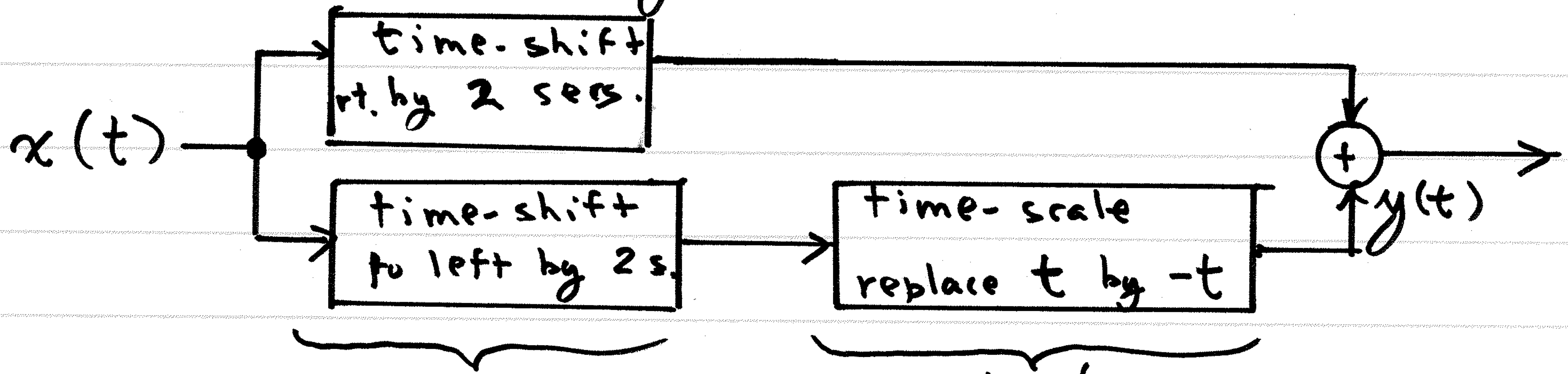
Prob. 1.27 (a) $y(t) = x(t-2) + x(2-t)$



LTI

example of
$y(t) = x(at)$
where $a = -1$
L not TI
also: noncausal

overall system:
- not LTI

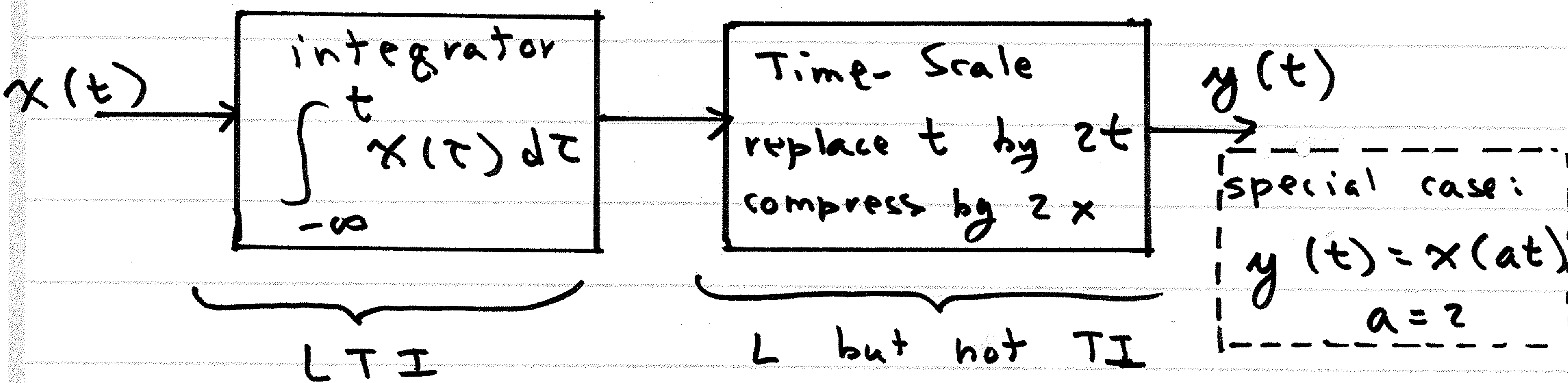
- overall system is linear but not TI

- stable, noncausal, not memoryless

1.27 (b) $y(t) = \cos(3t)\, x(t)$

- special case of $y(t) = g(t)\, x(t)$
- previously proved linear but not TI
- memoryless
- stable
- causal

