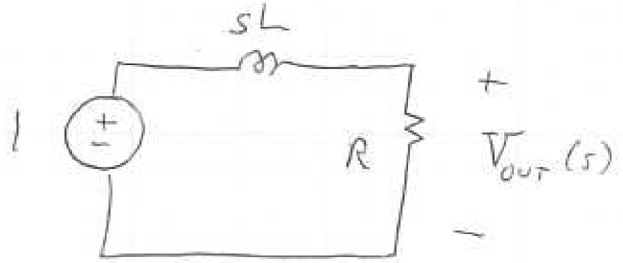
16.40a Place in frequency domain, set $V_s(s) = 1$ and solve for $V_{OUT}(s)$, Then inverse Laplace



Voltage Divider : $V_{OUT} = 1 \dfrac{R}{sL+R} = \dfrac{R/L}{s+R/L}$

Inverse Laplacing : $V_{OUT}(t) = \frac{R}{L} e^{-\frac{R}{L}t} = h(t)$

15.43b $x(t) = u(t) \qquad h(t) = 2e^{-t}u(t)$

$$y(t) = h(t) * x(t) = \int_0^t x(\lambda)\, h(t-\lambda)\, d\lambda$$

$$x(\lambda) = u(\lambda)$$

$$h(t-\lambda) = 2e^{-(t-\lambda)} u(t-\lambda)$$

so

$$y(t) = \int_0^t u(\lambda)\, 2e^{-(t-\lambda)} u(t-\lambda)\, d\lambda$$

but $\left.\begin{array}{lll} u(\lambda) = 1 & \text{for} & \lambda > 0 \\ u(t-\lambda) = 1 & \text{for} & \lambda < t \end{array}\right\}$ which is our limits

$$y(t) = \int_0^t 2e^{-t} e^{\lambda}\, d\lambda = 2e^{-t} e^{\lambda}\Big|_0^t = 2e^{-t}(e^t - 1)$$

so $\boxed{y(t) = 2(1 - e^{-t})}$

15.46d $y(t) = 4u(t)$ $\quad z(t) = e^{-2t}u(t)$

$$g(t) = \underset{\substack{\uparrow \\ \text{Treat like} \\ h(t)}}{4u(t)} * \underbrace{\left[4u(t) + e^{-2t}u(t)\right]}_{\substack{\text{Treat like} \\ x(t)}}$$

so

$$x(\lambda) = 4u(\lambda) + e^{-2\lambda}u(\lambda)$$

$$h(t-\lambda) = 4u(t-\lambda)$$

so

$$g(t) = \int_0^t x(\lambda)\,h(t-\lambda)\,d\lambda = \int_0^t \left[4u(\lambda) + e^{-2\lambda}u(\lambda)\right]4u(t-\lambda)\,d\lambda$$

but $u(\lambda) = 1$ for $\lambda > 0$ $\quad$ $u(t-\lambda) = 1$ for $\lambda < t$ $\Big\}$ This is our limits

so

$$g(t) = \int_0^t \left[4 + e^{-2\lambda}\right](4)\,d\lambda$$

$$g(t) = \left[16\lambda + \frac{4}{-2}e^{-2\lambda}\right]\Bigg|_0^t$$

$$g(t) = (16t - 0) - 2\left(e^{-2t} - e^0\right)$$

$$g(t) = 16t + 2 - 2e^{-2t}$$