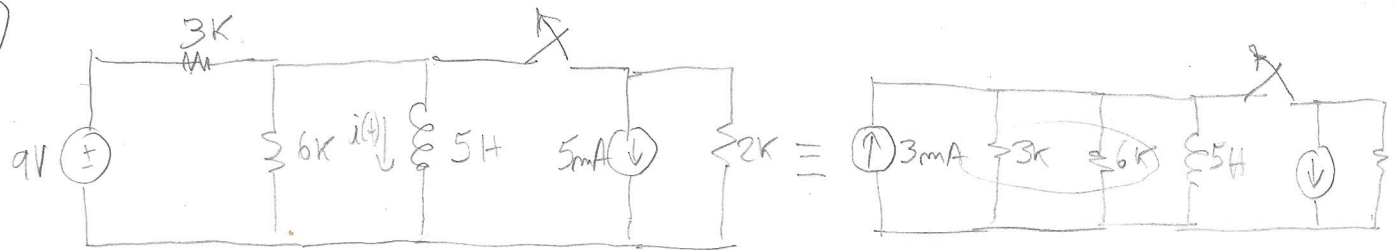
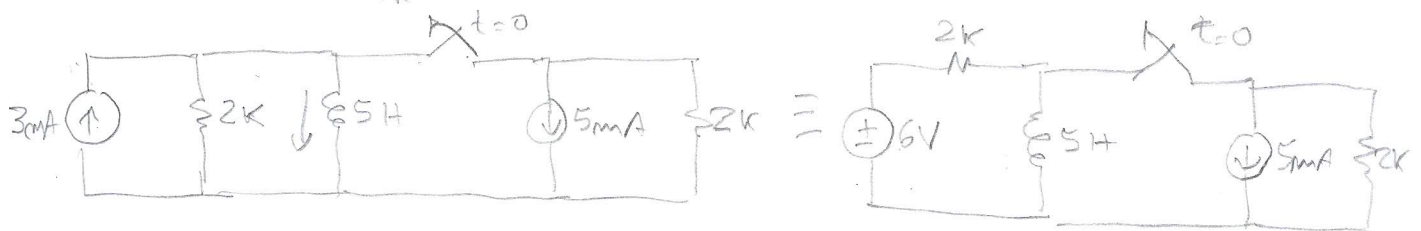


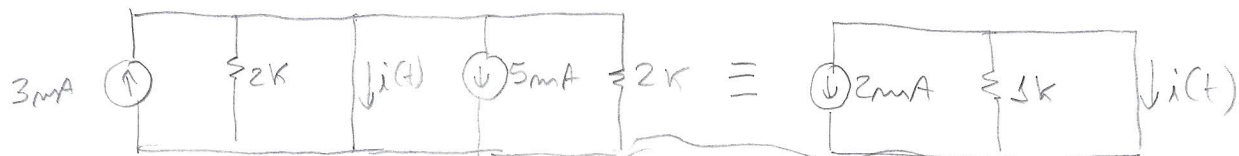
1)



$$3k \parallel 6k = \frac{3k \times 6k}{9k} = 2k$$

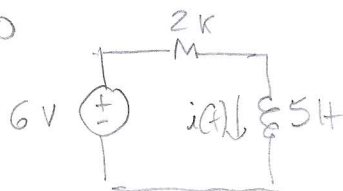


$t < 0$ é condições DC.



Logo $i(t) = -2mA \Rightarrow i(0^-) = i(0^+) = -2mA$

$t > 0$

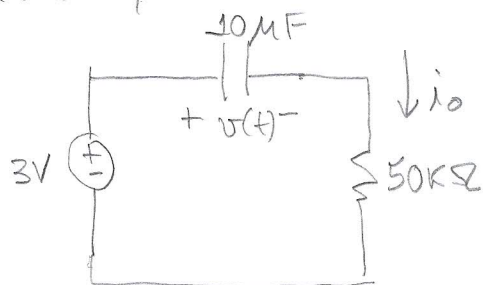


$$\tau = \frac{L}{R} = \frac{5}{2k} = 2,5ms ; V_s = 6V ; I_0 = -2mA$$

$$i(t) = \frac{6}{2k} + \left(-2mA - \frac{6}{2k}\right) e^{-\frac{t}{2,5ms}}$$

$i(t) = (3 - 5e^{-400t}) mA$

② $t > 0$, ten-se:



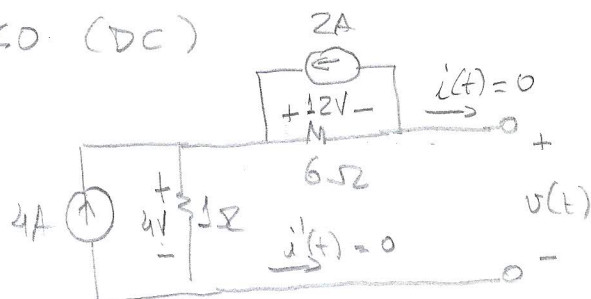
$$v(0) = -1, \tau = 10\mu \times 50k = 0,5s$$

$$v(t) = 3 + (-1 - 3)e^{-t/0,5}$$

$$v(t) = (3 - 4e^{-2t})V$$

$$i_o = 10\mu \frac{dv}{dt} = 10\mu \times (-4)(-2)e^{-2t} = 80e^{-2t} \mu A$$

③ $t < 0$ (DC)



