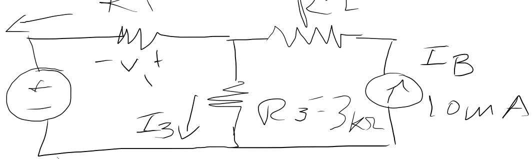
I

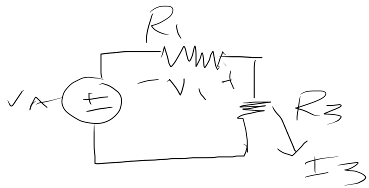
a)



$$V_1 = V_{1A} + V_{1B}$$

T. Sobreposição

$$I_3 = I_{3A} + I_{3B}$$



Contrib. de VA

$$V_{1A} = -\frac{R_1}{R_1+R_3} V_A = -\frac{1}{1+3} 25 = -6.25\,V$$

$$I_{3A} = \frac{V_A}{R_1+R_3} = \frac{25V}{4k\Omega} = 6.25\ mA$$

$$V_{1B} = R_1 \| R_3 \ I_B = 7.5V$$

$$= \frac{1000 \times 3000}{4000} = 750\,\Omega$$

$$I_{3B} = \frac{R_1}{R_1+R_3} I_B = 2.5\,mA \,//$$

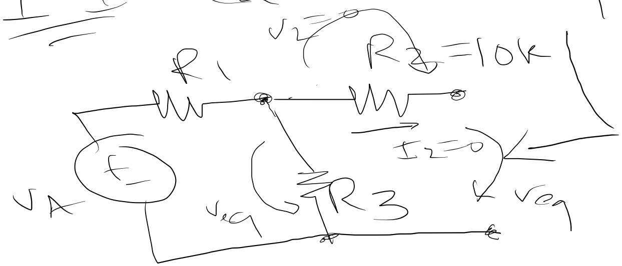
$$= \frac{\frac{1}{R_3}}{\frac{1}{R_1}+\frac{1}{R_3}} I_B$$

b) V_A recebe energia

Recebe se $V_A I_A > 0$

$I_A = \frac{V_1}{R} > 0$, $V_A > 0$ $\Rightarrow$ **SIM**

II Calcular Equiv. Thévenin



R_{eq} ($V_A = 0$)
curto-circuito

$R_{eq} = R_2 + R_1 \| R_3$

$V_{eq} = \frac{R_3}{R_1+R_3} V_A = \frac{3}{4} V_A$ $= 10 + 0.750 = 10.75 k\Omega$

$= 18.75V$ //

Div. Tensão

III

$I_B = 6 I_3$

Método das malhas

Sentido horário

$-V_A + R_1 I_a + R_3(I_a - I_b) = 0$

$4 I_a - 3 I_b = V_A$

$I_B = 6 I_3 = 6(I_a - I_b)$

$-I_b = 6(I_a - I_b)$

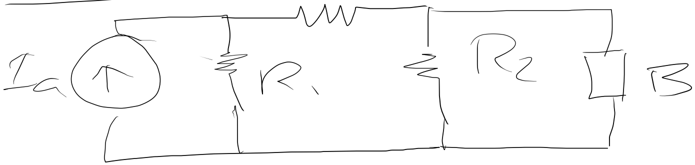
$6 I_a - 5 I_b = 0$

$-6 I_a + 5 I_b = 0$

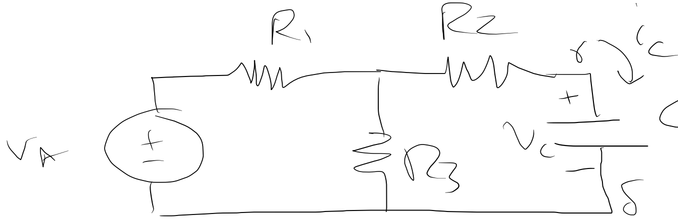
Ω

[ ]

