

3,2)

$$x[n] = 1 \cdot e^{\frac{j\omega_0 n}{N}} + e^{\frac{j\pi}{4}} e^{j2\omega_0 n} + e^{j\frac{\pi}{4}} e^{-j2\omega_0 n} + 2e^{j\frac{\pi}{3}} e^{j4\omega_0 n} + 2e^{-j\frac{\pi}{3}} e^{-j4\omega_0 n}$$

$$x[n] = 1 + \left[e^{j(2\omega_0 n + \frac{\pi}{4})} + e^{j(2\omega_0 n + \frac{\pi}{4})} \right] \frac{1}{2} + 2 \left[e^{j(4\omega_0 n + \frac{\pi}{3})} + e^{-j(4\omega_0 n + \frac{\pi}{3})} \right] \frac{1}{2}$$

$$x[n] = 1 + 2 \cos \left(2\omega_0 n + \frac{\pi}{4} \right) + 4 \cos \left(4\omega_0 n + \frac{\pi}{3} \right)$$

$$\text{Si } \omega_0(\alpha) = \sin \left(\alpha + \frac{\pi}{2} \right)$$

$$x[n] = 1 + 2 \sin \left(2\omega_0 n + \frac{3}{4}\pi \right) + 4 \sin \left(4\omega_0 n + \frac{5}{6}\pi \right)$$

$$\text{Si } \omega_0 = \frac{2\pi}{N} = \frac{2\pi}{5}$$

$$x[n] = 1 + 2 \sin \left(\frac{4\pi}{5} n + \frac{3}{4}\pi \right) + 4 \sin \left(\frac{8\pi}{5} n + \frac{5}{6}\pi \right)$$

3.21)

$$x(t) = \left(j e^{j \frac{2\pi}{8} t} - j e^{-j \frac{2\pi}{8} t} \right) \frac{1}{2j} + \left(2 e^{j \frac{\pi}{4} t} + 2 e^{-j \frac{\pi}{4} t} \right) \frac{1}{2}$$

$$x(t) = -2 \sin\left(\frac{\pi}{4}t\right) + 4 \cos\left(\frac{5\pi}{4}t\right)$$

$$\sin(\alpha) = \cos\left(\alpha - \frac{\pi}{2}\right)$$

$$x(t) = -2 \cos\left(\frac{\pi}{4}t - \frac{\pi}{2}\right) + 4 \cos\left(\frac{5\pi}{4}t\right)$$

3.44)

1) $x(t) \in \mathbb{R}^q$

2) $T = 6$

3) $\left\{ \forall k, k \in \{0\} \cup \{2, \infty\} \subset \mathbb{N} / a_k = 0 \right\}$

4) $x(t) = -x(t-3)$

5) $\frac{1}{6} \int_{-3}^3 |x(t)|^2 dt = \frac{1}{2}$

6) $a_1 \in \mathbb{R}^+$

7) Si ① \wedge ⑥ $\rightarrow a_{-1} = a_1^* = a_1$

8) Si ② $\rightarrow \omega_0 = \pi/3$

9) $a_2 = \alpha + \beta i \rightarrow a_2^* = \alpha - \beta i$

10) Si ③ \wedge ⑦ \wedge ⑧ \wedge ⑨ \rightarrow

$$x(t) = a_1 \left(e^{j\frac{\pi}{3}t} + e^{-j\frac{\pi}{3}t} \right) + a_2 e^{j\frac{2\pi}{3}t} + a_2^* e^{-j\frac{2\pi}{3}t}$$

$$x(t) = 2a_1 \cos\left(\frac{\pi}{3}t\right) + 2\alpha \cos\left(\frac{2\pi}{3}t + \beta\right)$$

