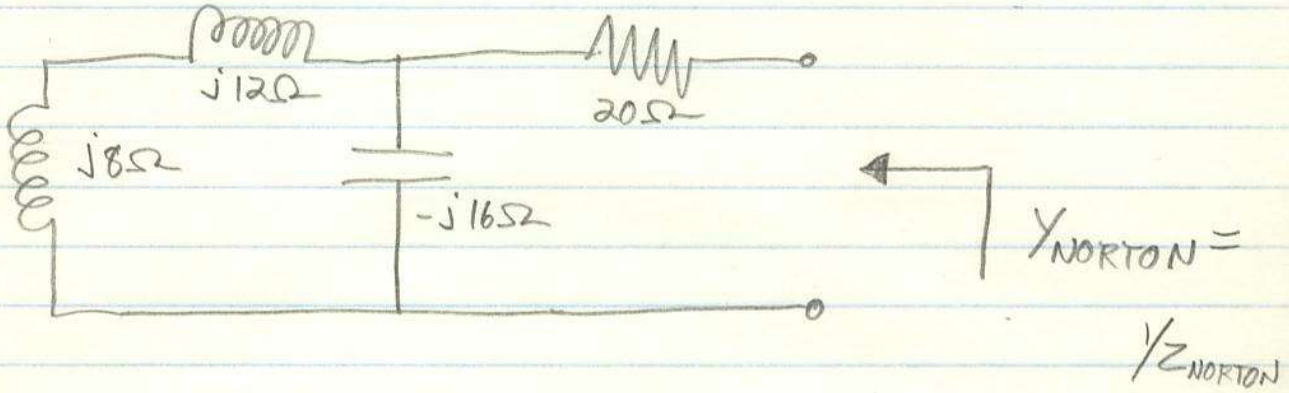
Solution P8-9

(a) L'admitance Y_{NORTON} est obtenue en annulant toutes les sources :

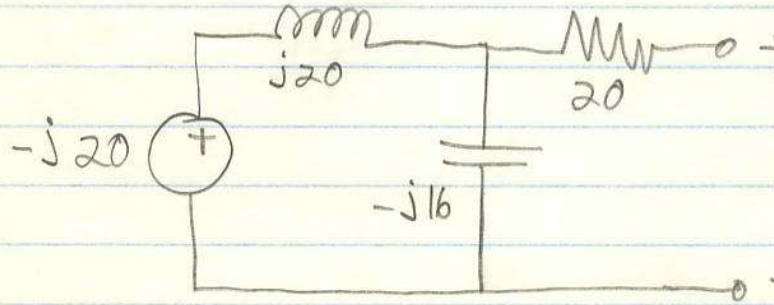


$$Z_{NORTON} = 20\,\Omega + (j20\,\Omega \parallel -j16\,\Omega)$$

$$= 20\,\Omega - j80\,\Omega$$

$$\Rightarrow Y_{NORTON} = 2.94\,m\mho + j\,11.8\,m\mho$$

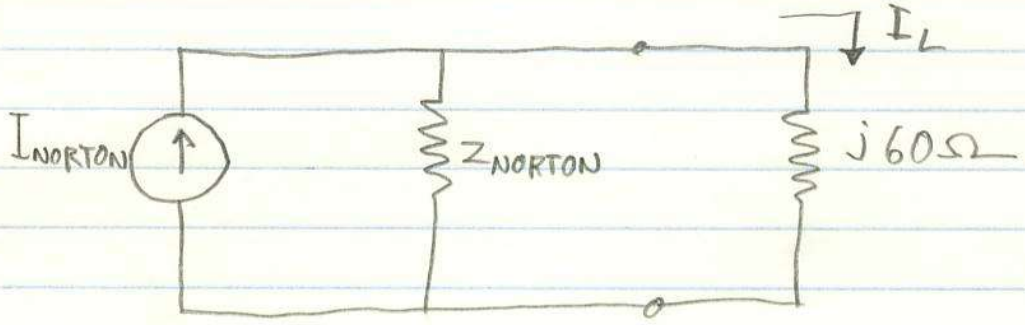
V_{OC} est obtenue du circuit suivant :



$$V_{OC} = \frac{(-j20)(-j16)}{(j20)+(-j16)} = 80j$$

$$\Rightarrow I_{NORTON} = \frac{V_{OC}}{Z_{NORTON}} = \frac{80j}{20-80j} = -0.941 + j\,0.235$$

