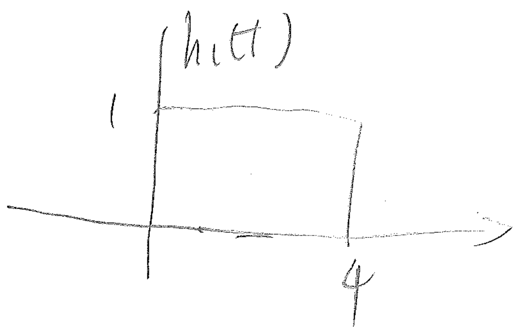
HW 3

#1 ① $h_1(t) = u(t) - u(t-4)$

ⓐ



ⓑ Causal, $h_1(t) = 0$ for $t < 0$

ⓒ $\int_{-\infty}^{\infty} |h(t)|\, dt < \infty$ stable.

② $x(t) = u(t) - u(t-2)$

$h(t) = u(t) - u(t-2)$

ⓐ stable $\int_{-\infty}^{\infty} |h(t)| < \infty$

ⓑ $y(t) = x(t) * h(t)$

when $t < 0$ $y(t) = 0$

when $t \in (0, 2)$ $\int_0^t d\tau = t$

when $t \in (2, 4)$ $\int_{2+t}^{2} d\tau = 4 - t$

when $t > 4$ $y(t) = 0$

ⓒ $\boxed{\text{LTI} \quad \text{Yes,}}$ prove linear and TI separate, refer HW2

#4 ① ⓐ $x(t) = \frac{1}{2}\left(e^{3\pi t j} + e^{-3\pi j t}\right)$

$a_1 = a_{-1} = 1/2$

ⓑ $y(t) = \sin(3\pi t)$

$= \dfrac{e^{+3\pi j t} - e^{-3\pi j t}}{2j}$ $a_1 = \frac{1}{2j}$ $a_{-1} = -\frac{1}{2j}$

ⓒ $z(t) = x(t)y(t)$

$= \sin(3\pi t)\cos(3\pi t) = \frac{1}{2}\sin(6\pi t)$

$\Rightarrow \frac{1}{2j}\left(\dfrac{-e^{-6\pi t j} + e^{6\pi t j}}{2}\right)$

$\frac{1}{4j} = a_2 = -a_{-2}$

② ⓐ By using same way as above

ⓐ $a_1 = a_{-1} = 1/2$

ⓑ $\cos^2(4\pi t) = y(t)$

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

$a_0 = 1/2$ $a_2 = a_{-2} = \frac{1}{4}$