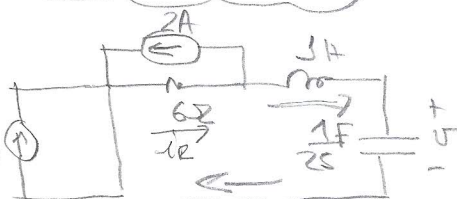
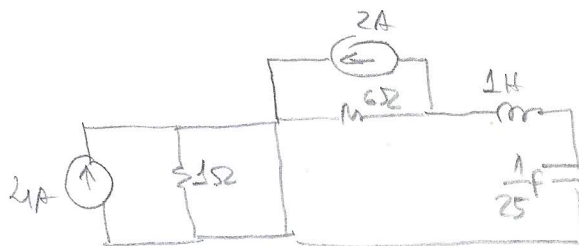
$$LTK: -4 + 12 + v = 0$$

$$v(t) = -8V$$

$$v(0^-) = v(0^+) = -8V$$

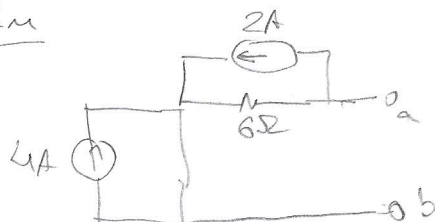
$$i(0^-) = i(0^+) = 0$$

$t > 0$



$$i(t) = i_c = \frac{1}{25} \frac{dv(t)}{dt} \Rightarrow \frac{dv(0^+)}{dt} = 25 i(0^+) = 0 \Rightarrow \frac{dv(0^+)}{dt} = 0$$

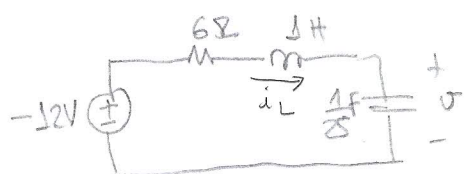
Thévenin



$$v_{ab} = -2 \times 6 = -12V$$

$$R_{ab} = 6\Omega$$

Logo



$$\alpha = \frac{6}{2} = 3; \omega_0 = \frac{1}{\sqrt{\frac{1}{25}}} = 5$$

$$\omega_d = \sqrt{\omega_0^2 - \alpha^2} = \sqrt{25 - 9} = 4$$

$$Então \quad v(t) = -12 + (K_1 \cos 4t + K_2 \sin 4t)e^{-3t}$$

$$\frac{dv(t)}{dt} = (-4K_2 \sin 4t + 4K_1 \cos 4t)e^{-3t} - 3(K_1 \cos 4t + K_2 \sin 4t)e^{-3t}$$

$$v(0) = -8 \Rightarrow K_1 - 12 = -8 \Rightarrow K_1 = 4$$

$$\frac{dv(0)}{dt} = 0 \Rightarrow 4K_2 - 3K_1 = 0 \Rightarrow K_2 = \frac{3}{4}K_1 \Rightarrow K_2 = 3$$

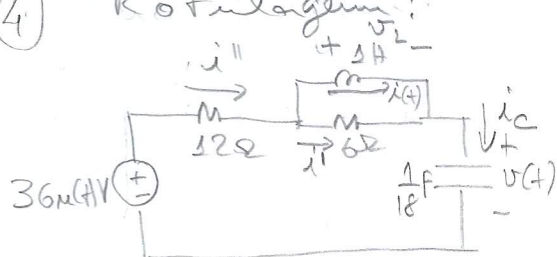
$$então \quad v(t) = [-12 + (4 \cos 4t + 3 \sin 4t)e^{-3t}]V$$

$$i_L = i_c = \frac{1}{25} \frac{dv}{dt} = \frac{1}{25} [(-16 \sin 4t + 12 \cos 4t - 12 \cos 4t - 9 \sin 4t)e^{-3t}]$$

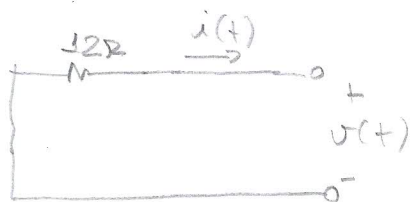
$$i_L = -\sin(4t)e^{-3t}A; \text{ No circuito (A): } i_R = 2 + i_L$$

$$i_R = [2 - \sin(4t)e^{-3t}]A$$

4) Rotulagem:



