

$$e^{-(a+j\omega)t} dt.$$

No.

Date

$$1. f(t) = e^{-at}.$$

$$\therefore \mathcal{F}[e^{j\omega_0 t}] = 2\pi \delta(\omega - \omega_0).$$

$$\therefore \mathcal{F}[e^{-at}] = \mathcal{F}[e^{-(a-j\omega)t}] = 2\pi \delta(\omega - ja).$$

$$f(t) \Leftrightarrow F(\omega). \quad \mathcal{F}[e^{-at}] = \int_0^{\infty} e^{-at} e^{-j\omega t} dt.$$

$$= -\frac{1}{a+j\omega} e^{-(a+j\omega)t} \Big|_0^{\infty}$$

$$= -\frac{1}{a+j\omega} [0 - 1] = \frac{1}{a+j\omega}.$$

$$2. f(t) = \begin{cases} t, & 0 \leq t < T \\ T, & T \leq t < 2T \\ 0, & \text{else.} \end{cases} \quad f(t) \text{ graph}$$

$$f(t) \Leftrightarrow F(\omega).$$

$$\mathcal{F}[f(t)] = \int_{-\infty}^{\infty} f(t) e^{-j\omega t} dt = \int_0^T t e^{-j\omega t} dt + T \int_T^{2T} e^{-j\omega t} dt.$$

$$= \int_0^T t e^{-j\omega t} dt + T \int_T^{2T} e^{-j\omega t} dt.$$

$$= e^{-j\omega t} \left(\frac{t}{-j\omega} + \frac{j}{\omega^2} \right) \Big|_0^T - \frac{T}{j\omega} e^{-j\omega t} \Big|_T^{2T}$$

$$= \frac{1}{\omega^2} [j\omega T e^{-j\omega T} + e^{-j\omega T} - 1].$$

$$3. a. f(t) = e^{-\frac{t^2}{20}}.$$

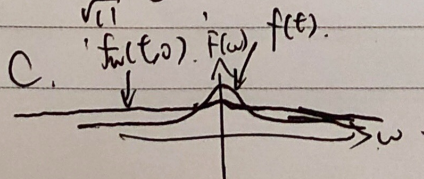
$$f(t) \Leftrightarrow F(\omega).$$

$$\mathcal{F}[f(t)] = \int_{-\infty}^{\infty} e^{-\frac{t^2}{20}} e^{-j\omega t} dt$$

$$= \int_{-\infty}^{\infty} e^{-\frac{1}{20} (t + j\omega)^2 - \frac{\omega^2}{20}} dt = \sqrt{20} e^{-\frac{\omega^2}{20}} \int_{-\infty}^{\infty} e^{-\frac{1}{20} (x + \frac{j\omega}{11})^2 - \frac{\omega^2}{11}} dx.$$

$$b. f(t) = e^{-\frac{1}{20} t^2}. \quad f_{\omega}(t, \omega) = e^{-\frac{1}{20} t^2} e^{-\frac{j\omega t}{11}} = e^{-\frac{1}{20} (x + \frac{j\omega}{11})^2 - \frac{\omega^2}{11}}.$$

$$\mathcal{F}[e^{-\frac{1}{20} t^2}] = \int_{-\infty}^{\infty} e^{-\frac{1}{20} (x + \frac{j\omega}{11})^2 - \frac{\omega^2}{11}} dx = \frac{\sqrt{20}}{\sqrt{11}} e^{-\frac{\omega^2}{11}}.$$



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