5.1) $Z_L = \frac{V_L}{I_L}$

a)

$Z_L = j\omega L$

$Z_R = R$

$I_L = I_S \cdot \frac{R}{j\omega L + R}$

$V_L = Z_L \cdot I_L = V_o$

$V_o = I_S \cdot \frac{R}{j\omega L + R} \cdot j\omega L = I_S \cdot \frac{j\omega L R}{R + j\omega L}$ //

b) $\left|\frac{V_o}{I_S}\right| = \left|\frac{j\omega L R}{R + j\omega L}\right| = \frac{\omega L R}{\sqrt{R^2 + \omega^2 L^2}}$

$\frac{\omega}{\sqrt{(1\times10^{3})^2 + \omega^2 (1\times10^{-3})^2}} = 0{,}707 \Leftrightarrow \omega - 0.707\sqrt{10^6 + x^2 \cdot 10^{-6}} = 0$

$\Leftrightarrow \omega = 707$

$f = \frac{\omega}{2\pi} = \frac{707}{2\pi} = 112.5\ Hz$ //

5.2) a) máo.

Divisor de corrente $I_{AB} = I_S \cdot \frac{R_1}{R_1 + \frac{1}{Cj\omega} + R_2} = I_S \cdot \frac{C_2 j\omega R_1}{C_2 j\omega (R_1 + R_2) + 1}$

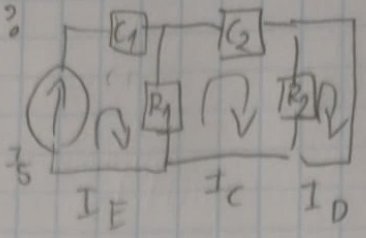
$V_{AB} = R_2 \cdot I_{AB} = I_S \cdot \frac{C_2 j\omega R_1 R_2}{C_2 j\omega (R_1 + R_2) + 1}$

$Z_{ab} = (Z_{C_2} + Z_{R_1}) // Z_{R_2} = \left(\frac{1}{C_2 j\omega} + R_1\right) // R_2 = \frac{1 + R_1 C_2 j\omega}{C_2 j\omega} // R_2 =$

$\left(\frac{C_2 j\omega}{1 + R_1 C_2 j\omega} + \frac{1}{R_2}\right)^{-1} = \frac{R_2 (1 + R_1 C_2 j\omega)}{1 + R_1 C_2 j\omega + R_2 C_2 j\omega} = \frac{R_2 + R_1 R_2 C_2 j\omega}{1 + (R_1 + R_2) j\omega C_2}$ //

b) $V_{oc} = V_{ab}$ $\quad I_{cc} =$

$$Z_{Th} = \frac{V_{oc}}{I_{cc}}$$



$I_E = I_S$

$$\begin{cases} R_1(I_C - I_E) + \frac{1}{C_2 j\omega}(I_C) + R_2(I_C - I_D) = 0 \\ R_3(I_D - I_C) = 0 \end{cases}$$

$I_D = I_{cc}$

$I_E = I_S$

$I_D = I_C$

$R_1 I_C - R_1 I_S + \frac{1}{C_2 j\omega} I_C = 0 \iff I_C\left(R_1 + \frac{1}{C_2 j\omega}\right) = R_1 I_S \iff$

$\iff$

$$I_C = I_D = I_{cc} = \frac{R_1 I_S}{R_1 + \frac{1}{C_2 j\omega}} = \frac{R_1 C_2 j\omega I_S}{R_1 C_2 j\omega + 1}$$

$$\frac{V_{AB}}{I_{cc}} = \frac{j\omega C_2 R_1 R_2 I_S}{1 + j\omega C_2 (R_1 + R_2)} \cdot \frac{R_1 C_2 j\omega + 1}{R_1 C_2 j\omega I_S} = \frac{R_2 R_1 C_2 j\omega + R_2}{1 + j\omega C_2 (R_1 + R_2)} = Z_{Th} //$$

S.3) 1) (Vou apenas usar associações)

$$= \left(L_2 j\omega + \frac{1}{C_2 j\omega}\right) // \frac{1}{C_1 j\omega} + L_1 j\omega = \frac{1 - L_2 C_2 \omega^2}{C_2 \omega j} // \frac{1}{C_1 j\omega} + L_1 j\omega =$$

$$= \left(\frac{C_2 \omega j}{1 - L_2 C_2 \omega^2} + C_1 j\omega\right)^{-1} + L_1 \omega j = \left(\frac{C_2 \omega j + C_1 j\omega(1 - L_2 C_2 \omega^2)}{1 - L_2 C_2 \omega^2}\right)^{-1} + L_1 \omega j =$$

$$= j\omega L_1 + \frac{1 - L_2 C_2 \omega^2}{C_2 \omega j + C_1 \omega j (1 - L_2 C_2 \omega^2)} = j\left(\omega L_1 - \frac{1 - L_2 C_2 \omega^2}{1 + \frac{C_2}{C_1} - \omega^2 C_2 L_2} \cdot \frac{1}{\omega C_1}\right)$$

2) $Z = (Z_{C_2} + Z_{L_2}) /\!/ Z_{L_1} + Z_{C_1} =$

$= \left(\frac{1}{C_2 j\omega} + L_2 j\omega\right) /\!/ L_1 j\omega + \frac{1}{C_1 j\omega} =$

$= \frac{1 - L_2 C_2 \omega^2}{C_2 j\omega} /\!/ L_1 j\omega + \frac{1}{C_1 j\omega} =$

