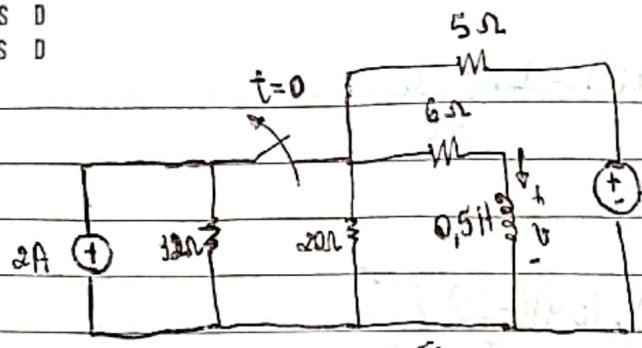
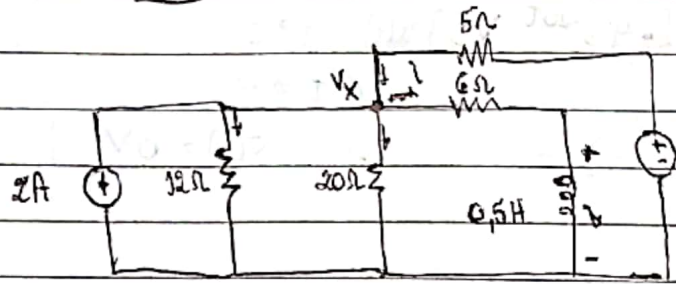
Carlos Luiz Ferreira Almeida Santos

Questão 1.



$V = Ri$

$t = 0^+$



$\Rightarrow i(0^+) = \frac{V_x}{6} = \frac{12}{6} = 2\,A$

$$\frac{2 + \frac{20 - V_x}{5} - \frac{V_x}{12} - \frac{V_x}{20} - \frac{V_x}{6} = 0}{}$$

$$\frac{2 + \frac{20 - V_x}{5}}{} = \frac{V_x}{12} + \frac{V_x}{20} + \frac{V_x}{6}$$

$$\frac{2 + \frac{20 - V_x}{5}}{} = V_x\left(\frac{1}{12} + \frac{1}{20} + \frac{1}{6}\right)$$

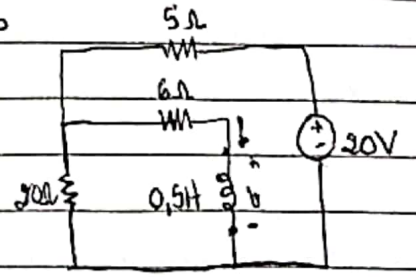
$$2 + 4 - \frac{V_x}{5} = V_x\,0{,}3$$

$$0{,}5\,V_x = 6$$

$$V_x = 6/0{,}5$$

$$V_x = 12\,V$$

$t \to \infty$



$R_{eq} = \frac{20 \cdot 5}{20+5} = 4\,\Omega \Rightarrow i(\infty) = \frac{4}{4+6}(4) = 1{,}6\,A$

$\tau = L/R \Rightarrow R_{eq} = \frac{20 \cdot 5}{20+5} + 6 = 10\,\Omega$

$\tau = 0{,}5/10 = 0{,}05\,s$

$i(t) = i(\infty) + [i(0) - i(\infty)]\,e^{-t/\tau}$

$i(t) = 1{,}6 + [2 - 1{,}6]\,e^{-t/0{,}05} = [1{,}6 + 0{,}4e^{-20t}]\,u(t)\ [A],$

$t \geq 0$

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Questão 1

$$v(t) = L \cdot \frac{di(t)}{dt}$$

~~$v(t) = (0,05$~~

$$v(t) = (0,5) \cdot (0,4)(-20)\, e^{-20t}$$

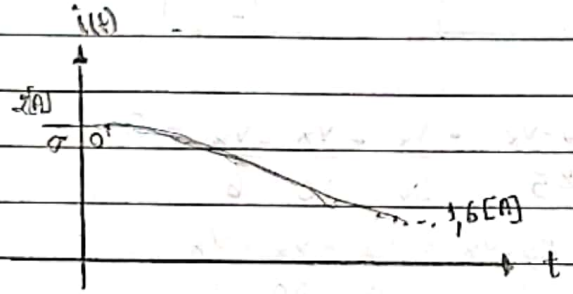
$$v(t) = [-4\, e^{-20t}\ V]\, u(t), \quad t \geq 0$$

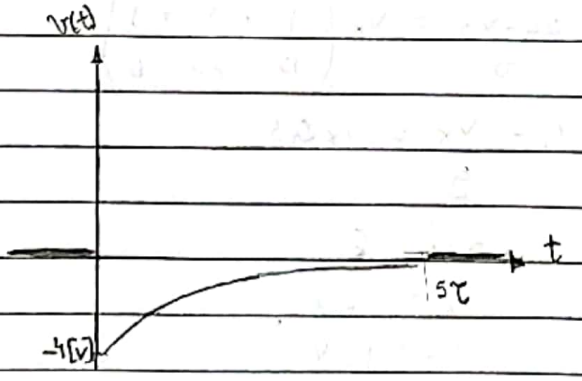
p/ $t = 0$

$v(t) = -4\ V$

p/ $t \to \infty$

$v(t) = 0\ V$





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L M M J V S D

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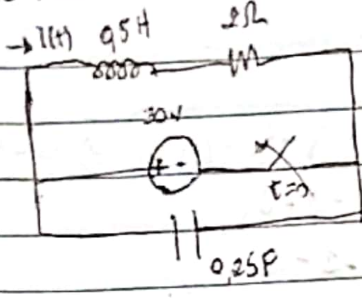
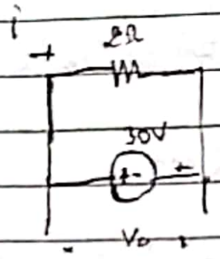
Questão 2.



