

RW 8.17

$$y_{\text{step}}(t) = 1 - e^{-2t}$$

$$u(t) = 2\delta(t) + 5u_s(t) - v(t)$$

$\delta(t)$ delta func

$u_s(t)$ step

$v(t)$ ramp

$$u_s(t) \rightarrow y(t) = 1 - e^{-2t}$$

$$\begin{aligned} f(t) \rightarrow y(t) &= \frac{d}{dt} (1 - e^{-2t}) \\ &= 2e^{-2t} \end{aligned}$$

$$\delta(t) = \frac{d}{dt} u_s(t)$$

$$y_\delta(t) = \frac{d}{dt} y_{\text{step}}(t)$$

$$v(t) \rightarrow y(t) = \int_0^t (1 - e^{-2t}) dt$$

$$v(t) = \int_0^t u_s(t) dt$$

$$= t + \frac{e^{-2t}}{2} \Big|_0^t$$

$$y_v(t) = \int_0^t y_{\text{step}}(t) dt$$

$$= t + \frac{e^{-2t}}{2} - 0 - \frac{1}{2}$$

$$y(t) = 2(2e^{-2t}) + 5(1 - e^{-2t}) - \left(t + \frac{e^{-2t}}{2} - \frac{1}{2}\right)$$

$$= 4e^{-2t} + 5 - 5e^{-2t} - t - \frac{1}{2}e^{-2t} + \frac{1}{2}$$

$$= -1.5e^{-2t} + 5.5 - t$$