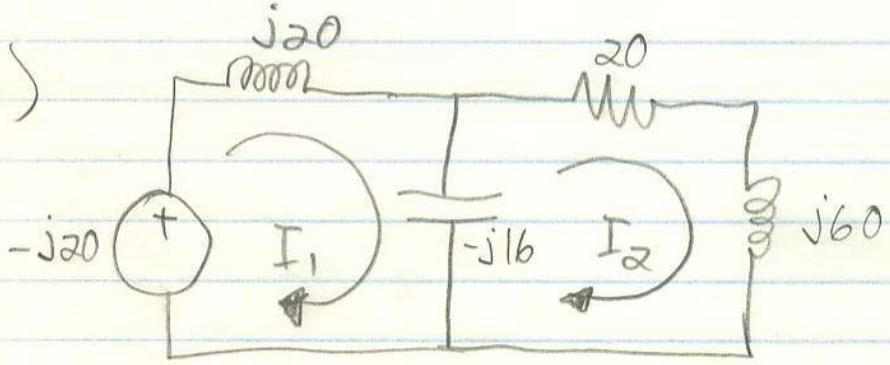
On calcule alors le courant dans Z_L avec le diviseur de courant:



$$I_L = \frac{I_{NORTON}\ Z_{NORTON}}{Z_{NORTON} + j60} = -2 + 2j$$

$$\Rightarrow i_L(t) = \underline{\underline{4\cos(\omega t + 135°)}} \text{ ampères.}$$

(b)



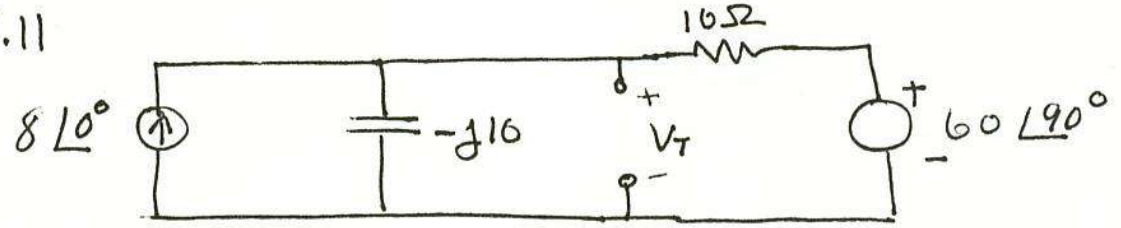
maille I : $(-j20) - (j20)I_1 - (-j16)(I_1 - I_2) = 0$

maille II : $-(-j16)(I_2 - I_1) - (20 + j60)I_2 = 0$

en solutionnant (MAPLE V) on trouve:

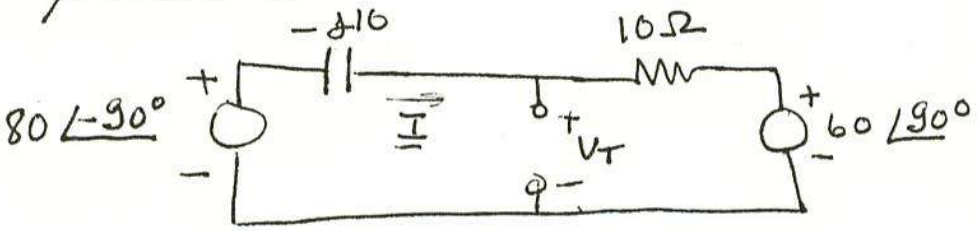
$$I_2 = -2 + 2j \Rightarrow \underline{\underline{i_2(t) = 4\cos(\omega t + 135°)\ A.}}$$
$$I_1 = 3 - 8j$$

P8.11



Find Thevenin equivalent of circuit

Easiest way is to use source transformation. The above circuit is equivalent to:



Let's find $\underline{I}$ in above circuit

$$\underline{I} = \frac{80\angle -90^\circ - 60\angle 90^\circ}{10 - j10} = \frac{140\angle -90^\circ}{10\sqrt{2}\angle -45^\circ}$$

$$= \frac{14}{\sqrt{2}}\angle -45^\circ$$

and $$\underline{V_T} = 60\angle 90^\circ + 10 \times \frac{14}{\sqrt{2}}\angle -45^\circ = 70 - 10j$$

$$= 70{,}7\angle -8{,}1^\circ$$

$$\underline{Z_T} = \frac{10\,\Omega \times -j10}{10 - j10} = \frac{-j10}{1-j} = -j5(1+j)$$

$$= 5 - j5$$

$$= 7{,}07\angle -45^\circ$$

and finally $$\underline{I_2} = \frac{\underline{V_T}}{\underline{Z_T} + \underline{Z}} = \frac{70 - 10j}{5 - j5 + 10j} = 6 - 8j$$

$$= 10\angle -53^\circ$$