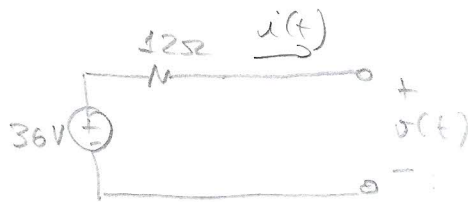
$t < 0$ (DC)



$$v(0^-) = v(0^+) = 0$$

$$i(0^-) = i(0^+) = 0$$

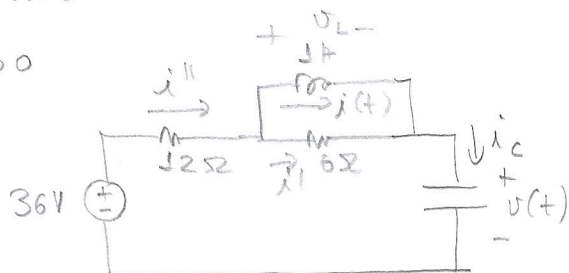
$t \rightarrow \infty$ (DC)



$$v(\infty) = 36V$$

$$i(\infty) = 0$$

$t > 0$



$$i'' = i + i' \Leftrightarrow \frac{36 - (v_L + v)}{12} = i + \frac{v_L}{6} \quad (I)$$

$$i + i' = i_c \Leftrightarrow i + \frac{v_L}{6} = i_c \quad (II)$$

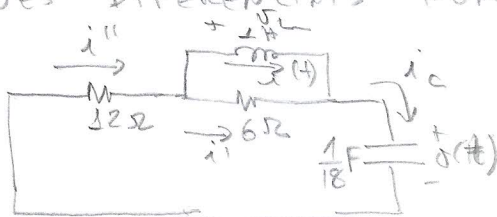
$$i_c = i''$$

$$(II) \text{ em } t=0^+ \Rightarrow i(0^+) + \frac{1}{6} \frac{di(0^+)}{dt} = \frac{1}{18} \frac{dv(0^+)}{dt} \Rightarrow \frac{dv(0^+)}{dt} = 3 \frac{di(0^+)}{dt}$$

$$(I) \Rightarrow 3 - \frac{1}{12} \left(\frac{di(0^+)}{dt} + v(0^+) \right) = i(0^+) + \frac{1}{6} \frac{di(0^+)}{dt} \Rightarrow 3 = \frac{1}{4} \frac{di(0^+)}{dt} \Rightarrow \frac{di(0^+)}{dt} = 12A/s$$

$$\Rightarrow \frac{dv(0^+)}{dt} = 36V/s$$

EQUAÇÕES DIFERENCIAIS HOMOGÊNEAS



$$i'' = i + i' \Leftrightarrow -\frac{(v_L + v)}{12} = i + \frac{v_L}{6} \quad (I)$$

$$i'' = i_c \Leftrightarrow \frac{1}{18} \frac{dv}{dt} = -\frac{(v_L + v)}{12} \Rightarrow$$

$$\Rightarrow \left(v_L = -\frac{2}{3} \frac{dv}{dt} - v \right) \Rightarrow \left(\frac{dv_L}{dt} = -\frac{dv}{dt} - \frac{2}{3} \frac{d^2v}{dt^2} \right) \quad (II)$$

$$\frac{d(I)}{dt} \Rightarrow -\frac{1}{12} \frac{dv_L}{dt} - \frac{1}{12} \frac{dv}{dt} = \frac{di}{dt} + \frac{1}{6} \frac{dv_L}{dt} \Rightarrow -\frac{1}{12} \frac{dv}{dt} = v_L + \frac{1}{4} \frac{dv_L}{dt} \quad (\text{Subst. (II) e (III)})$$

$$\Rightarrow -\frac{1}{12} \frac{dv}{dt} = -\frac{2}{3} \frac{dv}{dt} - v - \frac{1}{4} \frac{dv}{dt} - \frac{1}{6} \frac{d^2v}{dt^2} \Rightarrow \frac{dv}{dt} = 8 \frac{dv}{dt} + 12v + 3 \frac{dv}{dt} + 2 \frac{d^2v}{dt^2}$$

$$\Rightarrow \frac{2d^2v}{dt^2} + 10 \frac{dv}{dt} + 12v = 0 \Rightarrow \left(\frac{d^2v}{dt^2} + 5 \frac{dv}{dt} + 6v = 0 \right)$$

$$\lambda^2 + 5\lambda + 6 = 0 \Rightarrow \lambda_1 = -2, \lambda_2 = -3$$

$$\text{então } v(t) = 36 + K_1 e^{-2t} + K_2 e^{-3t}; \frac{dv}{dt} = -2K_1 e^{-2t} - 3K_2 e^{-3t}$$

$$v(0) = 0 \Rightarrow K_1 + K_2 = -36$$

$$\frac{dv(0)}{dt} = 36 \Rightarrow -2K_1 - 3K_2 = 36$$

$$\rightarrow K_1 = -72, K_2 = 36 \rightarrow v(t) = 36(1 - 2e^{-2t} + e^{-3t})V$$