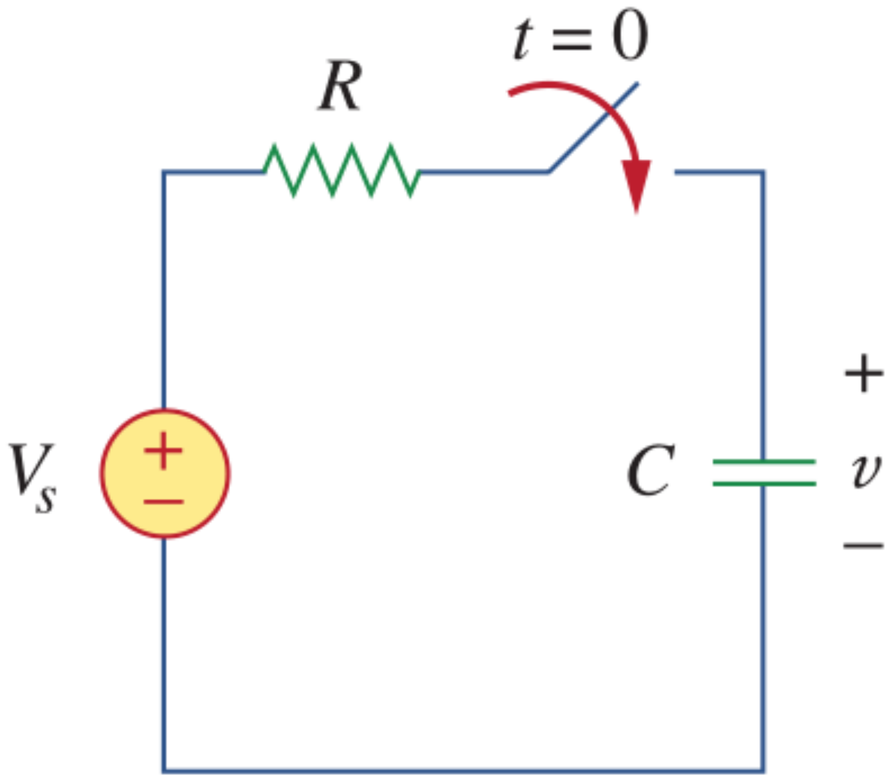
Step Response - RC Circuits

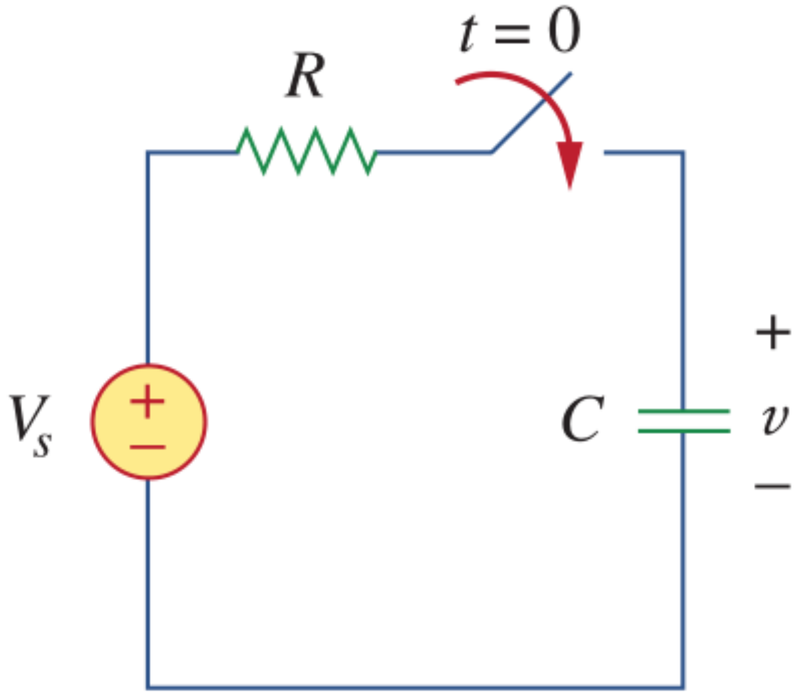
- Assume that at t=0, the capacitor voltage is equal to 0V

