Ex 9.3

$T_0 = 2\pi$, $\omega = \frac{2\pi}{2\pi} = 1$

Find $f(t)$

$(0,0)$, $(2\pi, 1)$

$x - x_1 \frac{(y_2 - y_1)}{(x_2 - x_1)} = y - y_1$

$y - 0 = (x - 0)\left(\frac{1-0}{2\pi - 0}\right)$

$y = x/2\pi$

Replace $y = f(t)$ & $x = (t)$

Then $f(t) = \frac{t}{2\pi}$

$D = \frac{1}{T_0}\int_0^{2\pi} f(t)\, dt$

$= \frac{1}{2\pi}\int_0^{2\pi} \frac{1}{2\pi}\, dt$

$= \frac{1}{4\pi^2}\int_0^{2\pi} t\, dt = \frac{1}{4\pi^2}\left[\frac{t^2}{2}\right]_0^{2\pi}$

$= \frac{1}{4\pi^2}\left[\frac{4\pi^2}{2}\right] = 1/2$

$\boxed{D = 1/2}$

$$D_n = \frac{1}{T_0}\int_{T_0} x(t)\, e^{-j\omega_0 n t}\, dt$$

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

$$= \frac{1}{4\pi^2}\int_0^{2\pi} t\, e^{-jnt}\, dt$$

$$\int t e^{-at}\, dt = -\frac{(1+a)e^{-at}}{a^2}$$

$$a = jn$$

$n\, 5\pi\, t$

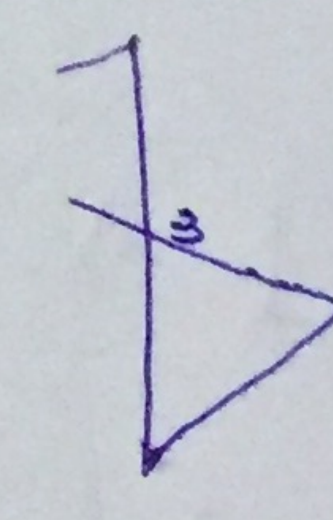
$$D_n = \frac{1}{4\pi^2}\left[-\frac{(1+jnt)e^{-jnt}}{(jn)^2}\right]_0^{2\pi}$$

$\leq 1/2$

$$= \frac{1}{4\pi^2}\left[-\frac{(1+jnt)e^{-jnt}}{n^2}\right]_0^{2\pi}$$

$< t \leq 3/2$

$$\boxed{D_n = \frac{1}{4\pi^2 n^2}(1+j2\pi n)e^{-j2\pi n}}$$



Then Fourier Series

$$f(t) = D_0 + \sum_{n=1}^{\infty} D_n e^{jn\omega_0 t} + D e^{-j\omega_0 t}$$

$$f(t) = \frac{1}{2} + \sum_{n=1}^{\infty} \frac{(1+j2\pi n)e^{-j2\pi n}}{4\pi^2 n^2} + \frac{(1-j2\pi n)e^{-j2\pi n}}{4\pi^2 n^2}\, t$$