

[Chapter 12] 연습문제 정답

12.1

[풀이]

$$\therefore f(x) = 4 \int_0^{\infty} \frac{\sin \omega \cos \omega x}{\omega} d\omega$$

12.2

[풀이]

$$\therefore f(x) = \frac{2}{\pi} \int_0^{\infty} \left[\frac{\sin \omega a}{\omega^2} - \frac{a \cos \omega a}{\omega} \right] \sin \omega x d\omega$$

12.3

[풀이]

$$\therefore f(x) = \frac{1}{\pi} \int_0^{\infty} \left\{ \left(\frac{1 - \cos \omega k}{\omega^2} \right) \cos \omega x - \frac{1}{\omega} \left(k - \frac{\sin \omega k}{\omega} \right) \sin \omega x \right\} d\omega$$

12.4

[풀이]

증명생략

12.5

[풀이]

$$\therefore f(x) = \frac{2}{\pi} \int_0^{\infty} \frac{1 - \cos \omega}{\omega^2} \cos \omega x d\omega \quad (\text{푸리에 코사인 적분})$$

$$f(x) = \frac{2}{\pi} \int_0^{\infty} \frac{w - \sin w}{\omega^2} \sin \omega x d\omega \quad (\text{푸리에 사인 적분})$$

12.6

[풀이]

푸리에 코사인 적분

$$\therefore f(x) = \int_0^{\infty} \frac{4(2w^2 \sin 2w + 2w \cos 2w - \sin 2w)}{\omega^3} \cos \omega x d\omega$$

푸리에 사인 적분

$$\therefore f(x) = \int_0^{\infty} \frac{4(-2w^2 \cos 2w + 2w \sin 2w + \cos 2w - 1)}{\omega^3} \sin \omega x d\omega$$

12.7

[풀이]

푸리에 코사인 적분

$$\therefore f(x) = \int_0^{\infty} \frac{2ae^a}{\pi(a^2 + w^2)} \cos wx d\omega$$

푸리에 사인 적분

$$\therefore f(x) = \int_0^{\infty} \frac{2we^a}{\pi(a^2 + w^2)} \sin wx d\omega$$

12.8

[풀이]

푸리에 코사인 적분

$$\therefore f(x) = \int_0^{\infty} \frac{2\{e(w \sin w + \cos w) - 1\}}{\pi(w^2 + 1)} \cos wx d\omega$$

푸리에 사인 적분

$$\therefore f(x) = \int_0^{\infty} \frac{2\{w - e(w \cos w - \sin w)\}}{\pi(w^2 + 1)} \sin wx d\omega$$

12.9

[풀이]

$$\therefore f(x) = \int_0^{\infty} \frac{2w \sin w \pi}{\pi(1 - w^2)} \cos wx d\omega$$

12.10

[풀이]

$$\therefore f(x) = \frac{1}{\pi\omega} \int_0^{\infty} \{\sin(1 + \omega)\pi - \sin(1 - \omega)\pi\} \sin wx d\omega$$

12.11

[풀이]

$$\therefore f(x) = \int_{-\infty}^{\infty} \frac{a\{e^{-jwk}(1 + jwk) - 1\}}{2\pi w^2} e^{jwx} dw$$

12.12

[풀이]

$$\therefore F(\omega) = \frac{\sin(\omega - 1)}{\pi(\omega - 1)}$$

12.13

[풀이]

$$F(\omega) = \frac{2i(w \cos w - \sin w)}{w^2}$$

12.14

[풀이]

$$\therefore F(\omega) = \frac{1 + i\omega e^{1+i\omega}}{(i - \omega)^2}$$

12.15

[풀이]

$$\therefore F(\omega) = \frac{ai}{\omega} (e^{i2\omega} + e^{i2\omega} - 2) \quad \text{or} \quad \frac{2ai}{\omega} (\cos 2\omega - 1)$$

12.16

[풀이]

$$\therefore F(\omega) = -i \sqrt{\frac{\pi}{k}} e^{\frac{w^2}{4k}}$$