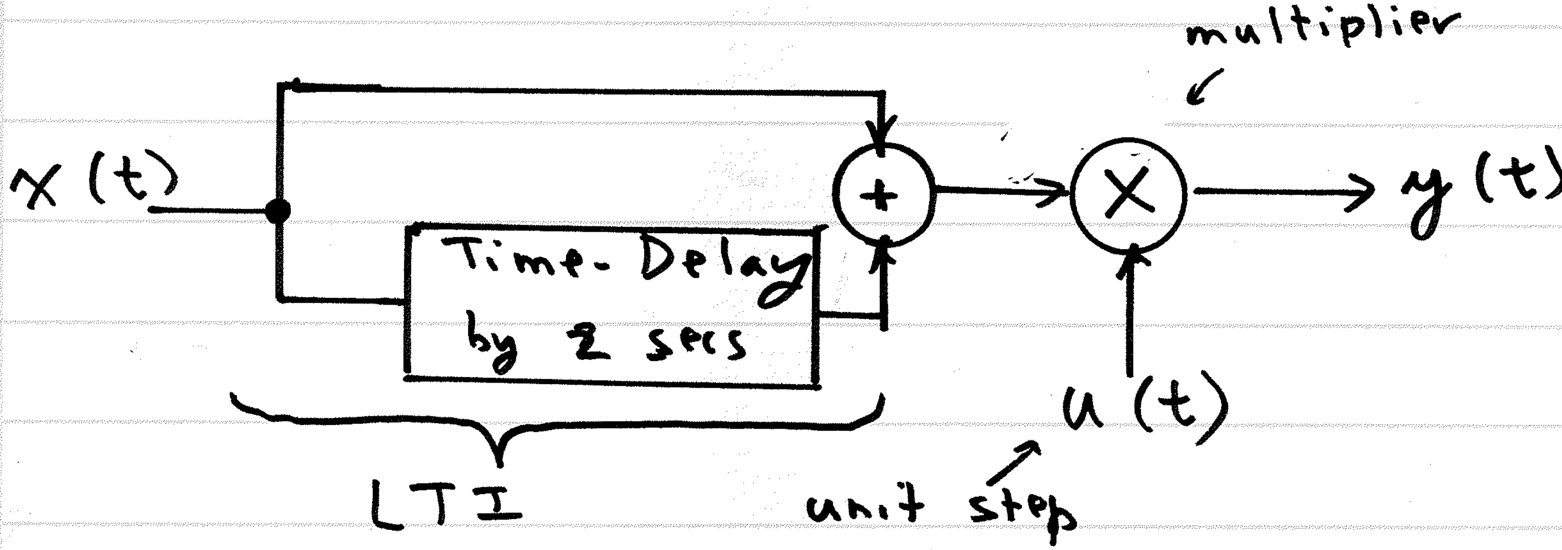
1.27 (c) $\quad y(t) = \int_{-\infty}^{2t} x(\tau)\, d\tau$



overall system is linear but not TI

- not stable: input $x(t) = u(t)$ $\quad \lim_{t \to \infty} y(t) = \infty$
- not memoryless
- not causal

1.27 (d) $y(t) = \begin{cases} 0, & t < 0 \\ x(t) + x(t-2), & t \geq 0 \end{cases}$



- overall system is L but not TI
- stable
- causal
- <u>not</u> memoryless

$$\underbrace{\text{unit step}}_{\text{special case of}}$$

special case of

$y(t) = g(t)\,x(t)$

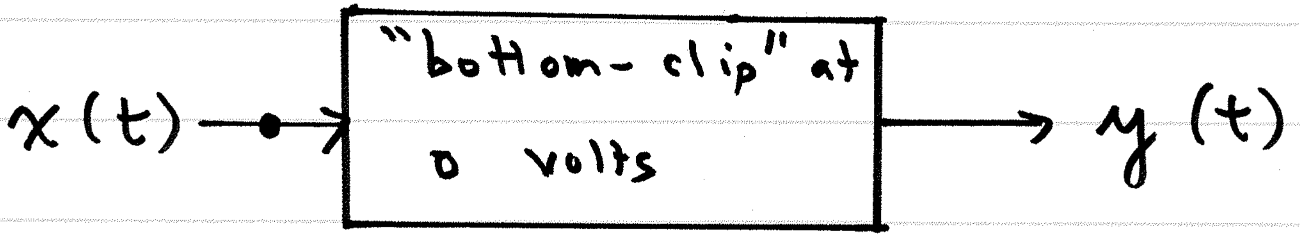
$\underbrace{g(t) = u(t)}_{\text{L but not TI}}$

