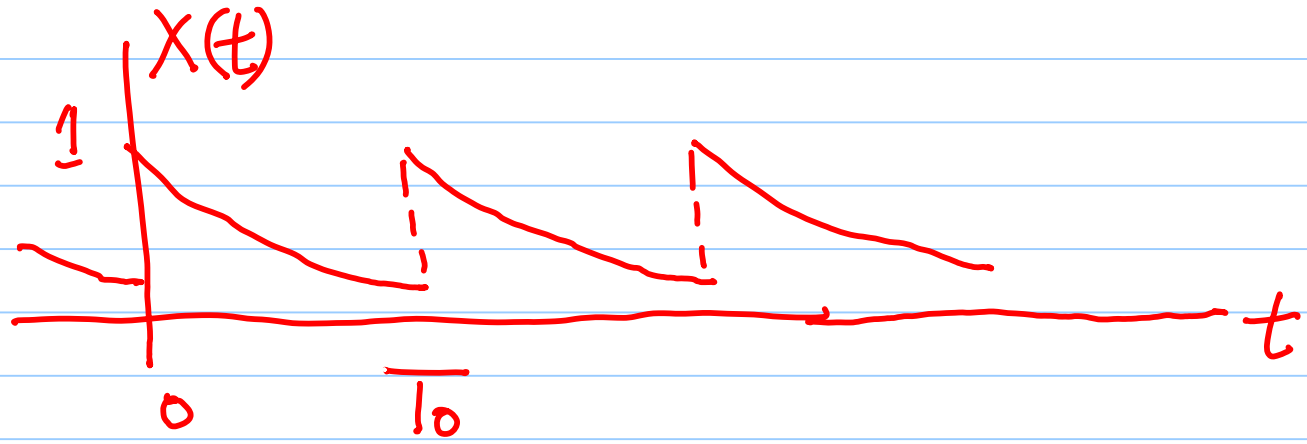
Find the Fourier series coefficients:

Note Title 10/21/2004



$$x(t) = e^{-\alpha t} \qquad 0 \le t \le T_0$$

$$a_k = \frac{1}{T_0}\int_0^{T_0} x(t)\, e^{-j\frac{2\pi k t}{T_0}}\, dt \qquad e^{-j2\pi k f_0 t}$$

$$a_k = \frac{1}{T_0}\int_0^{T_0} e^{-\alpha t}\, e^{-j\frac{2\pi k t}{T_0}}\, dt$$

$$= \frac{1}{T_0}\int_0^{T_0} e^{-(\alpha + j2\pi k/T_0)t}\, dt$$

$$= \frac{1}{T_0}\,\frac{-1}{\alpha + j2\pi k/T_0}\, e^{-(\alpha + j2\pi k/T_0)t}\Big|_0^{T_0}$$

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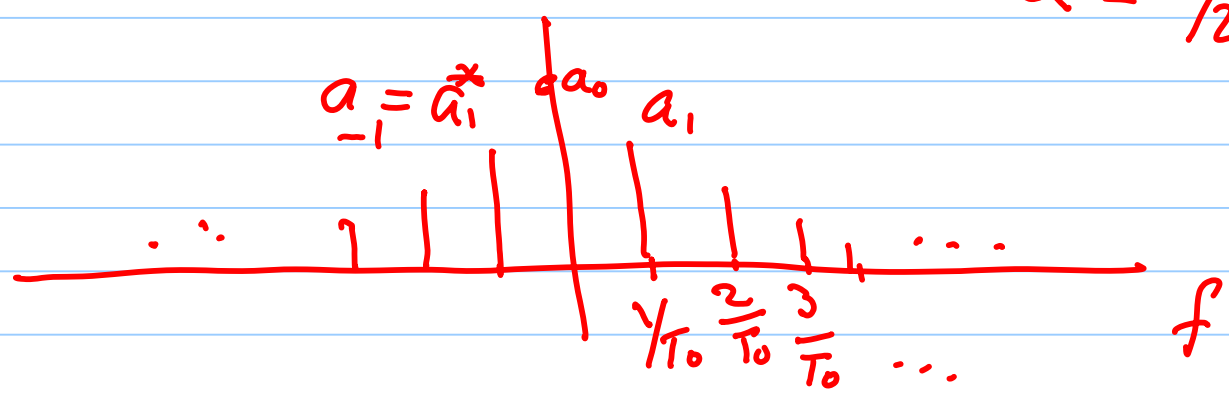
$$a_k = \frac{1}{\alpha T_0 + j2\pi k}\left(1 - e^{-(\alpha T_0 + j2\pi k)}\right)$$

$$= \frac{1}{\alpha T_0 + j2\pi k}\left(1 - e^{-\alpha T_0}\right)$$

$T_0 = 5\times10^{-3}$ s

$\alpha = 1/2$



signal	F coeff
$x(t)$	a_k
$\frac{dx(t)}{dt}$	$jk\omega_0 a_k$
$A\,x(t)$	$A a_k$
$x(t-t_d)$	$a_k e^{-j\omega_0 t_d k}$
$x_1(t) + x_2(t)$	$a_k^{(1)} + a_k^{(2)}$