Teste B



Era dual



$C = 20\mu F$

$v_A(t) = 10\,[1 - u(t)]$ V

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

$\boxed{t = -5\text{ s}}$ Condensador é circuito aberto

$i_C = C\frac{dv_C}{dt} = 0$

$v_C(t<0) = \frac{R_3}{R_1+R_3} V_A = \frac{3}{4} V_A$

$V_A = 10V$

$= 7.5\,V$

a) $w_c = \frac{1}{2} C V_c^2 = \frac{1}{2} \times 20 \times 10^{-6} (7.5)^2$

$= 562.5\,\mu J$

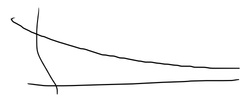
b) $v_{\gamma-\delta} = v_c(t \geq 0) = K_1 + K_2 e^{-\frac{t}{\tau}}$

$\tau = R_{eq} C = 10.75 \times 10^{3} \times 20 \times 10^{-6} = 215\,ms$

$\Omega F = s$

$\frac{1}{\tau}\ [s^{-1}]$ rad/s

nepper/s

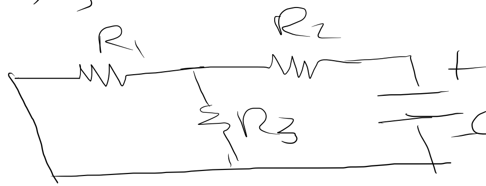


$e^{-t\alpha}$

$\alpha = \frac{1}{\tau}$

$v_A(t) = 10[1 - u(t)]$

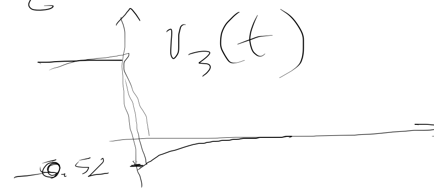
$t \geq 0$



$v_c(t) = K_1 + K_2 e^{-\frac{t}{\tau}}$

$$V_c(t) = K_1 + K_2 e^{-\frac{t}{\tau}}$$

$$V_c(t) = V_c(\infty) + [V_c(0) - V_c(\infty)] e^{-\frac{t}{\tau}}$$

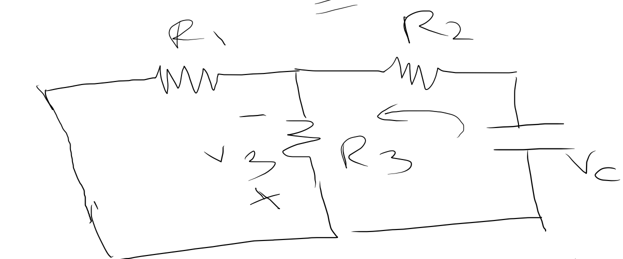


$V_c(0) = 7.5V$ $\qquad K_1 = 0$

$V_c(\infty) = 0$ $\qquad K_2 = 7.5V$

$\tau = 215 ms$

c) $V_3(t \geq 0) =$



$$V_3(t \geq 0) = V_3(\infty) + [V_3(0) - V_3(\infty)] e^{-\frac{t}{\tau}}$$

$$V_3(0) = \frac{-R_1 \| R_3}{R_1 \| R_3 + R_2} V_c(0) = \frac{-0.73 \cdot 7.5}{10.75} = -523.26 \text{ mV}$$

