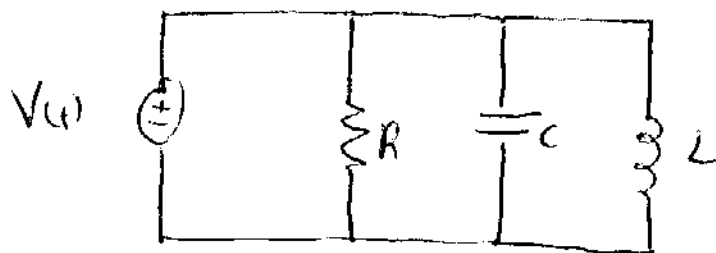


פתרון תרגיל 1 מערכת חשמלית

מחברים את המערכת
אין זרם: $i_L = 0$



$$R = 2 \Omega$$

$$C = 0.5 F$$

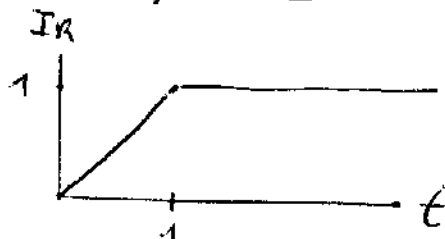
$$L = 1 H$$

(1)

$$V(t) = V_R(t)$$

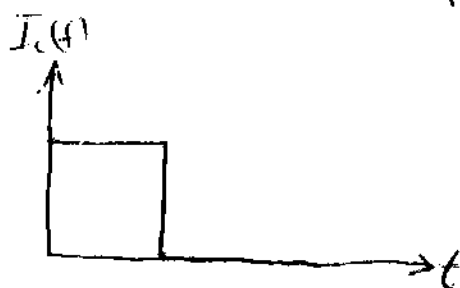
$$I_R(t) = \frac{V_R(t)}{R} = \frac{V(t)}{R} = \frac{V(t)}{2}$$

$$\underline{\underline{I_R(t) \text{ נדרש}}} \quad \underline{\underline{1.1}}$$



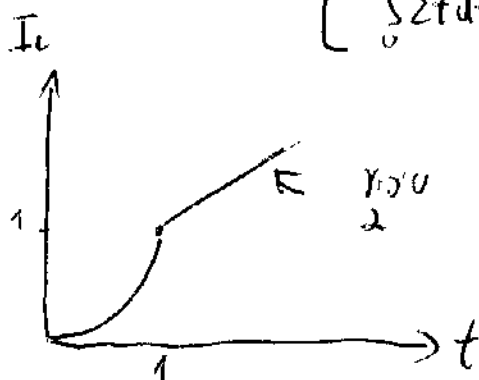
$$I_C = C \cdot \frac{dV}{dt} = \begin{cases} \frac{1}{2} \cdot 2 = 1 & 0 \leq t < 1 \\ 0 & t \geq 1 \end{cases}$$

$$\underline{\underline{I_C(t) \text{ נדרש}}}$$

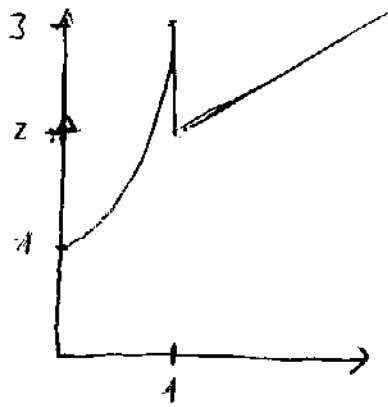


$$I_L(t) = \frac{1}{L} \int V_L(t) dt = \begin{cases} \int_0^t 2t dt = t^2 & 0 \leq t < 1 \\ \int_0^1 2t dt + \int_1^t 2 = \frac{t^2}{2} + 2t - \frac{1}{2} = 2t - 1 & 1 \leq t \end{cases}$$

$$\underline{\underline{I_L(t) \text{ נדרש}}}$$



$$i_{\text{total}} = I_R + I_C + I_L = \begin{cases} t^2 + t + 1 & 0 \leq t < 1 \\ 2t & 1 \leq t \end{cases} \quad (12)$$

