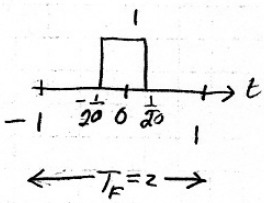
(1) $x(t) = \text{rect}(10t) \qquad -1 \le t \le 1$



$T_F = 2, \quad f_F = \frac{1}{2}$

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

$$= \frac{1}{2}\int_{-\frac{1}{20}}^{\frac{1}{20}} e^{-j2\pi k \frac{1}{2} t}\,dt = \frac{1}{2}\int_{-\frac{1}{20}}^{\frac{1}{20}} e^{-j\pi k t}\,dt$$

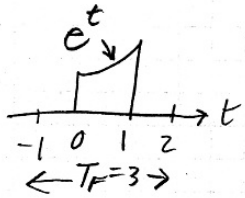
$$= \frac{1}{2}\left(-\frac{1}{j\pi k}\right) e^{-j\pi k t}\Big|_{-\frac{1}{20}}^{\frac{1}{20}}$$

$$= -\frac{1}{\pi k}\,\frac{1}{2j}\left(e^{-j\pi\frac{k}{20}} - e^{+j\pi\frac{k}{20}}\right)$$

$$= \frac{1}{\pi k}\left(\frac{e^{j\pi k/20} - e^{-j\pi k/20}}{2j}\right) = \frac{\sin\left(\frac{\pi k}{20}\right)}{\pi k}$$

$$= \frac{1}{20}\,\frac{\sin\left(\frac{\pi k}{20}\right)}{\frac{\pi k}{20}} = \boxed{\frac{1}{20}\,\text{sinc}\left(\frac{k}{20}\right)}$$

(2)



$T_F = 3, \quad f_F = \frac{1}{3}$

TOPS 35500

$$X[k] = \frac{1}{T_F}\int_{t_0}^{t_0+T_F} x(t)\, e^{-j2\pi k f_F t}\, dt = \frac{1}{3}\int_0^1 e^{t} e^{-j\frac{2\pi k}{3} t}\, dt$$

$$= \frac{1}{3}\int_0^1 e^{(1-j2\pi k/3)t}\, dt$$

$$= \frac{1}{3}\,\frac{1}{(1-j2\pi k/3)}\, e^{(1-j2\pi k/3)t}\Big|_0^1$$

$$= \boxed{\frac{1}{3-j2\pi k}\left(e^{1-j2\pi k/3} - 1\right)}$$

TOPS. 35500