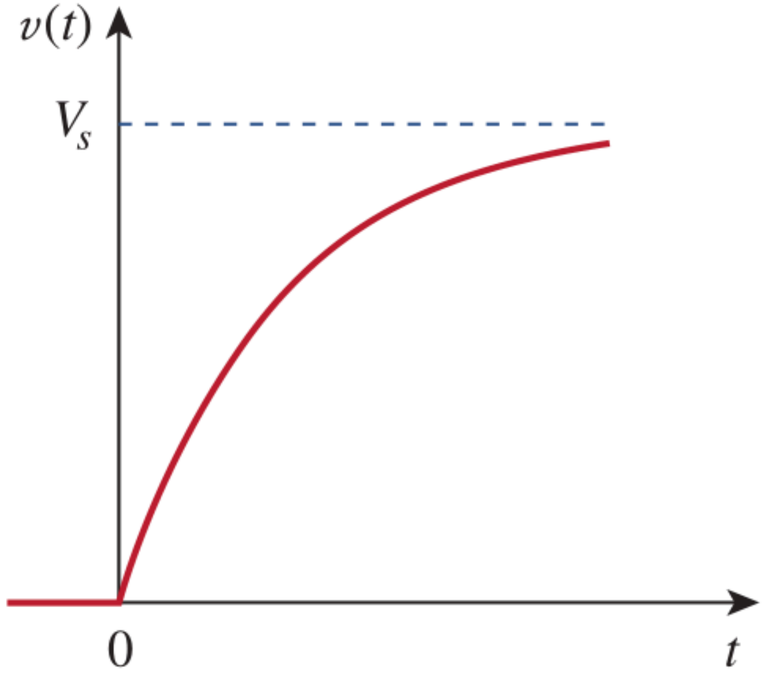


Step Response - RC Circuits

- Assume that at t=0, the capacitor voltage is equal to 0V

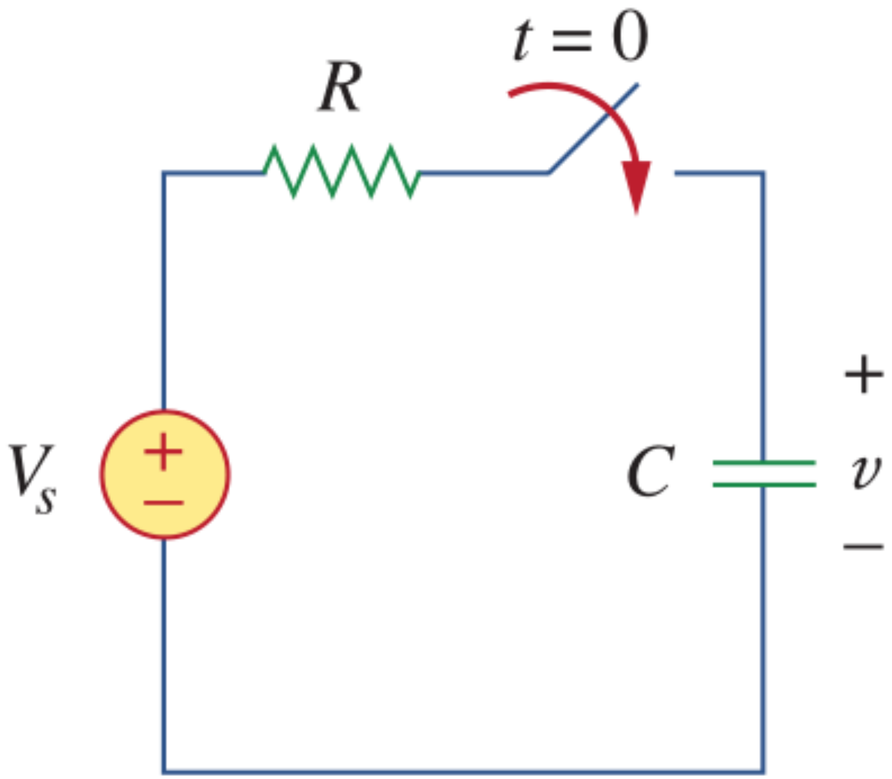
$$v(t) = V_s\left(1 - e^{\frac{-t}{RC}}\right) = V_\infty\left(1 - e^{\frac{-t}{\tau}}\right)$$





