

Find the Fourier transform of the function  $f(x) = \begin{cases} x, & \text{if } 0 < x < a \\ 0, & \text{otherwise} \end{cases}$ . [105 彰師光電 3]

$$\begin{aligned} [\text{解}] \int_{-\infty}^{\infty} f(x)e^{-i\omega x} dx &= \int_0^a xe^{-i\omega x} dx = -\frac{1}{i\omega} [xe^{-i\omega x} \Big|_0^a - \int_0^a e^{-i\omega x} dx] = -\frac{1}{i\omega} \left[ ae^{-i\omega a} + \frac{e^{-i\omega x}}{i\omega} \Big|_0^a \right] \\ &= -\frac{1}{i\omega} \left[ ae^{-i\omega a} + \frac{e^{-i\omega a} - 1}{i\omega} \right] = \frac{i\omega ae^{-i\omega a} + e^{-i\omega a} - 1}{\omega^2} \end{aligned}$$



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