Exercise 4.107

Answer (f).

We are given a LTI system with impulse response

$$h(t) = \cos(t)\delta(t+\tfrac{\pi}{2}) + 5\delta(t).$$

Simplifying the preceding equation, we have

$$\begin{aligned} h(t) &= \cos(t)\delta(t-[-\tfrac{\pi}{2}]) + 5\delta(t) \\ &= \cos(-\tfrac{\pi}{2})\delta(t-[-\tfrac{\pi}{2}]) + 5\delta(t) \\ &= 5\delta(t). \end{aligned}$$

show as explicity shift

equivalence property of δ

drop zero term

Clearly, $h(t)$ is only nonzero at $t = 0$. Since $h(t) = 0$ for all $t \neq 0$, the system is memoryless. Since $h(t) = 0$ for all $t < 0$, the system is causal.

