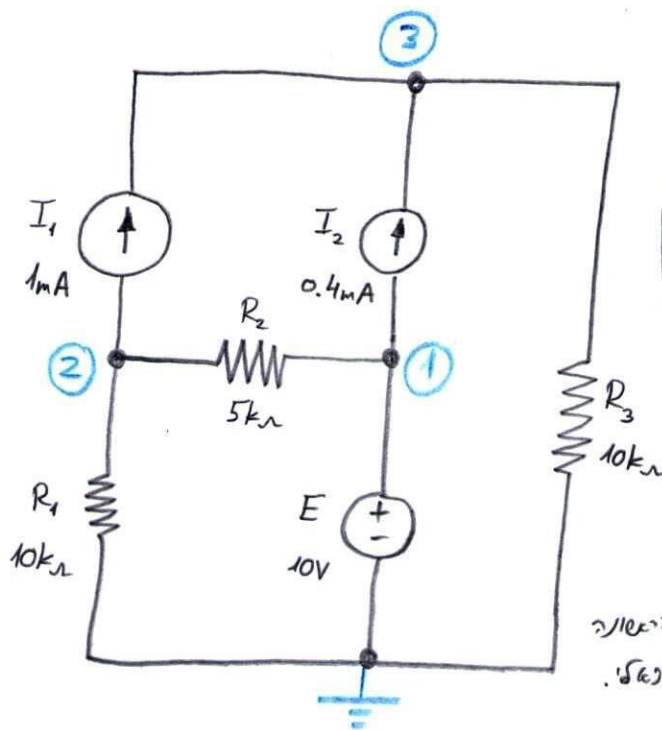


1



$$\begin{pmatrix} +G_{11} & -G_{12} & -G_{13} \\ -G_{21} & +G_{22} & -G_{23} \\ -G_{31} & -G_{32} & +G_{33} \end{pmatrix} \begin{pmatrix} V_1 \\ V_2 \\ V_3 \end{pmatrix} = \begin{pmatrix} I_{sc1} \\ I_{sc2} \\ I_{sc3} \end{pmatrix}$$

$V_1 = E = 10V$
 $(1 \ 0 \ 0)(V_1) = (10)$

יש להשתמש בנתונים הנ"ל כדי לחשב את המתחים והזרמים הנדרשים.

$$G_{21} = \frac{1}{R_2} = \frac{1}{5} \text{ mS} \quad G_{22} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{10} + \frac{1}{5} = \frac{3}{10} \text{ mS} \quad G_{23} = G_{32} = 0 \text{ mS}$$

$$G_{31} = 0 \text{ mS} \quad G_{33} = \frac{1}{R_3} = \frac{1}{10} \text{ mS} \quad I_{sc2} = -I_1 = -1 \text{ mA} \quad I_{sc3} = I_1 + I_2 = 1.4 \text{ mA}$$

⇓

$$\begin{pmatrix} 1 & 0 & 0 \\ -\frac{1}{5} & \frac{3}{10} & 0 \\ 0 & 0 & \frac{1}{10} \end{pmatrix} \begin{pmatrix} V_1 \\ V_2 \\ V_3 \end{pmatrix} = \begin{pmatrix} 10 \\ -1 \\ 1.4 \end{pmatrix} \Rightarrow \begin{cases} V_1 = 10V \\ V_2 = 3.333V \\ V_3 = 14V \end{cases}$$

