2001 Q6 Group A-1

$$a_0 = \frac{1}{T}\int_T x(t)\,dt$$

$$= \frac{1}{T}\int_{-T_1}^{T_1} 1\cdot dt$$

$$= \frac{1}{T}(t)_{-T_1}^{T_1}$$

$$= \frac{2T_1}{T}.$$

$$a_k = \frac{1}{T}\int_T x(t)e^{-jk\omega_0 t}\,dt$$

$$= \frac{1}{T}\int_{-T_1}^{T_1} e^{-jk\omega_0 t}\,dt$$

$$= \frac{-1}{jk\omega_0 T} e^{-jk\omega_0 t}\Big|_{-T_1}^{T_1}$$

$$= \frac{2}{k\omega_0 T}\left[\frac{e^{jk\omega_0 T_1} - e^{-jk\omega_0 T_1}}{2j}\right]$$

$$= \frac{2}{k\omega_0 T}\sin(k\omega_0 T_1)$$

$$= \frac{\sin(k\omega_0 T_1)}{k\cdot T}, \quad k \neq 0.$$

$$\sin(k\omega_0 T_1) = \frac{e^{jk\omega_0 T_1} - e^{-jk\omega_0 T_1}}{2j}$$