11) Si $\Theta \wedge (10)$

$$2a_1 \cos\left(\frac{n}{3}t\right) + 2\alpha \cos\left(\frac{2n}{3}t + \beta\right) = -2a_1 \cos\left(\frac{n}{3}t - n\right) - 2\alpha \cos\left(\frac{2n}{3}t - 2n + \beta\right)$$

$$2a_1 \cos\left(\frac{n}{3}t\right) + 2\alpha \cos\left(\frac{2n}{3}t + \beta\right) = 2a_1 \cos\left(\frac{n}{3}t\right) - 2\alpha \cos\left(\frac{2n}{3}t + \beta\right)$$

$$\alpha = 0$$

12) (5) \wedge Relación de Parseval

$$\sum_{k=-3}^3 |a_k|^2 = \frac{1}{2}$$

13) (12) \wedge (3) \wedge (11) \wedge (7) \wedge (6)

$$(a_{-1})^2 + (a_1)^2 = \frac{1}{2}$$

$$2a_1^2 = \frac{1}{2}$$

$$a_1 = \frac{1}{2}$$

$$x(t) = \cos\left(\frac{n}{3}t\right) \rightarrow \begin{cases} A = 1 \\ B = \frac{n}{3} \\ C = 0 \end{cases}$$



4.5)

$$x(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} X(j\omega) e^{j\omega t} d\omega$$

$$X(j\omega) = ||X(j\omega)|| e^{j\arg X(j\omega)}$$

$$X(j\omega) = 2[u(\omega+3) - u(\omega-3)] e^{-j\frac{3}{2}\omega} e^{j\pi}$$

$$X(j\omega) = \begin{cases} -2e^{-j\frac{3}{2}\omega}, & -3 < \omega < 3 \\ 0, & \text{o.c.} \end{cases}$$

$$x(t) = \frac{1}{2\pi} \int_{-3}^3 e^{j(-\frac{3}{2} + t)\omega} d\omega$$

$$x(t) = \frac{-1}{j\left(-\frac{3}{2} + t\right)} e^{j\left(-\frac{3}{2} + t\right)\omega} \Big|_{-3}^3$$

$$x(t) = \frac{-2}{\pi\left(\frac{3}{2} + t\right)} \sin\left[3\left(t - \frac{3}{2}\right)\right]$$

q.10)

a) $\mathcal{F}\left\{t \left(\frac{\sin t}{nt}\right)^2\right\} =$

$$j \frac{d}{dw} \left[\mathcal{F}\left\{\left(\frac{\sin t}{nt}\right)^2\right\} \right]$$

