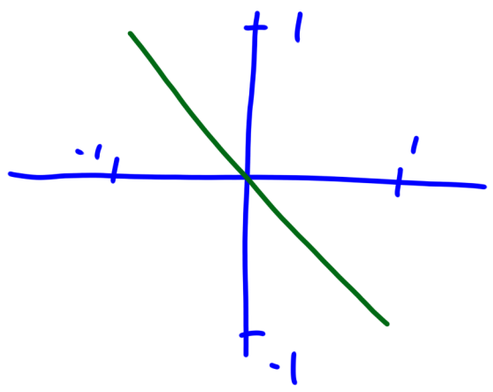

fourier series

$T = 2$

$$a_n = \frac{2}{T}\int_{-T/2}^{T/2} -t\cos(\omega_n t)\,dt$$

$$= -\int_{-1}^{1} t\cos(\omega_n t)\,dt$$

$$\int u\,dv = uv - \int v\,du$$

$u = t \qquad dv = \cos(\omega_n t)\,dt$

$du = dt \qquad v = \frac{\sin(\omega_n t)}{\omega_n}$

$$= -\left(t\,\frac{\sin(\omega_n t)}{\omega_n} - \int_{-1}^{1}\frac{\sin(\omega_n t)}{\omega_n}\,dt\right)$$

$$= -\left(t\,\frac{\sin(\omega_n t)}{\omega_n} + \frac{\cos(\omega_n t)}{\omega_n^2}\right)\Bigg|_{-1}^{1}$$

$$= -\left(\frac{\sin(\omega_n)}{\omega_n} + \frac{\cos(\omega_n)}{\omega_n^2} + \frac{\sin(-\omega_n)}{\omega_n} - \frac{\cos(-\omega_n)}{\omega_n^2}\right)$$

$$= 0$$

$$b_n = -\int_{-1}^{1} t\sin(\omega_n t)\,dt$$

$u = t \qquad dv = \sin(\omega_n t)\,dt$

$du = dt \qquad v = \frac{-\cos(\omega_n t)}{\omega_n}$

$$= -\left(\frac{-t\cos(\omega_n t)}{\omega_n} - \int_{-1}^{1}\frac{-\cos(\omega_n t)}{\omega_n}\,dt\right)$$

$$= \frac{+t\cos(\omega_n t)}{\omega_n} - \frac{\sin(\omega_n t)}{\omega_n^2}\Bigg|_{-1}^{1}$$

$$= \frac{\cos(\omega_n)}{\omega_n} - \frac{\sin(\omega_n)}{\omega_n^2} + \frac{\cos(-\omega_n)}{\omega_n} + \frac{\sin(-\omega_n)}{\omega_n^2}$$

$$= \frac{2\cos(\omega_n)}{\omega_n} - \frac{2\sin(\omega_n)}{\omega_n^2}$$