4.b

(1) e^{j100t}

$$e^{j100t} = \cos 100t + j\sin 100t$$

$$\therefore \Omega = 100 \text{ rad/s} \qquad T = \frac{2\pi}{\Omega} = \frac{\pi}{50} \text{ s}$$

(3) $\cos 2t + \sin 4t$

$$\therefore T_1 = \frac{2\pi}{2} = \pi \text{ (s)} \qquad T_2 = \frac{2\pi}{4} = \frac{\pi}{2} \text{ (s)}$$

$$\therefore T = \pi \text{ (s)} \quad \therefore \Omega = \frac{2\pi}{T} = 2 \text{ rad/s}$$

4.7 (a)

$$F_n = \frac{1}{T} \int_{-\frac{T}{2}}^{\frac{T}{2}} f(t) e^{-jn\Omega t} dt \qquad T = 4 \quad \Omega = \frac{2\pi}{T} = \frac{\pi}{2}$$

$$\therefore F_n = \frac{1}{4} \int_{-3}^{1} f(t) e^{-\frac{jn\pi t}{2}} dt \qquad \frac{e^{-\frac{jn\pi t}{2}}}{-2jn\pi} = \boxed{\left. \frac{e^{-\frac{jn\pi t}{2}}}{2n\pi} \right|_{-1}^{1}}$$

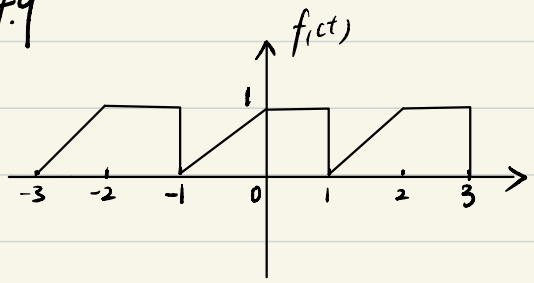$$= \frac{1}{4} \int_{-1}^{1} e^{-\frac{jn\pi t}{2}} dt$$

$$= \frac{1}{4} \left(\frac{e^{-\frac{jn\pi t}{2}}}{-\frac{jn\pi}{2}} \right) \Big|_{-1}^{1}$$

$$= \frac{j}{2n\pi} \left(e^{-\frac{jn\pi}{2}} - e^{\frac{jn\pi}{2}} \right)$$

$$= j \frac{\cos(-\frac{n\pi}{2}) + j\sin(-\frac{n\pi}{2}) - \cos(\frac{n\pi}{2}) - j\sin(\frac{n\pi}{2})}{2n\pi} = \frac{\sin(\frac{n\pi}{2})}{n\pi}$$

4.9

奇分量 $f_{od}(t) = \dfrac{f(t) - f(-t)}{2}$

偶分量 $f_{ev}(t) = \dfrac{f(t) + f(-t)}{2}$