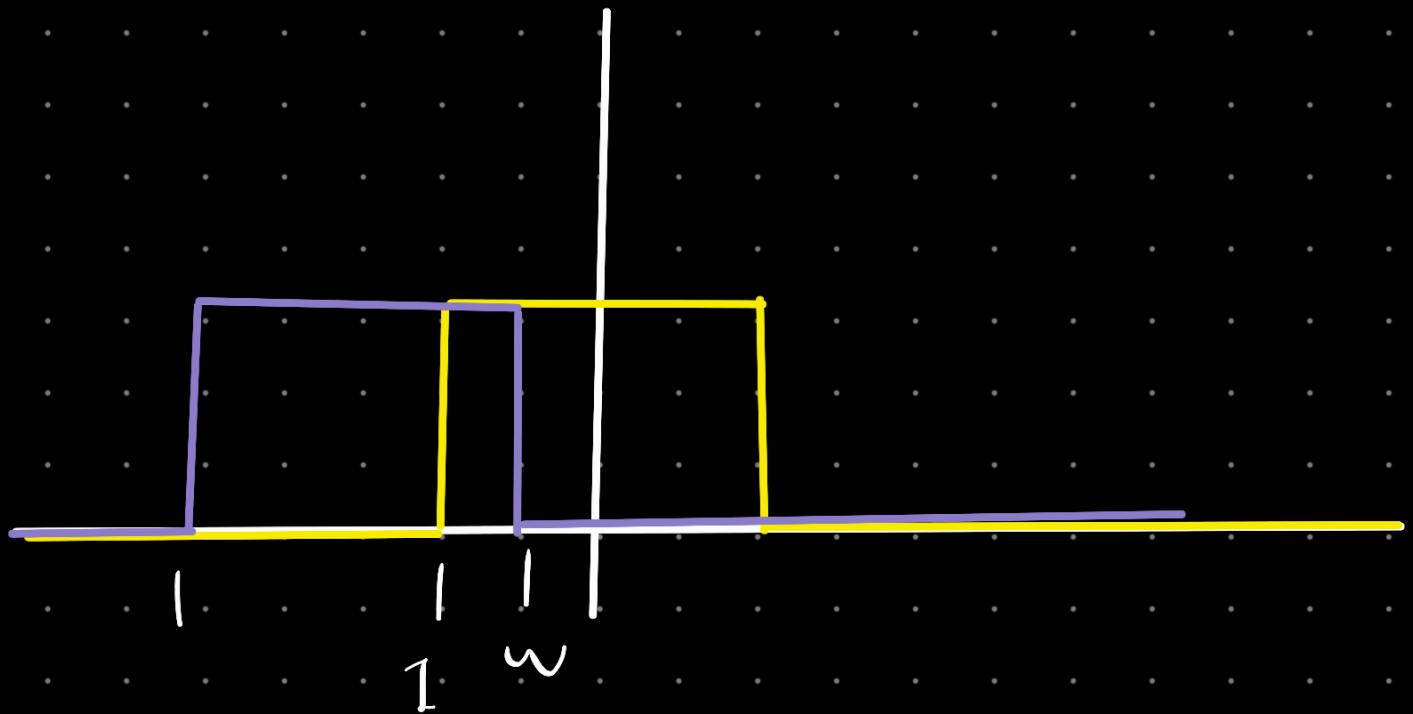
$$\mathcal{F}\left\{\left(\frac{\sin t}{nt}\right) \left(\frac{\sin t}{nt}\right)\right\} =$$

$$\frac{1}{2\pi} F(\omega t) * F(\omega t)$$

$$F(\omega t) = \begin{cases} 1, & -1 < \omega t < 1 \\ 0, & \text{o.c.} \end{cases}$$

$-L \leq x \leq L \quad \wedge \quad \omega t + 1 \leq x \leq \omega t - 1$

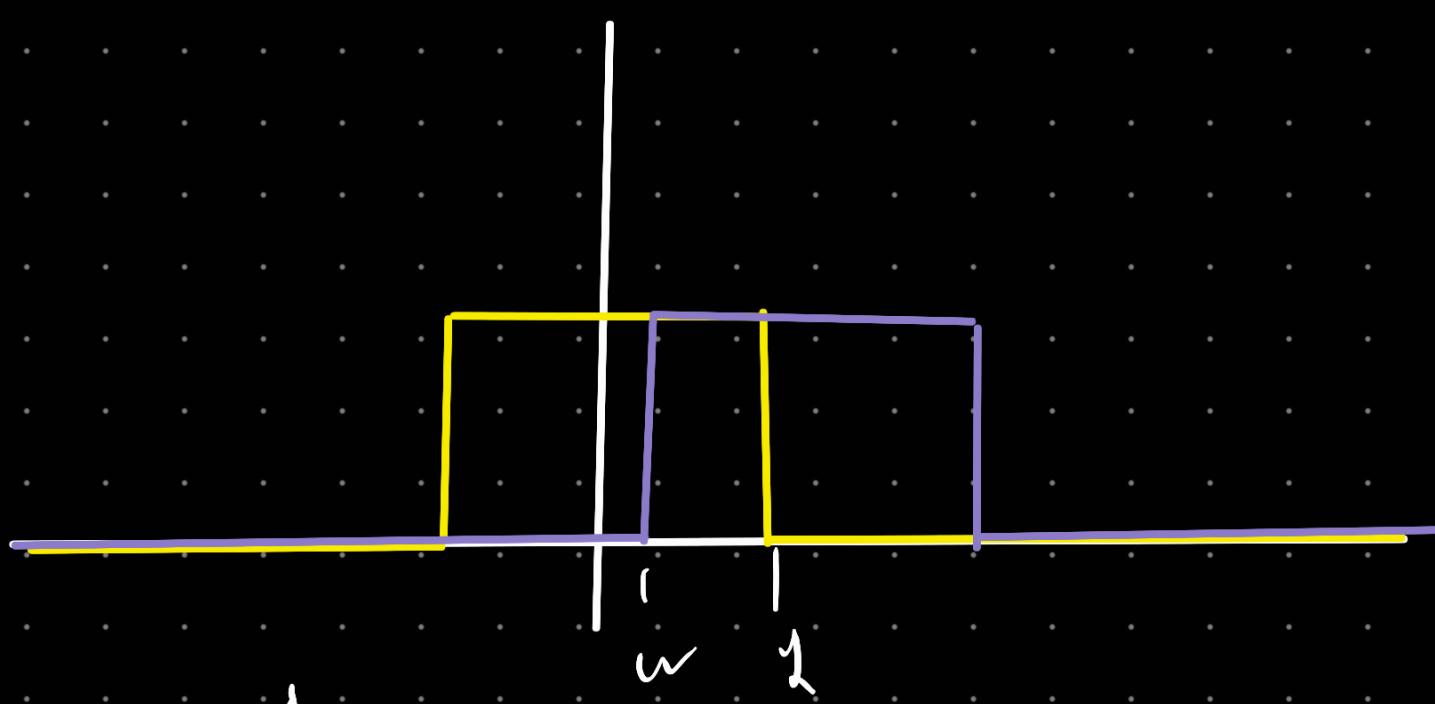
$$F * F = \int_{-\infty}^{\infty} [u(x+1) - u(x-1)] [u(\omega t - x + 1) - u(\omega t - x - 1)] dx$$