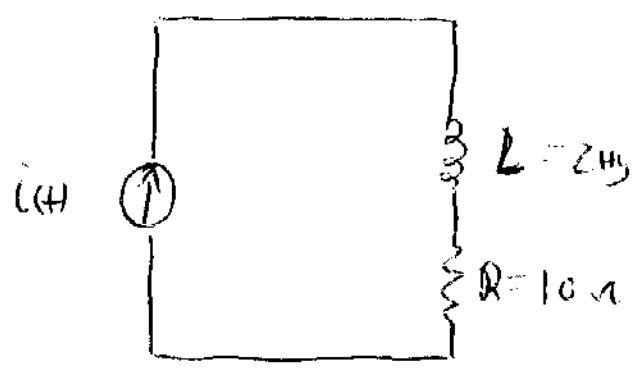


$$P_R(t) = I_R^2 \cdot R = \begin{cases} 2t^2 & 0 \leq t < 1 \\ 2 & t \geq 1 \end{cases} \quad (13)$$

$$P_C(t) = V_C(t) \cdot I_C(t) = \begin{cases} t & 0 \leq t < 1 \\ 0 & t \geq 1 \end{cases}$$

$$P_L(t) = V_L(t) \cdot I_L(t) = \begin{cases} t^3 & 0 \leq t < 1 \\ 2t^2 - t & t \geq 1 \end{cases}$$

②



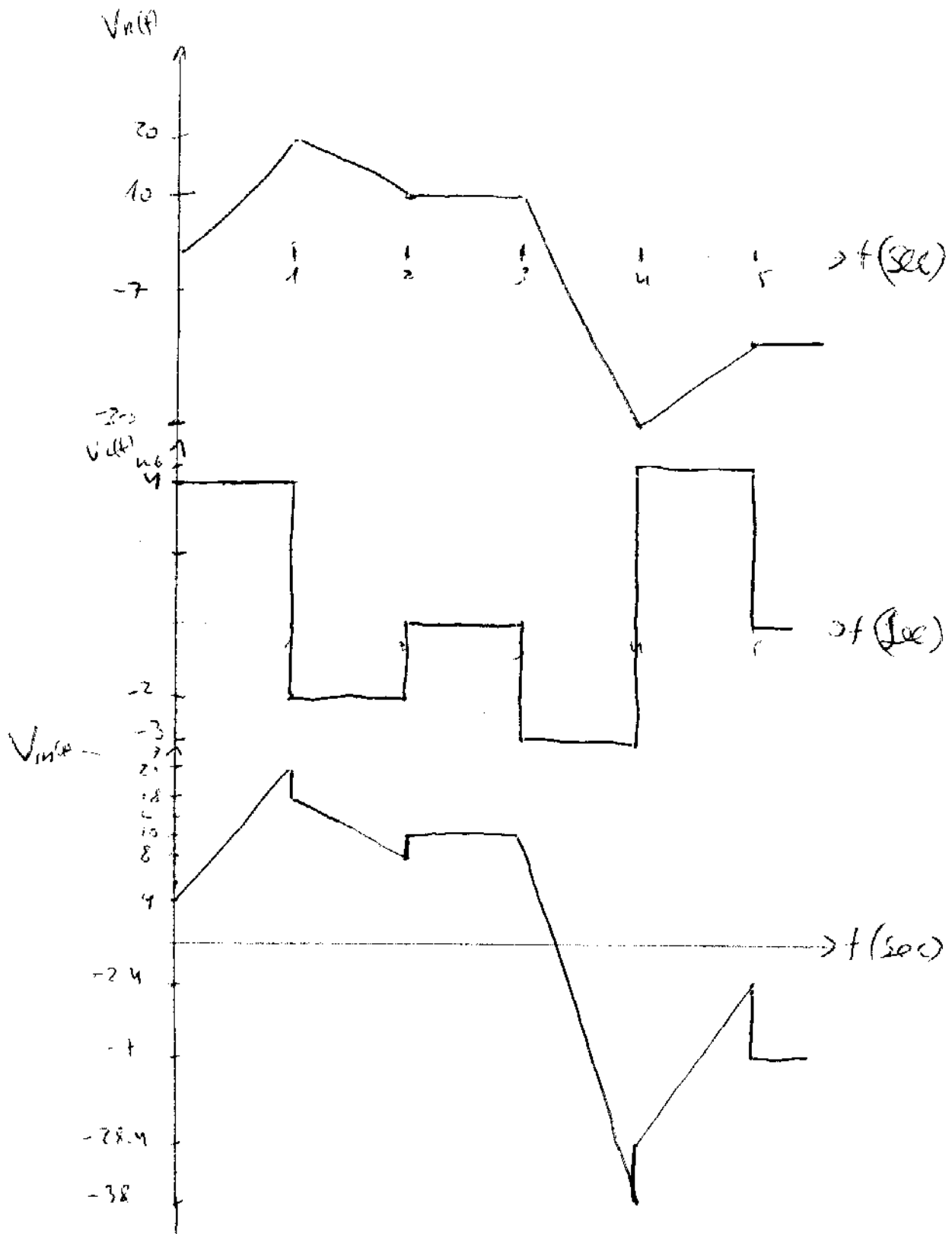
$$i(t) = \begin{cases} 2t & 0 < t < 1 \\ 3-t & 1 < t < 2 \\ 1 & 2 < t < 3 \\ 13-4t & 3 < t < 4 \\ 2.3t-12.2 & 4 < t < 5 \\ -0.7 & t > 5 \end{cases}$$