Ⓔ $U_{R1} = V_2 - 0 = 3.333V$

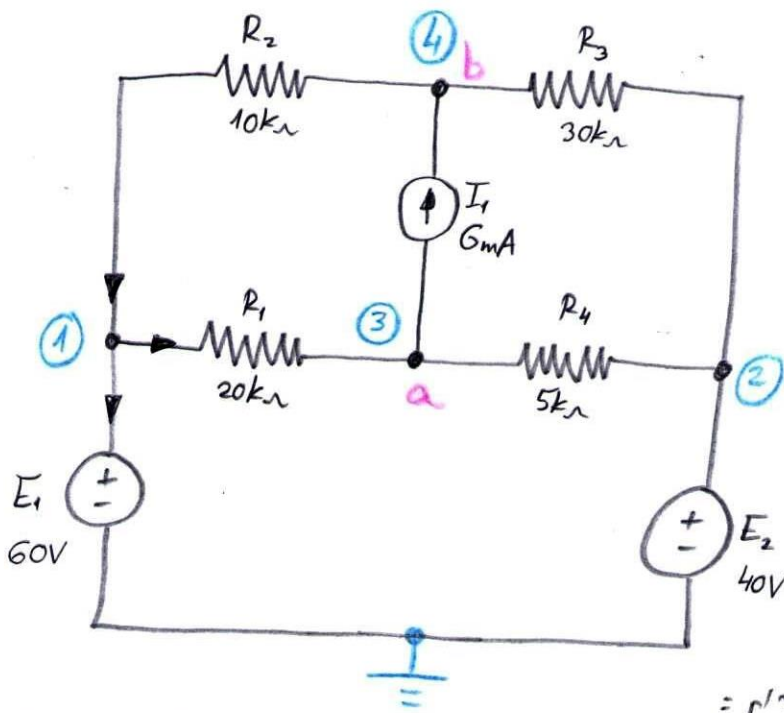
Ⓕ $P_{I_1} = I_1 \cdot U_{32} = 1(14 - 3.333) = 10.666 \text{ mW (גזר)}$

$P_{I_2} = I_2 \cdot U_{31} = 0.4(14 - 10) = 1.6 \text{ mW (גזר)}$

$I_E = I_2 + I_{R2} = 0.4 + \frac{V_1 - V_2}{R_2} = 0.4 + \frac{6.666}{5} = 1.733 \text{ mA}$

$P_E = I_E \cdot E = 1.733 \cdot 10 = 17.333 \text{ mW (גזר)}$

2



במחלק זה יש 4 צמתים
ואנחנו צריכים לבחור אחת מהן
למחלקת הפוטנציאל 4x4
בפוטנציאל מחלקת 1 ו-2
למחלקת, כי נרצות להאיר

$$V_1 = 60V$$

$$V_2 = 40V$$

ואנחנו בוחרים נודת לבחור
את שתי המחלקות הנותרות:

$$-G_{31}V_1 - G_{32}V_2 + G_{33}V_3 - G_{34}V_4 = I_{sc3}$$

$$-G_{41}V_1 - G_{42}V_2 - G_{43}V_3 + G_{44}V_4 = I_{sc4}$$

$$-\frac{1}{20} \cdot 60 - \frac{1}{5} \cdot 40 + \left(\frac{1}{20} + \frac{1}{5}\right)V_3 - 0 \cdot V_4 = -6$$

$$-\frac{1}{10} \cdot 60 - \frac{1}{30} \cdot 40 - 0 \cdot V_3 + \left(\frac{1}{10} + \frac{1}{30}\right)V_4 = 6$$

