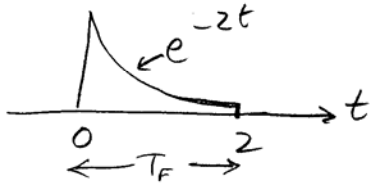
(2) calc $X[k]$ using Integral Formula:

Ex



compute CTFS ($X[k]$) from $0 \le t \le 2$

$$X[k] = \frac{1}{T_F}\int_{t_0}^{t_0+T_F} x(t)\, e^{-j2\pi k f_F t}\, dt \qquad T_F = 2, \quad f_F = \frac{1}{2}$$

$$= \frac{1}{2}\int_0^2 e^{-2t} e^{-j2\pi \frac{k}{2} t}\, dt$$

$$= \frac{1}{2}\int_0^2 e^{-(2+j\pi k)t}\, dt$$

$$\int a e^{-bx}\, dx = -\frac{a}{b} e^{-bx}$$

$$= \frac{1}{2}\left(-\frac{1}{2+j\pi k}\right) e^{-(2+j\pi k)t}\Big|_0^2$$

$$= -\frac{1}{4+j2\pi k}\left(e^{-(4+j2\pi k)} - 1\right)$$

$$= \frac{1}{4+j2\pi k}\left(1 - e^{-4} \cancel{e^{j2\pi k}}^{\,1}\right)$$

$$\boxed{X[k] = \frac{1}{4+j2\pi k}\left(1-e^{-4}\right) = \frac{.9817}{4+j2\pi k}}$$