2.1

$$V_R(t) = i(t) \cdot 10 = \begin{cases} 20t & 0 < t < 1 \\ 30-10t & 1 < t < 2 \\ 10 & 2 < t < 3 \\ 130-40t & 3 < t < 4 \\ 23t-122 & 4 < t < 5 \\ -7 & t > 5 \end{cases}$$

$$V_L(t) = L \frac{di(t)}{dt} = \begin{cases} 4 & 0 < t < 1 \\ -2 & 1 < t < 2 \\ 0 & 2 < t < 3 \\ -8 & 3 < t < 4 \\ 4.6 & 4 < t < 5 \\ 0 & t > 5 \end{cases}$$

$$V_{in}(t) = V_R + V_L = \begin{cases} 4 + 20t & 0 < t < 1 \\ 28 - 10t & 1 < t < 2 \\ 10 & 2 < t < 3 \\ 122 - 40t & 3 < t < 4 \\ 23t - 117.4 & 4 < t < 5 \\ -7 & t > 5 \end{cases} \quad \underline{\underline{7.2}}$$



$$W = \int_{t_1}^{t_2} P(t) dt$$

2.3

$$P(t) = V \cdot I$$

$$P_e(t) = V_e(t) \cdot I_e(t)$$

$0 < t < 1$ / NS, 170, 1008

$$P_e(t) = 4 \cdot 2t = 8t$$

$$W = \int_0^1 8t dt = 8 \int_0^1 t dt = 8 \cdot \frac{t^2}{2} \Big|_0^1 = 4 \text{ J}$$

$$W_L = \frac{1}{2} L \cdot I^2 = \frac{1}{2} \cdot 2 \cdot (2t)^2 = 4t^2 = 4 \text{ J}$$

$0 < t < 1$ $t=1$

170, 1008

$$V_L(t) = L \frac{d}{dt} (I_m \sin(\omega t)) = \omega L \cdot I_m \cdot \cos(\omega t)$$