Step Response - RC Circuits

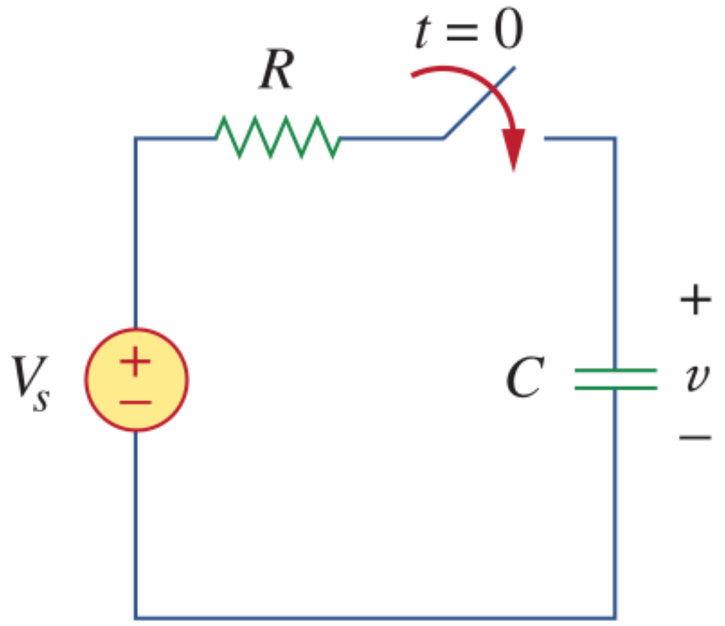
- Assume that at t=0, the capacitor voltage is equal to V_o