Para $-2 < \omega < 0$

$$F * F = \int_{-1}^{\omega} dx = \omega + 1$$

Para $0 < \omega < 2$



$$F * F = \int_w^1 dx = -\omega + 1$$

Para $\omega < 0$

$$F * F = 0$$

$$F * F = \begin{cases} w+1 & -2 < w < 0 \\ -w+1 & 0 < w < 2 \\ 0 & \text{O.C.} \end{cases}$$

$$\frac{\partial}{\partial w} F * F = \begin{cases} 1 & -2 < w < 0 \\ -1 & 0 < w < 2 \\ 0 & \text{O.C.} \end{cases}$$

s

0 0

$$\mathcal{F}\left\{t \left(\frac{\sin t}{nt}\right)^2\right\} = \begin{cases} j/2n & -2 < w < 0 \\ -j/2n & 0 < w < 2 \\ 0 & \text{O.C.} \end{cases}$$

b)

$$A = \int_{-\infty}^{\infty} \left[t \left(\frac{\sin t}{\pi t} \right)^2 \right] dt = \frac{1}{2\pi} \left[\int_{-2}^{0} \left(\frac{j}{2\pi} \right)^2 dw + \int_0^2 \left(\frac{-j}{2\pi} \right)^2 dw \right]$$

$$A = -\frac{1}{2\pi^3}$$

Q. 15)

1) $x(t)$ es par

2) $x(t) = 0$ para $t \leq 0$

3) $\frac{1}{2\pi} \int_{-\infty}^{\infty} \operatorname{Re} \{X(j\omega)\} e^{j\omega t} d\omega = |t| e^{-|t|}$

4) ① $\rightarrow \Im \{x_{pw}(t)\} = \operatorname{Re} \{X(wj)\}$

5) $x_{pw}(t) \equiv \frac{1}{2} [x(t) + x(-t)]$

6) ③ \wedge ⑤ $\rightarrow \frac{1}{2} [x(t) + x(-t)] = |t| e^{-|t|}$

7) ② \wedge ⑥ $\rightarrow \frac{1}{2} x(t) = t e^{-t} \cdot \underset{0 < t}{\circ}$

• • $x(t) = t e^{-t} u(t)$

□