.5 \end{cases}$$

$$T=1$$

$$T=4T_1$$

$$a_k = \frac{1}{T} \int_{-T/2}^{T/2} x(t) e^{-j\omega_k t} dt$$

$$\omega_0 = \frac{2\pi}{T}$$

$$a_k = \frac{1}{1} \int_{-0.25}^{0.25} \left(\frac{1}{4} - |t|\right) e^{-j k 2\pi t} dt + 0$$

$$= \int_{-0.25}^0 \left(\frac{1}{4} + t\right) e^{-j 2\pi k t} dt + \int_0^{0.25} \left(\frac{1}{4} - t\right) e^{-j 2\pi k t} dt$$

↓
replace by $t = -t$

$$\int_0^{0.25} \left(\frac{1}{4} - t\right) e^{j 2\pi k t} dt$$

$$a_k = \int_0^{0.25} \left(\frac{1}{4} - t\right) (e^{j 2\pi k t} + e^{-j 2\pi k t}) dt$$

$$a_k = \int_0^{0.25} \left(\frac{1}{4} - t\right) (2 \cos 2\pi k t) dt$$

$$a_k = \left[\frac{1}{4\pi k} \sin 2\pi k t \right]_0^{0.25} - 2 \int_0^{0.25} t \cos 2\pi k t dt$$

$$a_k = \frac{1}{4\pi k} \sin\left(\frac{\pi k}{2}\right) - 2 \left(\left[t \int \cos 2\pi k t dt \right]_0^{0.25} - \int_0^{0.25} \frac{\sin 2\pi k t}{2\pi k} dt \right)$$

$$a_k = \frac{\sin\left(\frac{\pi k}{2}\right)}{4\pi k} - 2 \left(\frac{\left(0.25\right) \sin\left(\frac{\pi k}{2}\right)}{2\pi k} + \frac{\cos 2\pi k t}{4\pi^2 k^2} \right)_0^{0.25}$$

$$\frac{\sin \frac{\pi k}{2}}{4\pi k} - \frac{\sin \frac{\pi k}{2}}{4\pi k} - 2 \left(\frac{\cos \frac{\pi k}{2}}{4\pi^2 k^2} - \frac{1}{4\pi^2 k^2} \right)$$

$$a_k = \frac{1 - \cos \frac{\pi k}{2}}{2\pi^2 k^2}$$