$\Rightarrow$

$$V_1 = 60V$$

$$V_2 = 40V$$

$$V_3 = 20V$$

$$V_4 = 100V$$

$\Leftarrow$

$$\textcircled{e} \quad V_a = 20V, \quad V_b = 100V$$

$$\textcircled{a} \quad U_{I_1} = V_4 - V_3 = 100 - 20 = 80V$$

$$P_{I_1} = I_1 \cdot U_{I_1} = 6 \cdot 80 = 480mW \quad (\text{ג'ו})$$

$$I_{R_1} = \frac{U_{R_1}}{R_1} = \frac{60 - 20}{20} = 2mA$$

$$I_{R_2} = \frac{U_{R_2}}{R_2} = \frac{100 - 60}{10} = 4mA$$

$\Downarrow$

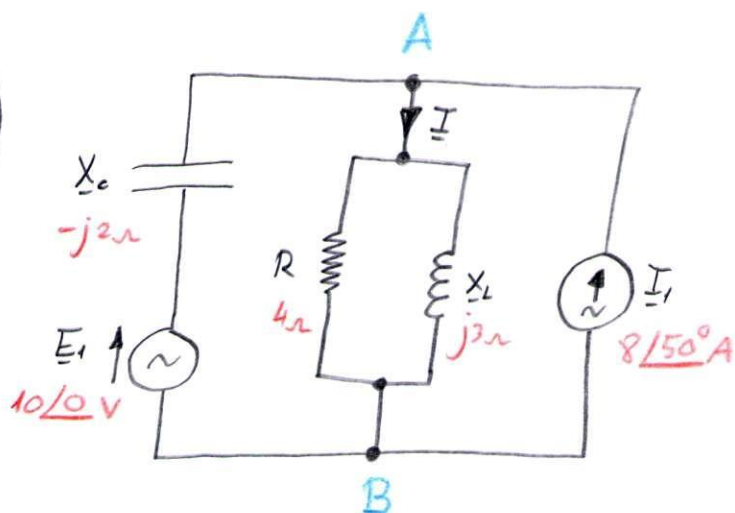
$$I_{E_1} = I_{E_2} = I_{R_2} - I_{R_1} = 4 - 2 = 2mA$$

$\Downarrow$

$$P_{E_1} = I_{E_1} \cdot E_1 = 2 \cdot 60 = 120mW \quad (\text{פ'3})$$

$$P_{E_2} = I_{E_2} \cdot E_2 = 2 \cdot 40 = 80mW \quad (\text{ג'ו})$$

③



②

$$X_c = \frac{1}{\omega C}$$

$$2 = \frac{1}{0.5 \cdot 10^6 \omega}$$

$$\omega = 1 \cdot 10^6 \frac{\text{rad}}{\text{Sec}}$$

⇓

$$X_L = \omega L$$

$$3 = 1 \cdot 10^6 \cdot L$$

$$L = 3 \mu\text{H}$$

$$\textcircled{E} \quad U_{AB} = \frac{\frac{E_1}{X_c} + I_1}{\frac{1}{X_c} + \frac{1}{R} + \frac{1}{X_L}} = \frac{\frac{12.26 \angle 65.2}{0.3 \angle 33.7}}{0.3 \angle 33.7} = 40.8 \angle 31.5^\circ \text{ V}$$

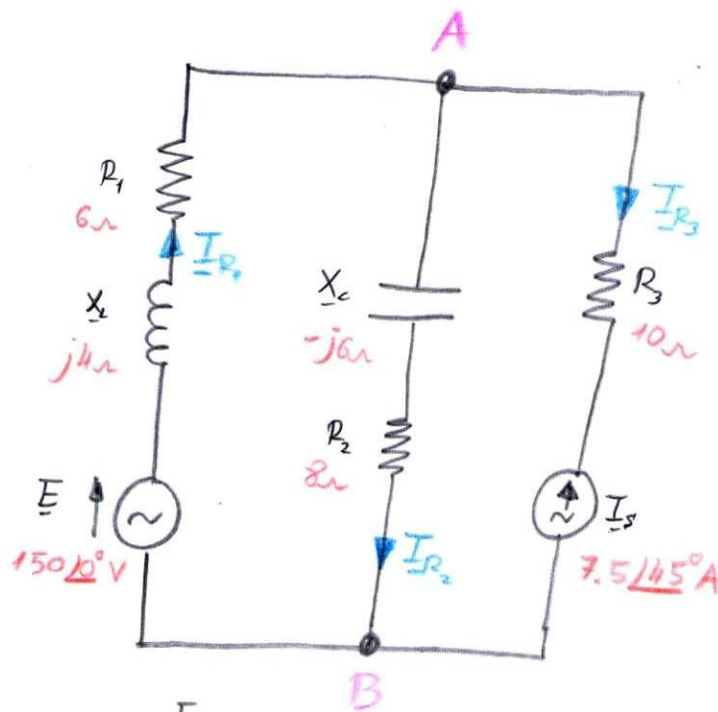
⇓

$$\underline{I} = \frac{U_{AB}}{R \parallel X_L} = \frac{40.8 \angle 31.5}{4 \parallel j3} = \frac{40.8 \angle 31.5}{1.44 + j1.92} = 17 \angle -21.63^\circ \text{ A}$$