$V_3(\infty) = 0$ (condensador descarrega)

$$V_3(t<0) = V_c(t<0) = 7.5$$

$$v_3(t>0) = V_{31} + V_{32} e^{-t/\tau}$$

$$V_{31} = 0 \quad (v_3(\infty) = 0)$$

$$V_{32} = -523.26\, mV$$

$R_2 = 0$

V

$v_A(t) = 40 \cos(2\pi 10^3 + \frac{\pi}{6})$

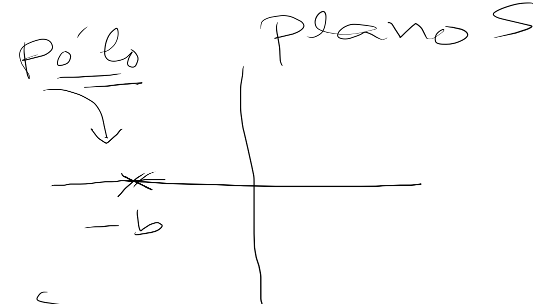
a) $T(s) = K_0 \dfrac{1+\frac{s}{a}}{1+\frac{s}{b}} = \dfrac{V_1(s)}{V_a(s)}$

$K_0 = ?$ Ganho D.C. $\Rightarrow$ C é circuito aberto
$s = 0$ (freq. nula)

$$\left.\frac{V_1}{V_A}\right|_{s=0} = K_0 = \frac{-R_1}{R_1+R_3} = -0.25$$

$$T(s) = K_0 \frac{1 + \frac{s}{a}}{1 + \frac{s}{b}}$$

$s_1 = -b$ o denominador anula-se



$$s_1 = -\frac{1}{R_{eq} C} = -\frac{1}{\tau}$$

Solução eq. característica

Solução da forma $Ae^{+s_1 t}$

$$b = \frac{1}{\frac{R_1 R_3}{R_1 + R_3} \cdot C}$$

nepper/s

s^{-1}

$$b = 66.67\ s^{-1}$$

$$T(s) = k_0 \frac{1+\frac{s}{a}}{1+\frac{s}{b}}$$

$$v_A = 40\cos\left(2\pi \times 10^3 t + \frac{\pi}{6}\right)$$

$s \rightarrow \infty \Rightarrow C$ é curto-circuito

$$\left.\frac{v_1}{v_A}\right|_{s=\infty} = k_0 \frac{b}{a} = -1 \; v_A$$

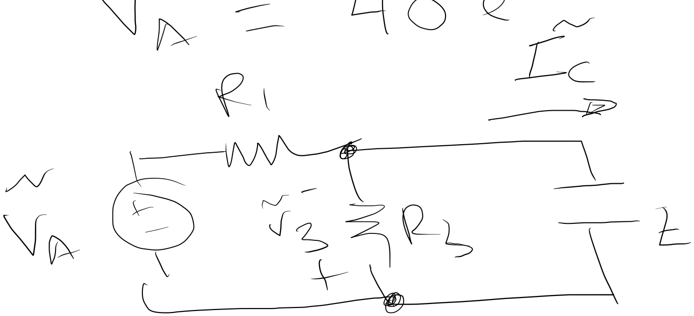
$$v_1 = -v_A$$

$$a = -k_0 b = -0.25 \times 6667 = 16.67 \, s^{-1}$$

b) $v_A(t) = 40\cos\left(2\pi 10^3 t + \frac{\pi}{6}\right)$

$$v_3(t) = A_3 \cos\left(2\pi 10^3 t + \phi\right)$$

$$\tilde{V}_A = 40\, e^{j\frac{\pi}{6}}$$



$$\tilde{V}_3 = \frac{R_3 \| \frac{1}{j\omega C}}{R_3 \| \frac{1}{j\omega C} + R_1}\, \tilde{V}_A$$

$A_3 = 318.19\ \text{mV}$

$\varphi^\circ = 120.5^\circ$

DIV. TENSÃO

$\tilde{I}_c = -\frac{\tilde{V}_3}{Z_c} = -\tilde{V}_3 j\omega C$; $\tilde{V}_c = -\tilde{V}_3$

c) Potência Reactiva no C

$$P_{react} = \mathrm{Im}\left\{\frac{\tilde{V}_c \tilde{I}_c^*}{2}\right\}$$

potência complexa P_c

d) $P_{apparent}$

$$= |P_c| = \left|\frac{\tilde{V}_c \tilde{I}_c^*}{2}\right|$$