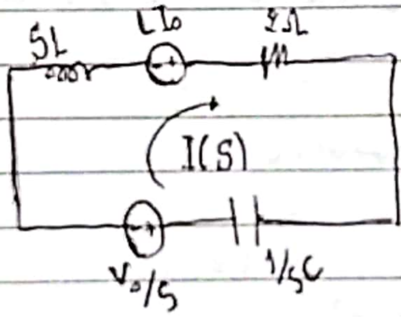
$t < 0$



$$V_0 = -30V$$

$$I_0 = 30/2 = 15A$$

$t \geq 0$



$$RI(S) + SLI(S) - LI_0 + \frac{1}{SC} I(S) + \frac{V_0}{S} = 0$$

$$I(S)\left(R + SL + \frac{1}{SC}\right) = LI_0 - \frac{V_0}{S}$$

$$I(S) = \frac{SC}{S^2LC + SRC + 1}\left(LI_0 - V_0/S\right)$$

$$I(S) = \frac{I_0 S - V_0/L}{S^2 + R/L\, S + 1/LC} + \frac{SV_g(S)/L}{S^2 + R/L\, S + 1/LC} \to 0$$

$$I(S) = \frac{15(S) - (-30/(0,5))}{S^2 + 2/0,5\, S + 1/(0,5)(0,25)}$$

$$I(S) = \frac{15S + 60}{S^2 + 4S + 8}$$

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Questão 2.

Eq. Características: s^2+4s+8

$$s_{1,2} = \frac{-b \pm \sqrt{b^2-4ac}}{2} \Rightarrow s = \frac{-4 \pm \sqrt{4^2-4(1)(8)}}{2} \Rightarrow = \frac{-4 \pm \sqrt{16-32}}{2}$$

$$s_{1,2} = \frac{-4 \pm \sqrt{16i}}{2} \Rightarrow \begin{cases} s_1 = -2+2i \\ s_2 = -2-2i \end{cases}$$

s_1 e $s_2 \in \mathbb{C} \Rightarrow \omega_0^2 > \alpha^2$: subamortecida

$$\alpha = R/2L = \frac{2}{2(0,5)} = 2 \text{ rad/s}$$

$$\omega_0 = 1/\sqrt{LC} = \frac{1}{\sqrt{(0,5)(0,25)}} = \frac{1}{\sqrt{0,125}} = 2,82 \text{ rad/s}$$

$$\omega_0^2 = 8 \; ; \; \alpha^2 = 4$$

$\omega_0^2 > \alpha^2 \Rightarrow$ subamortecida

$$A = \frac{155+60}{(s+2+2i)}\Big|_{s=-2-2i} \Rightarrow A = 15$$

$$B = \frac{155+60}{(s+2-2i)}\Big|_{s=-2+2i} \Rightarrow B = 15$$

$$i(t) = A e^{-\alpha t}\cos(\omega_d t) + B e^{-\alpha t}\text{sen}(\omega_d t)$$

$$\omega_d = \sqrt{\omega_0^2 - \alpha^2} = \sqrt{8-4} = 2$$

$$\therefore i(t) = \left[15\cos(2t) + 15\,\text{sen}(2t)\right] e^{-2t} \; [A]$$

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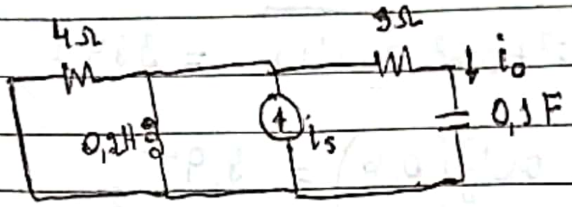
Questão 3.



$$i_s = 5\cos(10t + 40°)\ [A]$$

$$\hat{I}_s = 5e^{j40}\ [A] \Rightarrow 5\angle 40°$$

Logo:

$$\frac{1}{j\omega C} = 0,1[F]$$

$$\frac{1}{j(10)(0,1)} = -j$$

e ...

$$j\omega L = 0,2H$$

$$j(10)(0,2) = j2$$

A Impedância: Z

$$Z_1 = 4 // j_2 \Rightarrow \frac{j8}{4+j2} = 0,8 + j1,6$$

$$Z_2 = 3 - j$$

$$I_o = \frac{Z_1}{Z_1 + Z_2} \cdot I_s$$

$$I_o = \frac{0,8 + j1,6}{3,8 + j0,6} \cdot 5e^{j40} \Rightarrow$$

$$\Rightarrow \rho_1 = \sqrt{0,8^2 + 1,6^2} = \sqrt{0,64 + 2,56} = \sqrt{3,2} \cong 1,789$$

$$\theta_1 = \operatorname{arctg}\left(\frac{1,6}{0,8}\right) = 63,43°$$

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Questão 3

$$\Rightarrow Z_2 = \sqrt{3,8^2 + 0,6^2} = \sqrt{14,8} = 3,847 \Omega$$

$$\theta_2 = \operatorname{arctg}\left(\frac{0,6}{0,8}\right) = 8,97°$$

$$I_o = \frac{(1,789 \angle 63,43°) \cdot (5 \angle 40°)}{(3,847 \angle 8,97°)} \Rightarrow 2,325 \angle 94,46°$$

$$\therefore i_o(t) = 2,325 \cos(10t + 94,46°) \text{ [A]}$$