1.27 (e)

modified

$$y(t) = \begin{cases} 0, & x(t) < 0 \\ x(t) + \cancel{x(t-2)}, & x(t) \geq 0 \end{cases}$$

ignore initially



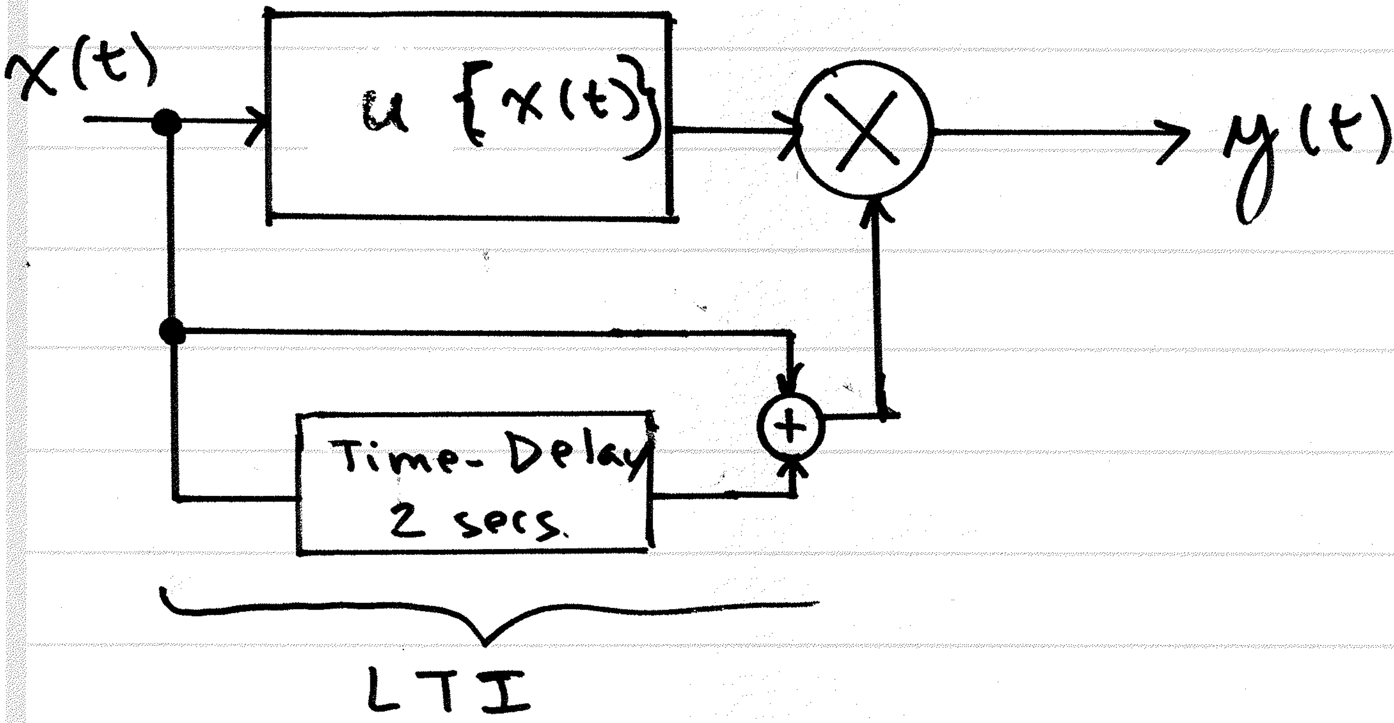
special case of

clipper ⇒ not linear but is TI

- memoryless
- causal
- stable

1.27 (e) actual $y(t)=\begin{cases}0, & x(t)<0\\ x(t)+x(t-2), & x(t)\geq 0\end{cases}$

not linear but is TI



• overall system is not LTI

1.27 (f) $y(t) = x\left(\frac{t}{3}\right)$

special case of time-scaling system

$y(t) = x(at)$ where $a = \frac{1}{3}$

- expansion by a factor of 3

- L but not TI

- stable

- not memoryless

- non causal:

e.g. $y(-1) = x\underbrace{\left(-\frac{1}{3}\right)}_{\text{future time}}$