⇓

$$\begin{aligned} \textcircled{2} \quad i(t) &= I\sqrt{2} \cdot \sin(\omega t + \varphi_u) = 17\sqrt{2} \cdot \sin(10^6 t - 21.63^\circ) [\text{A}] = \\ &= 24.041 \cdot \sin(10^6 t - 21.63^\circ) [\text{A}] \end{aligned}$$

4



$$\boxed{U_{AB} = \bar{V}} \quad : \text{pot}$$

Σ P_{in} = P_{out}
Loen = 113 W
 = 113 W

$$e) \quad U_{AB} = \frac{\frac{E}{R_1 + X_L} + I_S}{\frac{1}{R_1 + X_L} + \frac{1}{R_2 + X_C}} = \frac{\frac{150 \angle 0}{6 + j4} + 7.5 \angle 45}{\frac{1}{6 + j4} + \frac{1}{8 - j6}} = 119.6 \angle -10.46^\circ \text{ V}$$



$$I_{R_1} = \frac{E - U_{AB}}{R_1 + X_L} = \frac{150 \angle 0 - 119.6 \angle -10.46}{6 + j4} = 5.408 \angle 0.16^\circ \text{ A}$$

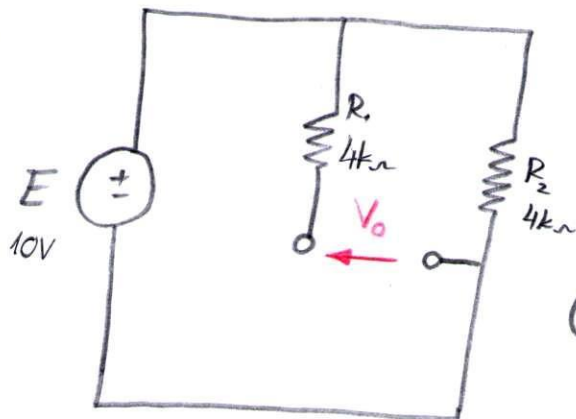
$$P_{R_1} = I_{R_1}^2 \cdot R_1 = 5.408^2 \cdot 6 = 175.478 \text{ W}$$

$$I_{R_2} = \frac{U_{AB}}{R_2 + X_C} = \frac{119.6 \angle -10.46}{8 - j6} = 11.96 \angle 26.4^\circ \text{ A}$$

$$P_{R_2} = I_{R_2}^2 \cdot R_2 = 11.96^2 \cdot 8 = 1144.333 \text{ W}$$

$$P_{R_3} = I_{R_3}^2 \cdot R_3 = 7.5^2 \cdot 10 = 562.5 \text{ W}$$

9 ①



$t = \infty$ נ/כ
:סב

② $V_0 = 10V$

⑤ $R = \rho \cdot \frac{l}{A} = 100\Omega \quad A = \frac{\pi d^2}{4}$

$$R = \rho \cdot \frac{4l}{\pi d^2} = \frac{4\rho}{\pi} \cdot \frac{l}{d^2} = 4X = 100 \Rightarrow X = 25$$

כאשר d הוא 2, ρ הוא 2, l הוא 2, X הוא 25

$$R' = \frac{4\rho}{\pi} \cdot \frac{2l}{4d^2} = \frac{2\rho \cdot l}{\pi \cdot d^2} = 2X = 2 \cdot 25 = 50\Omega$$

$\Downarrow$

② $R' = 50\Omega$