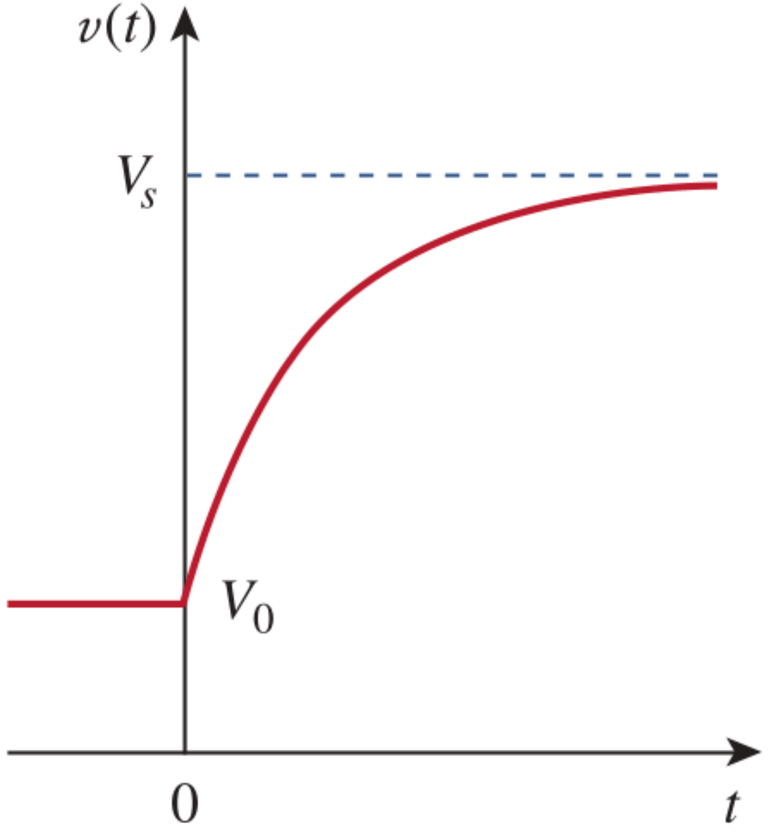


Step Response - RC Circuits

- Assume that at t=0, the capacitor voltage is equal to V_o

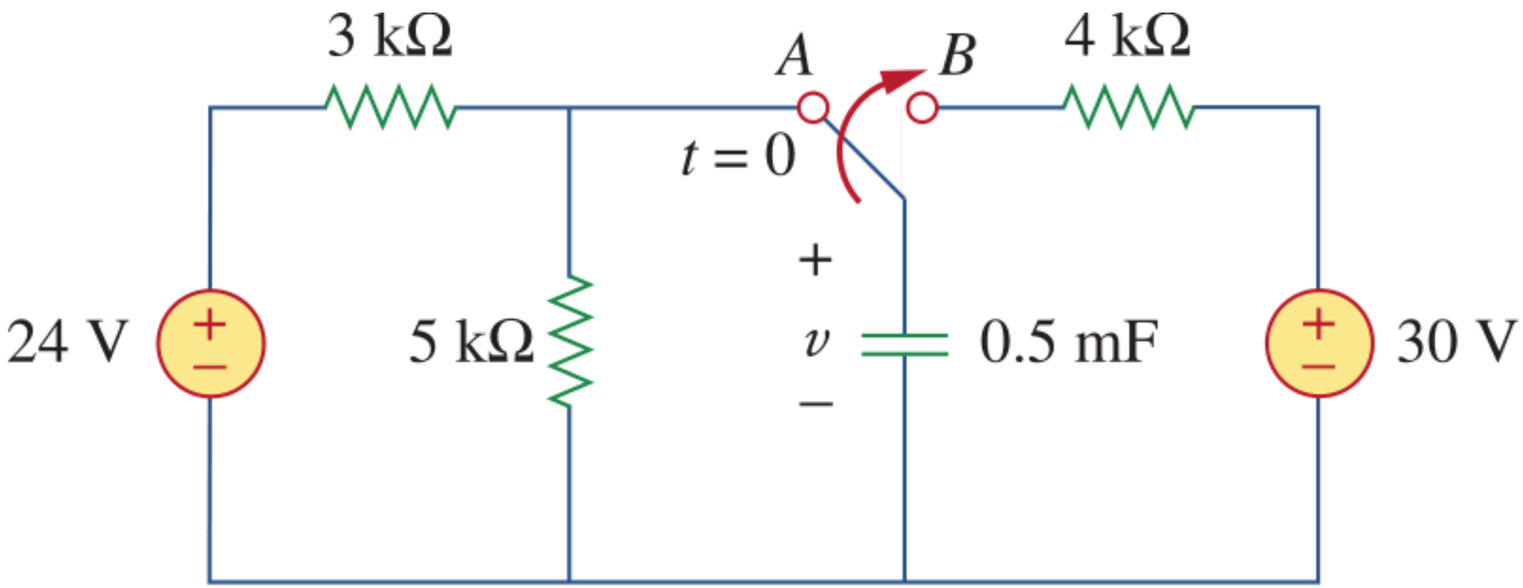
$$V_c(t) = V_s + (V_0 - V_s)e^{-t/\tau}$$
$$= V_\infty + (V_0 - V_\infty)e^{\frac{-t}{RC}}$$