LB

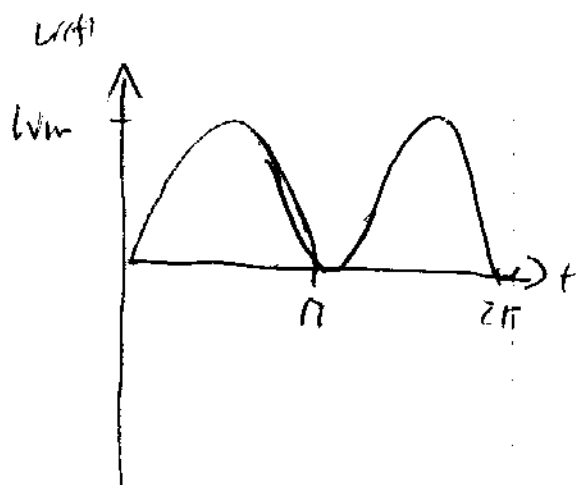
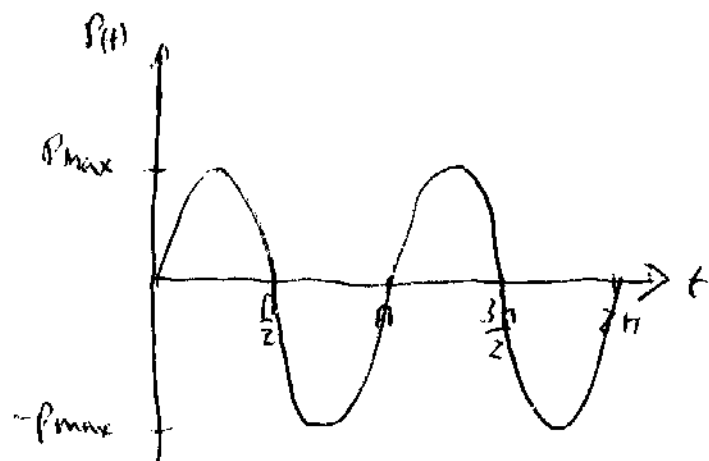
$$P(t) = V(t) \cdot I(t) = \omega L \cdot I_m^2 \sin(\omega t) \cdot \cos(\omega t) =$$

$$= \frac{1}{2} \omega L \cdot I_m^2 \sin(2\omega t)$$

$$W(t) = \int_0^t \frac{1}{2} \omega L \cdot I_m^2 \sin(2\omega \tau) d\tau = \frac{1}{2} L \cdot I_m^2 \sin^2 \omega t$$

$\frac{1}{2} L I_m^2$ שווה לנפח האנרגיה המאגורה בלינדה $\omega t = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2} \dots$ סדר

האנרגיה המאגורה בלינדה שווה לאפס $\omega t = 0, \pi, 2\pi, 3\pi \dots$ סדר



$$i(t) = C \frac{d}{dt} V_L(t) = \omega \cdot C \cdot V_m \cos(\omega t)$$

LB (ג)

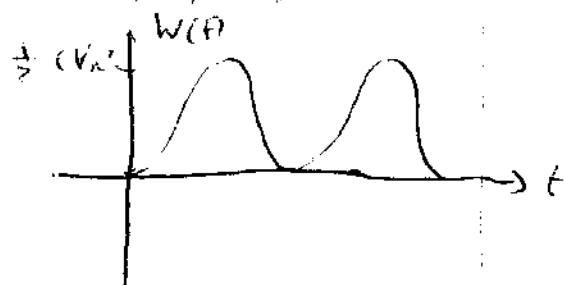
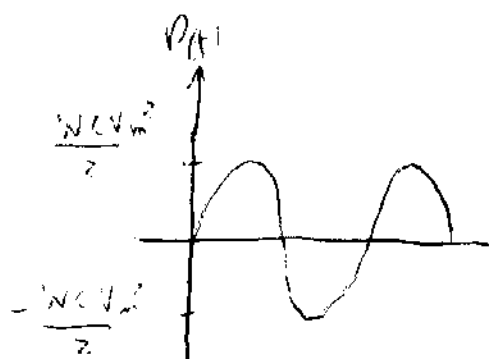
$$P(t) = V \cdot I = \frac{1}{2} \omega \cdot C \cdot V_m^2 \sin(2\omega t)$$

$$q(t) = C \cdot V = C V_m \sin \omega t$$

$$W(t) = \int_0^t P(\tau) d\tau = \frac{1}{2} C \cdot V_m^2 \sin^2 \omega t$$

נפח האנרגיה המאגורה $\omega t = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2} \dots$

