(11) $x(t) = t \quad -\pi < t < \pi \quad , \quad 2\pi$

$x(t) = \frac{a_0}{2} + \sum_{n=1}^{\infty} \left(a_n \cos(nt) + b_n \sin(nt) \right)$

$b_n = \frac{1}{\pi} \int_{-\pi}^{\pi} t \sin(nt)\,dt = \frac{2}{\pi} \int_0^{\pi} t \sin(nt)\,dt$

$u = t \Rightarrow du = dt$

$dv = \sin(nt)\,dt \Rightarrow v = \int \sin(nt)\,dt = -\frac{\cos(nt)}{n}$

$\int t \sin(nt)\,dt = -\frac{t\cos(nt)}{n} + \frac{1}{n} \int \cos(nt)\,dt = \frac{\sin(nt)}{n}$

$= -\frac{t\cos(nt)}{n} + \frac{\sin(nt)}{n^2}$

$\int_0^{\pi} t \sin(nt)\,dt = \left[-\frac{t\cos(nt)}{n} + \frac{\sin(nt)}{n^2} \right]_0^{\pi}$

$(=\pi) \quad -\frac{\pi\cos(n\pi)}{n} + \frac{\sin(n\pi)}{n^2} \quad (0) \quad (-1)^n$

$-\frac{\pi(-1)^n}{n}$

$b_n = \frac{2}{\pi} \int_0^{\pi} t \sin(nt)\,dt = \frac{2}{\pi} \left(-\frac{\pi(-1)^n}{n} \right)$

$= \frac{2(-1)^{n+1}}{n}$

$x(t) = \sum_{n=1}^{\infty} \frac{2(-1)^{n+1}}{n} \sin(nt)$

(11) $x(t) = e^{-\alpha|t|}$

$\Rightarrow y'(t) = \frac{d}{dt} x(t) \quad / \quad \frac{d}{dt} x(t) \Leftrightarrow jw X(w)$

$Y(w) = jw\, X(w) = jw \frac{2\alpha}{\alpha^2 + w^2}$

(11) $X(w) = \int_{-\infty}^{\infty} x(t) e^{-jwt}\,dt = \int_{-\infty}^{0} t\,dt + \int_0^{\infty} -t$

$|t|$

$\frac{1}{\alpha - jw} + \frac{1}{\alpha + jw} = \frac{2\alpha}{\alpha^2 + w^2}$