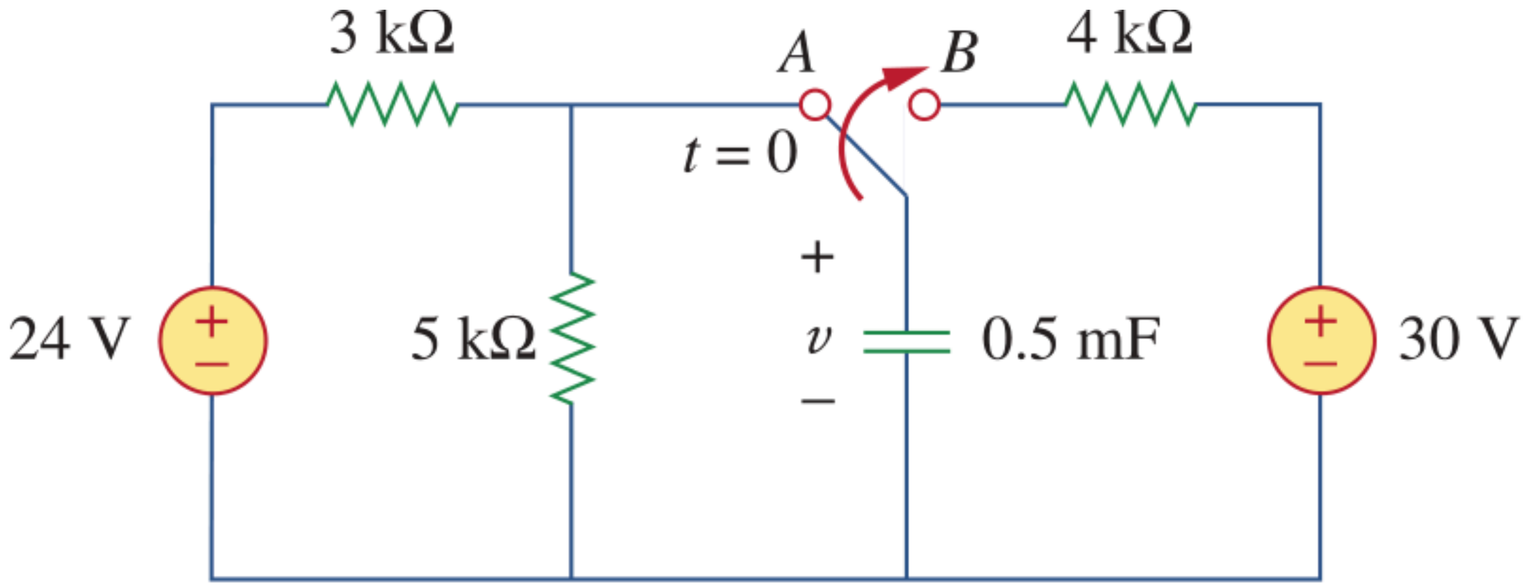


Example 1 - Step-Response in RC Circuits

- Determine v(t)



Example 1 - Step-Response in RC Circuits



$$V_c(t) = V_\infty + \left(V_0 + V_\infty\right) e^{\frac{-t}{\tau}}$$

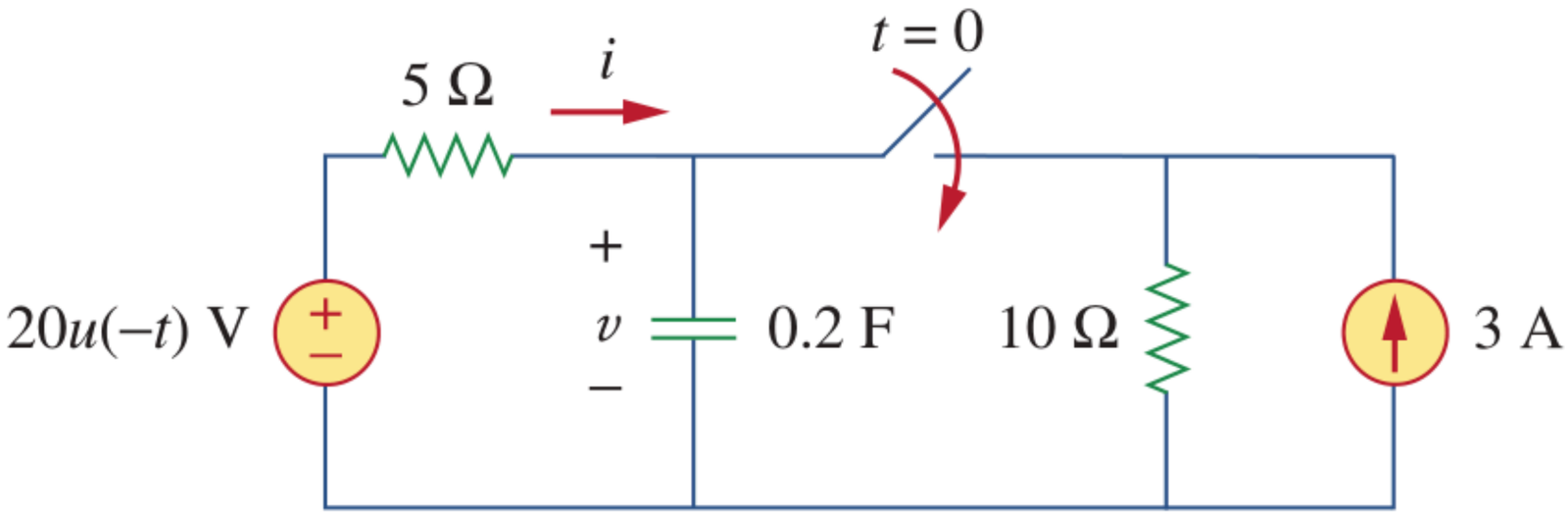
$$V_0 = 15V$$

$$\tau = 2s$$

$$V_\infty = 30V$$

Example 2- Step-Response in RC Circuits

- Determine v(t)



Unit Step Function

$$u(\tau) = \begin{cases} 1 \text{ if } \tau \geq 0 \\ 0 \text{ if } \tau < 0 \end{cases}$$

Draw $\quad u(t)\ ,\ u(t-5)\ ,\ u(-t)$

$$V_0 = 20V$$

$$\tau = 2/3\ s$$

$$V_\infty = 10V$$

$$V_c(t) = V_\infty + \left(V_0 + V_\infty\right) e^{\frac{-t}{\tau}}$$