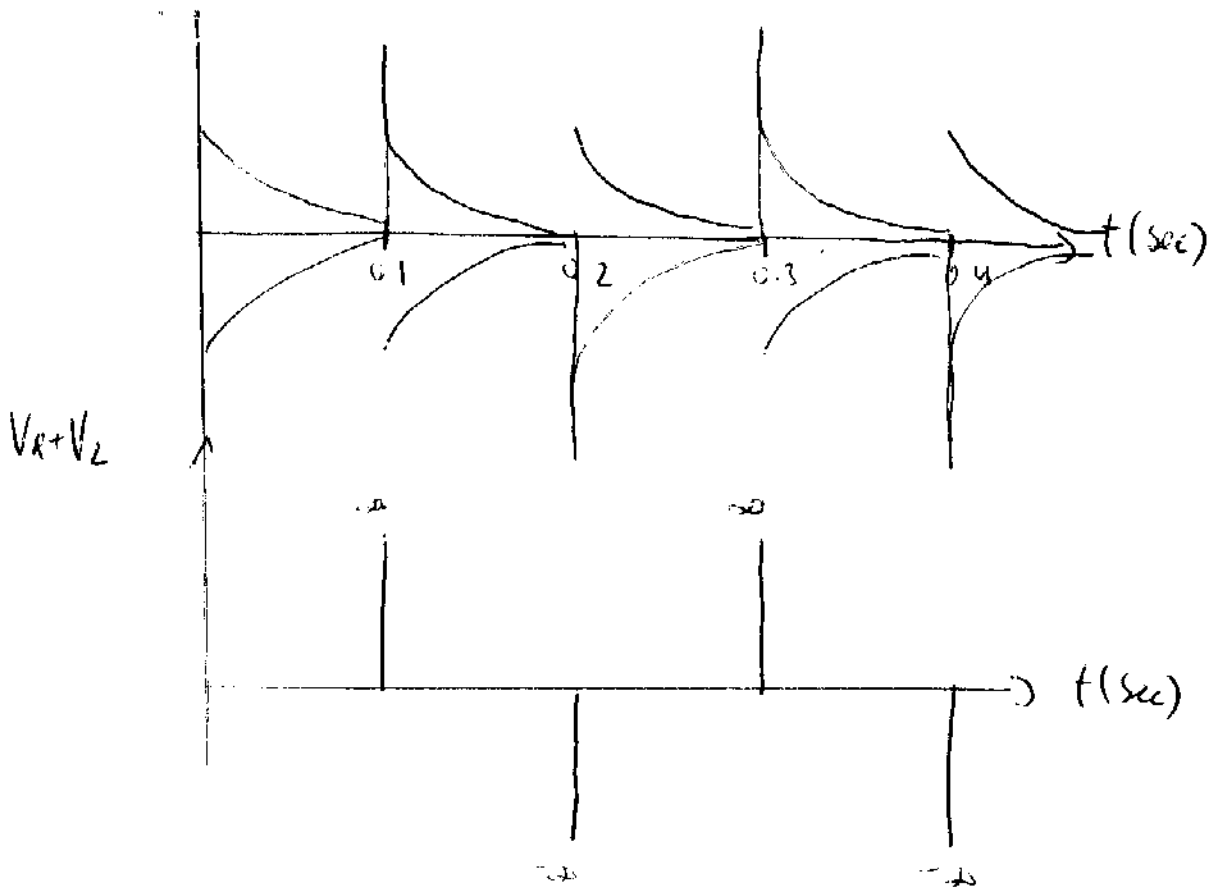
0 $\omega t = 0, \pi, 2\pi, 3\pi$



$$V_R(t) = (1t) \cdot 200 = 200 \cdot e^{-200t}$$

$$V_L(t) = 0.1 \frac{d}{dt} (10 e^{-200t}) = -200 e^{-200t}$$

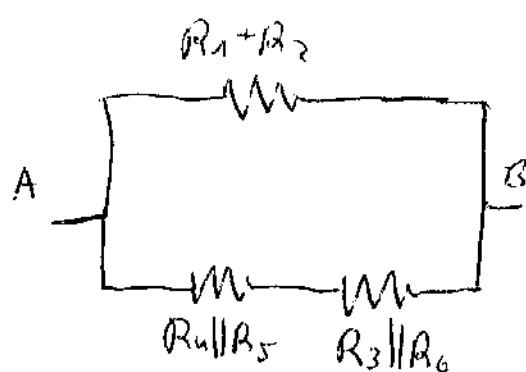
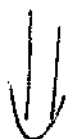
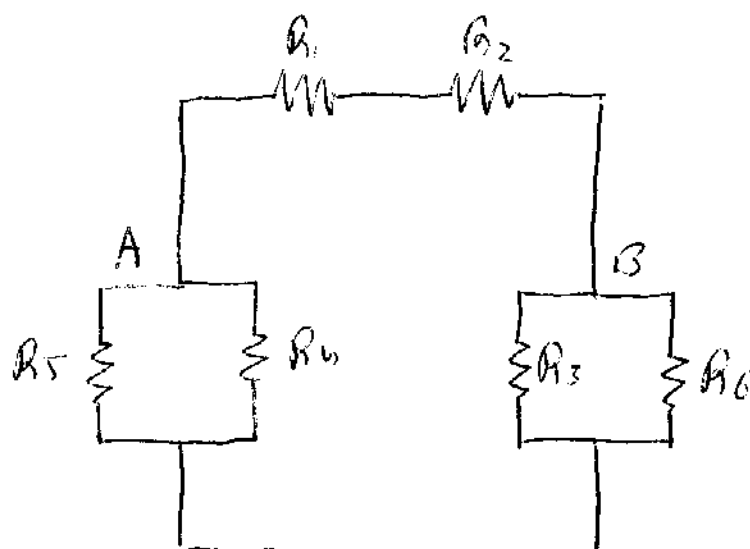
(4)



$$V_L(t) + V_R(t) = \sum_{n=-\infty}^{\infty} (-1)^{n+1} V(t-nT)$$

$$T = 0.1$$

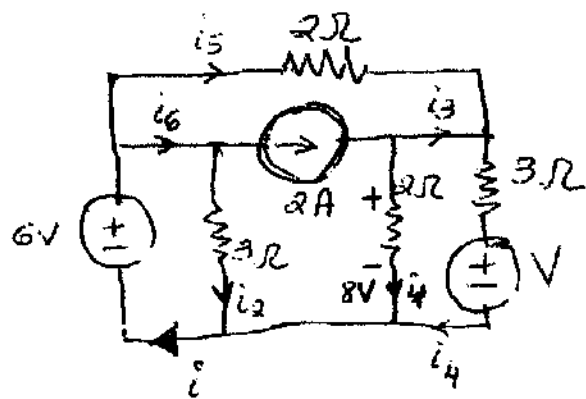
5
 מצא את ההתנגדות הנראית בין הנקודות A ו-B



~~$(R_1 + R_2) || (R_5 || R_6 + R_3 || R_4)$~~

$$R_{AD} = \boxed{(R_1 + R_2) || (R_5 || R_6 + R_3 || R_4)}$$

8127A



$\cdot V$ \rightarrow i \rightarrow i_3 i_4 i_5

$$i_1 = \frac{8V}{2\Omega} = 4A;$$

117A

$$i_3 = 2A - 4A = -2A;$$

$$\begin{cases} 6V = 2\Omega \cdot i_5 + 3\Omega \cdot i_4 + V \\ 8V = 3\Omega \cdot i_4 + V \\ i_5 + i_3 - i_4 = 0 \end{cases}$$

$$\Rightarrow i_5 = -1A \Rightarrow i_4 = -3A$$

$$i_7 = i_1 + i_4 = 1A$$

$$i_2 = \frac{6V}{3\Omega} = 2A$$

$$\Rightarrow i = i_2 + i_1 + i_4 = 3A //$$

$$V = 17V //$$