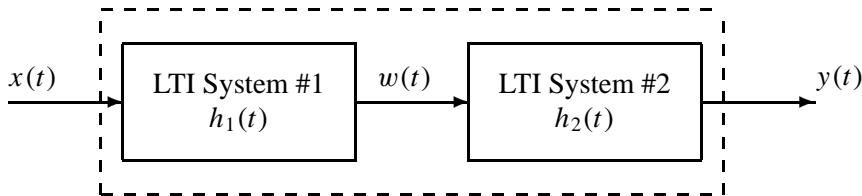


PROBLEM:



In the cascade of two LTI systems shown in the figure above, the first system has an impulse response

$$h_1(t) = \begin{cases} e^{-2t} & 0 \leq t < 1 \\ 0 & \text{otherwise,} \end{cases}$$

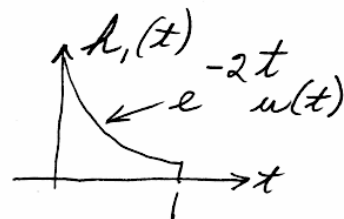
and the second system is a differentiator system described by the input/output relation

$$y(t) = \frac{dw(t)}{dt}$$

Find the impulse response of the overall system; i.e., find the output $y(t) = h(t)$ when the input is $x(t) = \delta(t)$. Give your answer both as an equation and as a carefully labeled sketch.



$$y(t) = x(t) * h_1(t) * h_2(t)$$



$$h_1(t) = e^{-2t} (u(t) - u(t-1))$$

$$\begin{aligned} y(t) &= \frac{d h_1(t)}{dt} = -2e^{-2t} (u(t) - u(t-1)) + e^{-2t} (\delta(t) - \delta(t-1)) \\ &= -2e^{-2t} [u(t) - u(t-1)] + \delta(t) - e^2 \delta(t-1) \end{aligned}$$

