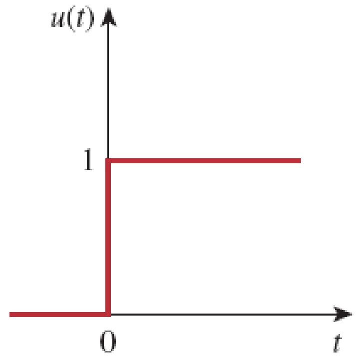
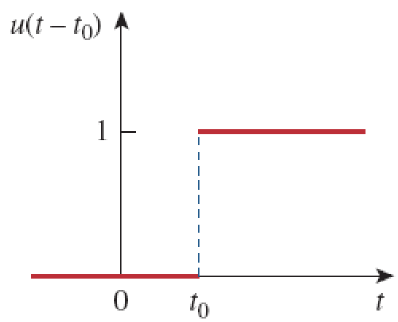
Señales singulares

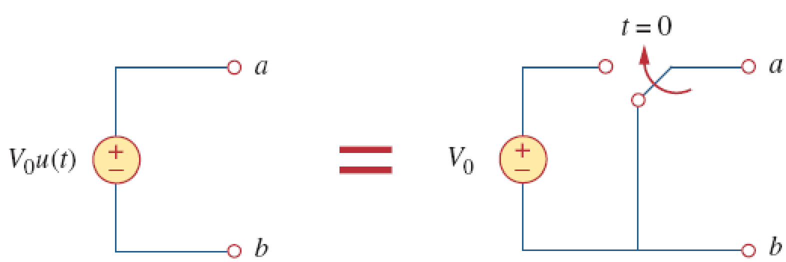
Función escalón:



$$u(t) = \begin{cases} 0, & t < 0 \\ 1, & t > 0 \end{cases}$$

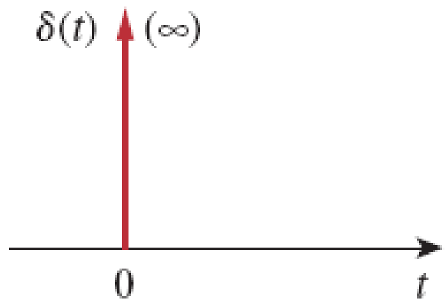


$$u(t - t_0) = \begin{cases} 0, & t < t_0 \\ 1, & t > t_0 \end{cases}$$



Señales singulares

Función impulso:



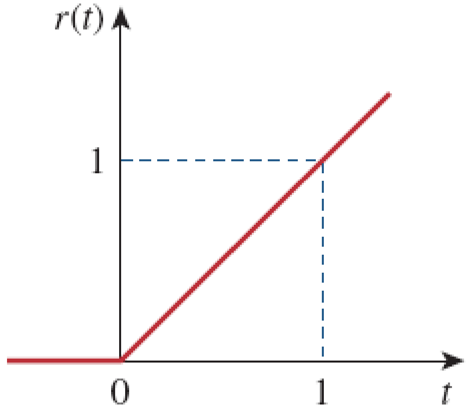
$$\delta(t) = \frac{d}{dt}u(t) = \begin{cases} 0, & t < 0 \\ \textbf{No definido} & t = 0 \\ 0, & t > 0 \end{cases}$$

$$\int_{0^-}^{0^+} \delta(t)\, dt = 1$$

$$\int_a^b f(t)\delta(t - t_0)\, dt = f(t_0)$$

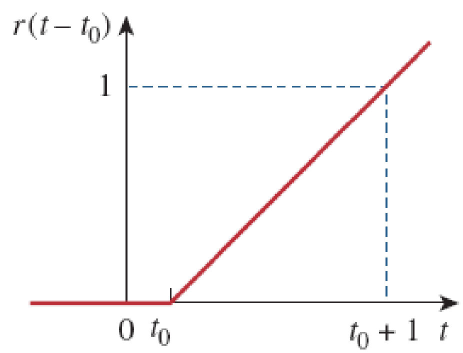
Señales singulares

Función rampa:



$$r(t) = \begin{cases} 0, & t \le 0 \\ t, & t \ge 0 \end{cases}$$

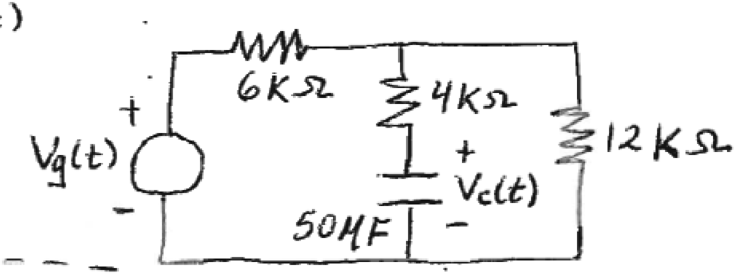
$$r(t) = \int_{-\infty}^{t} u(\lambda)d\lambda = tu(t)$$

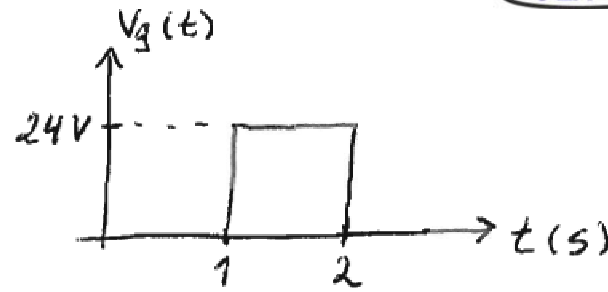


$$\delta(t) = \frac{du(t)}{dt}, \qquad u(t) = \frac{dr(t)}{dt}$$

Ejercicio con señales singulares y desplazamiento en tiempo

Hallar $V_c(t)$





$t < 1: \; V_c(t) = 0\,V$

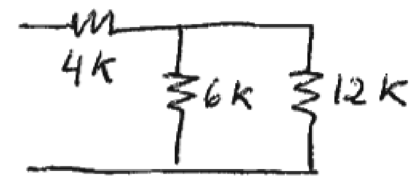
$1 \leq t \leq 2: \; V_c(t) = V_c(\infty) + \left(V_c(1^+) - V_c(\infty)\right) e^{-\frac{(t-1)}{\tau}}$

$V_c(1^+) = V_c(1^-) = 0\,V$

$V_c(\infty) = V_{TH} = 16\,V$

$V_c(t) = 16 - 16\, e^{-\left(\frac{t-1}{0{,}4}\right)}\,V$

$R_{TH}:$



$R_{TH}: \; \frac{6K\,12K}{18K} + 4K$

$R_{TH} = 4K + 4K = 8K\Omega$

$\tau = 8K\Omega \cdot 50\mu F = 400\,ms$

$t_s = 2\,s$

$t > 2:$

$V_c(t) = V_c(\infty) + (V_c(2^+) - V_c(\infty))\, e^{-\frac{(t-2)}{\tau}}$

$V_c(2^+) = V_c(2^-)$

$V_c(2^-) = 16 - 16\, e^{-\frac{(2-1)}{0{,}4}}\,V$

$V_c(2^-) = 14{,}68\,V$

$V_c(\infty) = 0\,V$

$V_c(t) = 14{,}68\, e^{-\frac{(t-2)}{0{,}4}}\,V$