$= \left(\frac{C_2 j\omega}{1 - L_2 C_2 \omega^2} + \frac{1}{L_1 j\omega}\right)^{-1} + \frac{1}{C_1 j\omega} =$

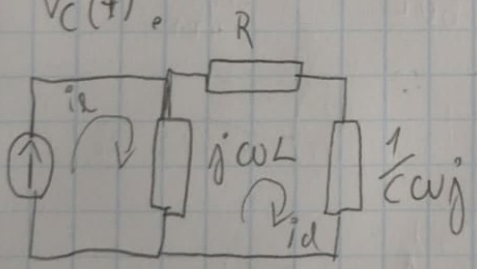
$= \left(\frac{C_2 j\omega \, L_1 j\omega - L_2 C_2 \omega^2 + 1}{L_1 j\omega (1 - L_2 C_2 \omega^2)}\right)^{-1} + \frac{1}{C_1 j\omega} = j\left(\frac{\omega L_1 (1 - L_2 C_2 \omega^2)}{1 - \omega^2 C_2 (L_1 + L_2)} - \frac{1}{C_1}\right.$

5.4)

$i_G(t) = 5\cos(1000t + \frac{\pi}{4})$

a) $i_G(t) = 5 e^{j\pi/4}$

b) $V_C(t)$:



$i_g = i_g$

$j\omega L(i_d - i_g) + R i_d + \frac{1}{C\omega j} i_d = 0 \iff \frac{j\omega L \, i_g}{j\omega L + R + \frac{1}{C\omega j}} = i_d$

$V_C = \frac{1}{C\omega j} \cdot \frac{j\omega L \, i_g}{j\omega L + R + \frac{1}{C\omega j}}$

$T = \frac{j\omega L}{C\omega j (j\omega L + R + \frac{1}{C\omega j})} = \frac{j\omega L}{1 - \omega^2 CL + j\omega CR} /\!/$

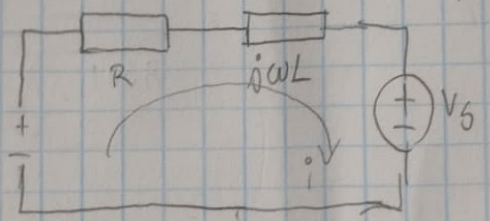
c) $V_c = i_g \cdot \left| \frac{j\omega L}{1 - \omega^2 LC + j\omega RC} \right|$

↓ Calculadora e substituindo valores

$V_c = \frac{1}{2} \cdot i_g = \frac{1}{2} 5 \cdot e^{\frac{\pi}{4} j} = 2.5 e^{\pi/4 j}$

$V_c(t) = 2.5 \cos(1000 t + \pi/4)$

5.5)



$i(t) = 0.8 \sin(20t) = 0.8 \cos(20t - \frac{\pi}{2}) = 0.8 e^{j(-\frac{\pi}{2})}$

$iR + i\, j\omega L + V_S - V_{im} = 0$

Calculadora para resolver → $0.8 e^{-\frac{\pi}{2} j} \cdot 100 + 0.8 e^{-\frac{\pi}{2} j} \cdot j \cdot 20 \cdot 10 + 60 e^{-143^\circ j} = V_{im}$

$\approx 120 - 110 i = V_{im}$

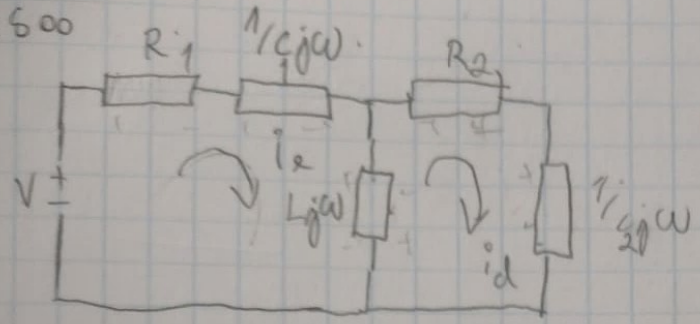
$\sqrt{120^2 + (-110)^2}\, e^{j\, tg^{-1}\left(\frac{-110}{120}\right)}$ $\quad -0,741 = -42.5 \cdot \frac{\pi}{180}$

$\approx 162 e^{j(-0,741)} \rightarrow 162 \cos(20t - 0,741)$

5.6)

$\omega = 500$

a)



$$\begin{cases} i_d = i_c \\ R_1 i_e + \frac{1}{C_1 j\omega}(i_e) + Lj\omega(i_e - i_d) - V = 0 \\ Lj\omega(i_d - i_e) + R_2(i_d) + \frac{1}{C_2 j\omega}(i_d) = 0 \end{cases} \Leftrightarrow V = 23.24 - 18.92i$$

$$\hookrightarrow 29.96 e^{i(-0.68)}$$

$$\hookrightarrow 29.96 \angle -39.2°$$

$$\hookrightarrow 29.96 \cos(500t - \frac{39.2}{180}\pi)$$

b) $\left(R_2 + \frac{1}{C_2 j\omega}\right) // (Lj\omega) + R_1 + \frac{1}{C_1 j\omega} = \frac{97}{13} + \frac{61}{13}i$

$$\hookrightarrow 8.81 e^{i 0.561375}$$

$$\hookrightarrow 8.81 \angle 32.2° //$$